KINGDOM OF CAMBODIA
NATION RELIGION KING

Fertility Study Among Women Living with HIV in Cambodia

RESEARCH TECHNICAL REPORT

UNAIDS

CamTech
KNOWLEDGE, REASON, CHARACTER

Disclaimer: The findings, interpretations, and conclusions expressed in this report are those of the authors and do not necessarily reflect the views of the National Centre for HIV/AIDS, Dermatology and STD (NCHADS), National Maternity and Child Health Centre (NMCHC), UNAIDS, or any other affiliated organizations. The report is intended for informational purposes only, and the authors are not responsible for any actions taken based on its content.

Suggested Citation: NCHADS, NMCHC. (2025). Fertility Study Among Women Living with HIV in Cambodia: Key Findings and Implications. Phnom Penh, Cambodia: National Centre for HIV/AIDS, Dermatology and STD (NCHADS), and National Maternity and Child Health Centre (NMCHC).

Acknowledgements

The National Centre for HIV/AIDS, Dermatology and STD (NCHADS), National Maternity and Child Health Centre (NMCHC), and UNAIDS Cambodia, Lao PDR, and Malaysia Multi-country Office would like to extend heartfelt appreciation to all partners, communities, and stakeholders for their unwavering commitment and invaluable contributions to the successful implementation of the Cambodia Women Living with HIV Fertility Study.

The National Programs are especially grateful for the dedicated efforts of focal points from NCHADS (Dr. Samreth Sovannarith, Dr. Ngauv Bora, Dr. Kaoeun Chetra), NMCHC (Ms. Sheryl Keller and Dr. Chhorn Samnang), and UNAIDS (Dr Khin Cho Win Htin and Dr. Ye Yu Shwe) in coordinating with all concerned partners throughout the study's implementation. The collaboration of provincial health departments, PASPs, local stakeholders from ART sites, and volunteers played an essential role in this effort, as did the invaluable contributions of recruiters, interviewers, and field workers.

We extend our deepest gratitude to the women living with HIV who generously gave their time and courageously shared their personal experiences with the study team. Without their participation, this study would not have been possible.

Special thanks are due to the lead technical partner of this research study, Cambodia University of Technology and Science (CamTech), and the principal investigator, Dr. Vatana Chea, along with his dedicated research team. We also acknowledge the critical input and expertise provided by development partners, particularly US-CDC, USAID, UN Agencies, FHI360, and CHAI, whose collaboration was instrumental during the inception, conceptualization, and implementation phases of this research study.

This collective effort represents a significant step forward in understanding and addressing the needs of women living with HIV in Cambodia. Thank you all for your dedication and support.

Director of NCHADS

Assist Prof. Ouk Vichea

Director of NMCHC

Assist Prof. Kim Rattana

ABBREVIATIONS

AEM	Asian Epidemic Model
ART	Anti-Retroviral Therapy
ASFR	Age-Specific Fertility Rate
CamTech	Cambodia University of Technology and Science
CDHS	Cambodia Demographic and Health Survey
CMC	Century-Month Code
FEW	Female Entertainment Workers
GFR	General Fertility Rate
HFC	High-Frequency Checks
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
IRB	Institutional Review Board
IBBS	Integrated Biological and Behavioral Survey
MTCT	Mother-To-Child Transmission
NCHADS	National Center for HIV/AIDS, Dermatology and STD
NECHR	National Ethics Committee for Health Research
NMCHC	National Maternal and Child Health Center
OLS	Ordinary Least Square
RH	Reproductive Health
RSE	Relative Standard Error
SDG	Sustainable Development Goals
STD	Sexually Transmitted Diseases
TB	Tuberculosis
TFR	Total Fertility Rate
VCCT	Voluntary Confidential Counselling and Testing
UNAIDS	Joint United Nations Programme on HIV/AIDS

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Cambodian government is firmly committed to achieving the ambitious 95-95-95 goals by 2025, which aims to have 95% of people living with HIV know their status, 95% of those diagnosed with antiretroviral treatment, and 95% of those on treatment with suppressed viral loads. Additionally, the Ministry of Health has renewed its commitment, particularly to eliminating mother-to-child transmission of HIV by 2025. To monitor progress, Cambodia relies on modeled estimates from the AIDS Epidemic Model, which has limitations in terms of data availability and quality in a developing country context.

The objective of this study is two-fold. Firstly, it aims to collect data and estimate the Age-Specific Fertility Rate (ASFR) and Total Fertility Rate (TFR) of women living with HIV and receiving antiretroviral therapy (ART) in Cambodia. Secondly, it seeks to obtain information from the same sample on places of child delivery and their breastfeeding practices and over the past five years. The study also intends to highlight any pertinent findings on the association between reproductive health (RH) gaps and certain variables, such as age group, location, and education, in order to understand the underlying inequalities. Furthermore, the study will compare the collected data with the Cambodian Census 2019 and the Cambodia Demographic and Health Survey 2021–22.

The sampling frame for this survey consisted of the latest updated list (June 2023) of women aged 15-49 years old receiving ART from 73 sites across Cambodia's 25 provinces. The total number of women in the sampling frame is 19,395. The sampling approach follows a two-stage procedure. In the first stage, stratified random sampling with probability proportional to size was used, stratifying the 25 provinces into 73 sampling strata and selecting 15 strata. In the second stage, a fixed number of samples are surveyed from each stratum using simple random sampling, by interviewing all women aged 15-49 who visited the ART sites between February and April 2024.

The research team successfully recruited and trained 12 qualified female enumerators, including a team leader and a field manager, to conduct a survey of women living with HIV. The enumerators underwent a two-day training covering the study overview, data collection procedures, and the use of data collection tools, KoboToolbox. A pilot test and role-play exercises were also conducted to ensure the enumerators' understanding and the effectiveness of the questionnaire. The enumerators were tasked with interviewing eligible participants who came to the ART sites to collect their medication. In some cases, participants sent representatives to collect their medication, and the researchers then obtained their contact from the representatives and interviewed them at their residences or other convenient locations. In total, we managed to survey 1409 samples of women living with HIV and aged between 15 and 49 years old.

It should also be highlighted that to enable direct comparisons with the Cambodia Demographic and Health Survey (CDHS) 2021-2022, we employed the same instruments in the questionnaires and a similar data analysis approach to calculate the Age-Specific Fertility Rate (ASFR) and Total Fertility Rate (TFR). The entire data collection and analysis process was conducted using the R programming language, a popular statistical package among quantitative researchers.

Survey findings highlighted the unique fertility situation of HIV-positive women, which is significantly lower (TFR = 1.8) compared to the general population (TFR = 2.7) in

Cambodia. However, the age-specific fertility rate for adolescents living with HIV (15-19 years old) is higher than the national average, suggesting they are more likely to be sexually active and become pregnant. Adolescent patients living with HIV also tend to desire more children and have better pregnancy outcomes in terms of live births compared to older HIV-positive women. Given the distinctive nature of their fertility experiences, the research emphasizes the importance of focusing future studies on the fertility and life course of adolescent females living with HIV, as it will have significant implications for procreation among this population.

In addition, the survey also noted the low awareness among young HIV-positive individuals about the benefits of antiretroviral therapy (ART), achieving viral suppression and in preventing vertical transmission Additionally, there are concerns about the healthcare-seeking behavior of adolescents, who are more likely to visit private clinics for antenatal care but public facilities for delivery. Furthermore, the low rates of breastfeeding among HIV-positive women, with the majority opting for infant formula, can also be attributed to limited awareness of the benefits of ART in enabling safe breastfeeding. Improving this awareness could potentially increase breastfeeding rates, leading to better health and economic outcomes for the children.

There is also a significant incidence of induced abortion and miscarriage among HIV-positive women, with overall rates standing at 25 percent and 17 percent, respectively. Moreover, this rate is particularly higher among older age groups. The high abortion prevalence among women living with HIV can be attributed to a lack of awareness about the potential effects of antiretroviral therapy (ART) on their reproductive health. Additionally, in Asian culture, the decision to have an abortion involves family members, who can be very influential in the outcome of the resolution. Addressing these social and cultural barriers is crucial to ensuring that people living with HIV can make autonomous decisions about their reproductive health. In the short term, encouraging the use of contraceptive methods could be an immediate solution to help decrease the abortion rate.

The survey results provide a basis for the following recommendations:

- Develop an information awareness campaign using social media and success stories to educate women on the benefits of ART in preventing vertical transmission.
- Collaborate with local community partners to leverage their networks and communication channels to amplify awareness-raising messages.
- Create a guideline illustrating safe childcare and support for HIV-positive mothers to show breastfeeding is possible with effective treatment.
- Provide counseling sessions for couples living with HIV to support informed reproductive health decisions.
- Engage and train healthcare providers to ensure that they are aware of the latest national guidelines and can effectively counsel and support HIV-positive patients who desire to have children.
- Offer tailored treatment and support services package specifically for HIV-positive adolescents.

1. Background

A major worldwide health catastrophe resulting in widespread disease and mortality was brought about by the discovery of the Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS) in the 1980s. Since it was first thought to affect particular populations disproportionately, the virus was linked to stigma and discrimination. But through its tremendous efforts in public health, Cambodia has made significant progress toward the Sustainable Development Goals (SDGs) and the elimination of new HIV/AIDS infections. The country's progression and response to one of the most serious global epidemics can be classified into three phases (Vun et al., 2014).

Phase I, spanning from 1991 to 2000, began when Cambodia officially detected its first-ever cases of HIV among blood donors. It is also worth noting that the initial phase took place while the country was still in the final period of its three-decade civil war and recovering from the scar of its tragic past. During these 10 years, HIV and other Sexually Transmitted Diseases (STDs) had expanded rapidly among entertainment workers and their clients, and government interventions, including the distribution of condoms and awareness raising, concentrated on preventing further transmission through brothel-based entertainment work (National Center for HIV/AIDS, Dermatology and STD (NCHADS), 2006).

In the second phase of Cambodia's response to the HIV/AIDS epidemic (2001 – 2011), significant progress was made in expanding access to HIV Voluntary Confidential Counselling and Testing (VCCT) and treatment services using antiretroviral therapy (ART). The country systematically integrated these services with its national maternal and child health (MCH) and tuberculosis (TB) programs and also strengthened the connections between health facilities and the community. During this period, there was increased focus on key affected populations, service quality, and improving patient outcomes. At the same time, the country also witnessed an expansion of HIV-related-treatment facilities and a decentralized approach to ART services at the district level and VCCT at the district and health center levels. The early implementation of Phases I and II of the intervention program effectively mitigated the transmission that was fueling Cambodia's HIV epidemic.

At the 2011 United Nations General Assembly High-Level Meeting on AIDS in New York, Cambodia expressed its commitment to the global goals and targets for the "Three Zeros" initiative, marking the beginning of Phase III of its HIV response. Accordingly, the country has set an ambitious goal of eliminating new HIV infections by achieving the 90-90-90 targets by 2020 (NCHADS, 2016). The key elements of this strategy are (1) Targeted HIV prevention efforts for key populations at higher risk, coupled with linkages to health services; (2) Elimination of mother-to-child transmission of HIV; and (3) Optimization of the cascade of HIV-related interventions, including HIV testing, linkages to care, and treatment (Vun et al., 2014). To expedite timely HIV diagnosis among key populations, the expansion of outreach HIV testing using finger-prick methods was introduced and facilitated in 2013 at most healthcare facilities where antenatal care and tuberculosis services are provided. This innovative community-based HIV testing mechanism is the first of its kind in the ASEAN region. By abolishing blood sample referrals from health centers, dropouts and delays have shown a significant decline (NCHADS, 2017). Consequently, Cambodia has been recognized by the global community for reaching, earlier than its intended timeline, the 90-90-90 target (to diagnose 90% of all people living

with HIV, provide ART for 90% of those diagnosed with HIV, and achieve viral suppression for 90% of people who receive the ART).

To put the Cambodian achievements during these three phases into a concrete perspective, it is worth highlighting that the HIV prevalence among adults aged 15-49 declined from 1.7 percent in 1998 (Vun et al., 2014) to 0.9 percent in 2010 and 0.5 in 2022 (Joint United Nations Programme on HIV/AIDS (UNAIDS), 2023), and the estimated number of new HIV infections plummeted from 20,000 annually in the early 1990s NCHADS, 2016) to approximately 1,400 in 2022 (UNAIDS, 2023). Furthermore, new infections in children aged 0-14 years dropped dramatically from 1,000 in 2000 to only 100 in 2012 and then hovered around 70 in 2022 and 2023 (NCHADS, 2023a), indicating the success of the program in curbing the spread of HIV across different age groups in Cambodia.

Currently, the Cambodian government is firmly committed to achieving the more aspiring 95-95-95 goal by the year 2025. The goal is quite ambitious due to the shortfall in funding to cover fundamental and critical HIV services, while the current approach to service delivery remains unchanged. Even though local funding for HIV-related programs has been slowly increasing over the years, the withdrawal of international donors, who financed roughly 86 percent of total spending in 2012 (Vun et al., 2014) and 76 percent in 2017 (NCHADS, 2020), is occurring at a much quicker rate. In addition, public attention was predominantly shifted towards focusing on the COVID-19 pandemic between 2020 and 2023, which was another major global public health crisis requiring immediate action. But now that COVID-19 has subsided, the Cambodia Ministry of Health (MoH) has renewed its commitment, particularly to eliminating the transmission of HIV from mothers to their children by 2025. This goal is defined as having a mother-to-child transmission (MTCT) rate of HIV less than 5% and a case rate of fewer than 50 cases per 100,000 live births (NCHADS & National Maternal and Child Health Center, 2021). The current aspirations and contextual circumstances can be interpreted as Cambodia transitioning into a new stage, designated as phase IV, in its ongoing efforts to address the HIV/AIDS epidemic.

It should be highlighted that to monitor progress in achieving the aforementioned objectives, the MoH uses modeled estimates to track and measure indicators such as the MTCT rate and the antiretroviral therapy (ART) coverage for pregnant women living with HIV. Since 2002, Cambodia has relied on the AIDS Epidemic Model, also known as the Asian Epidemic Model (AEM)-spectrum model to generate HIV estimates, including the number of women living with HIV (Brown et al., 2024). This model takes into account estimates of HIV transmission within a population aged 15 and above, meaning individuals enter the model at the age of 15 and exit only by death, either AIDS-related or non-AIDS-related (e.g., accident). It also considers women of reproductive age living with HIV and, thereby, the pediatric impacts (MTCT) in the calculation, which requires demographic data such as age-specific fertility rate and breastfeeding practice (Brown & Peerapatanapokin, 2004). However, accurate and reliable data of this nature is not easy to come by, especially in developing countries. That said, similar to any projection model, the effectiveness of AEM is contingent on the quality of the inputs. Unless one carefully evaluates the validity of the data fed into the AEM model, the resulting output will be flawed and essentially useless. In other words, poor-quality inputs will inevitably lead to poor-quality outputs, commonly called "garbage in, garbage out."

This study's objective is two-fold. Firstly, we aim to collect data and estimate the Age-Specific Fertility Rate (ASFR) and Total Fertility Rate (TFR) of women living with HIV and receiving ART in Cambodia. Secondly, we seek to obtain information from the same sample on their breastfeeding practices and places of child delivery in the past five years. We will also highlight if there are pertinent findings on the association between RH gaps and certain variables (e.g., age group, location, education, etc.), as we would like to understand the underlying inequalities. In the process, we also compare these indicators with the Cambodian Census 2019 and the Cambodia Demographic and Health Survey 2021 – 22. It should be highlighted that since Cambodia has already accomplished its 90-90-90 target and is on its way to achieving the 95-95-95 goal, almost everyone living with HIV in the country has been universally diagnosed and received ART. In other words, the population of women with HIV is virtually the same as the population of women living with HIV and receiving ART. As a result, our study can also be generalized to all women living with HIV in Cambodia despite our data collection focus, which we will discuss later, being only on women receiving ART treatment.

2. ART and the Fertility of HIV-Positive Women

HIV has been one of the biggest challenges in modern public health and causes of mortality globally, especially in Asia and Africa, since the 1980s (Okada, 2012). From the microeconomic perspective, HIV is also very disastrous, leading to multiple unfavorable consequences, including household poverty (Shisana et al., 2009), long-term malnutrition among children in the family (Magadi, 2011), slower early childhood development (Filteau, 2009), late enrollment, high absenteeism, sizable dropout, and low performance; hence, poor school completion rate (Guo et al., 2012 and references therein). If education is a mean to an economic end, having HIV/AIDS is a signal that individual victims and their household members have begun to fall into the repetitive cycle of poverty and can hardly escape it. On the macro level, it precipitates lower life expectancy, low labor productivity, limited economic growth (Danziger, 1994; Piot et al., 2001), high under-five mortality (Preble, 1990), skipped generation (Knodel et al., 2007), and, more importantly, bizarre population distribution and composition (Boutayeb, 2009).

The altered age-sex structure observed is due to the impact of HIV/AIDS on the adult population, leaving in its wake a larger proportion of older people in the population. It is worth noting that the disease has directly led to the deaths of many adults, resulting in a significant loss of individuals capable of reproduction and engendering a lower fertility rate. Not to mention that certain events, such as the spouse of the patient's remarriage or giving birth, do not occur or occur less frequently than they would have done if HIV had not taken place (Heuveline, 2004). Additionally, the transmission of HIV from mother to child, either perinatally during pregnancy, labor and delivery, or postnatally through breastfeeding, has led to the deaths of infected children. It is reported that without proper interventions, approximately one-third of children born to HIV-positive mothers are likely to contract the virus (Mukandavire & Garira, 2007), and 90 percent of new HIV infections in children were done through perinatal transmission (Feyissa et al., 2019). This is because some women living with HIV still choose to conceive a child despite the knowledge of their HIV status (O'Shea et al., 2016). However, in many more cases, particularly those in Sub-Saharan Africa, women only learn of their HIV diagnosis almost at the same time as their pregnancy (Katirayi et al., 2016).

Research studies have long recognized that HIV infection can suppress fertility or the physiological ability to have children (Ross et al., 2004; Zaba & Gregson, 1998). The HIV effect becomes more pronounced as the infection progresses, particularly in older HIV-positive women who have likely been infected for several years (Nguyen et al., 2006). Prior to the widespread availability of antiretroviral therapy (ART), the fertility of HIV-positive women across the developing world in Africa and Asia Pacific was lower than that of similar HIV-negative women due to a combination of biological and behavioral factors (Dwi Kartika Rukmi et al., 2020; Jose et al., 2016; Mehta et al., 2018; Yeatman et al., 2016). During the initial stages of the HIV/AIDS epidemic without ART availability, women living with HIV were often discouraged from having children due to the risk of transmitting the disease (Nattabi, Li, Thompson, Orach, & Earnest, 2009). Additionally, there have been documented cases of forced sterilization of HIV-positive women in Latin America (Kendall & Albert, 2015). But employing the Cambodia Demographic and Health Survey 2005 (CDHS), Okada (2012) also asserts that women infected with HIV have fewer number of children, but they are also in better health condition. This is due to the quantity-quality tradeoff in childrearing. However, his findings should be interpreted with extreme caution because of the low prevalent rate of HIV (0.6%) among his sample and the selection bias arising from the use of Ordinary Least Square (OLS) regression, which only tells the relationship between variables.

Breaking down further, population-based studies also revealed that at younger ages (<20), fertility was higher among HIV-positive women, likely due to selection effects, but above the age of 20, fertility among HIV-positive women was 25-40 percent lower than among HIV-negative women (Lewis et al., 2004). Supporting this argument using 20 DHS Surveys collected between 2003 and 2007, Chen & Walker (2010) showed that the age-specific fertility rate decreased with age until the fertility of HIV-positive women was approximately half that of HIV-negative women in the 40-44 age group. But while the negative relationship between HIV and fertility in Asia in the absence of ART is well understood, the impact of the increasing availability of treatment on this relationship remains unclear. Even though it is not possible to completely cure HIV at the moment, the virus can be treated and suppressed using ART to prevent onward transmissions, especially from mother to children and between sexual couples. As a result, ART can serve as a strong incentive to encourage intercourse and, hence, pregnancy among women living with HIV.

By undergoing ART treatment, individual woman can experience a significant improvement in their overall well-being and a sense of optimism regarding their fertility prospects. One study indicates that the desire for fertility was associated with a longer duration of ART among female participants but not among male participants (Myer et al., 2007). Their findings suggest a significant proportion of HIV-infected individuals receiving ART in South Africa would like to have children in the future. Supporting this statement, a meta-analysis indicates a significant proportion (42.04%) of people living with HIV express a desire to have children (Yan et al., 2021). The factors associated with fertility desires include ART use, sex, age, marital status, number of children, and education. However, another meta-analysis asserts otherwise. Berhan & Berhan (2013) argue that there is no statistical difference between those who receive ART and those who do not in terms of fertility desire. Investigating childbearing intention among HIV-positive women in South Africa who use highly active ART, Kaida et al. (2011) also found the intentions of HIV-positive women are not significant from zero by the use or duration of the use of ART. A similar study on fertility desire and intention among both men and women living

with HIV in Southern India arrived at a similar conclusion (Jose et al., 2016). In rural Uganda, ART is associated with increased fertility desire but not pregnancy or livebirth among women in an early HIV treatment program (Maier et al., 2009).

Having said that, it is advisable to consider a few factors that may have influenced the result, including regional variations, urban-rural differences, a quantitative sample size of several hundred, the moderate prevalence and coverage of ART in these countries, and individual knowledge and perception about ART and the prevention of MTCT. Analyzing 49 DHS surveys, Marston et al. (2017) discovered that the effects of HIV on fertility are somewhat mitigated as national ART coverage increases. Nevertheless, they also found that the differences in fertility between HIV-positive and HIV-negative individuals persist. Another research study in northern Uganda likewise indicated that variables, including the duration and adherence to ART regimens, CD4 levels (an indicator of immunological function), and virus loads, could also affect how well ART affects the odds of becoming pregnant and reproductive results (Makumbi et al., 2011). In this regard, while the fertility of women receiving ART should not be assumed to be the same as that of HIV-negative women, this relationship, as well as differences, should be continuously evaluated as more data become available, underscoring the need to understand the fertility behavior of women living with HIV in the context of high ART coverage.

3. Research Method

3.1. Initial Preparation

Key to the successful outcome of research addressing sensitivities associated with HIV infection and fertility is to ensure that the research aligns with national priorities and is ethically and methodologically robust. Initial discussions between CamTech and UNAIDS started in March 2023. However further stakeholder discussions between CamTech, UNAIDS, the National Center for HIV/AIDS, Dermatology, and STD (NCHADS), and the National Maternal and Child Health Center (NMCHC) team concerning the agenda setting, priorities, objectives, expected outcomes, and methodology for the survey only took place between September-December 2023.

Closely related to stakeholder engagement is the need to address ethical considerations because research on such a topic often involves working with vulnerable populations and handling confidential data. Keeping this in mind, the design of this study was built on the philosophy of respect for persons, beneficence, and justice, ensuring that respondents have the space and environment in which they feel most comfortable sharing their insight and personal information. Furthermore, to foster genuine and in-depth conversations, the project's integrity is upheld by ensuring that no participant, whether they represent an organization, a demographic, or any other group, faces discrimination, marginalization, or stigmatization due to their involvement in our study. Above all, our interactions with all stakeholders, namely study participants, government representatives, health service providers, or community members, were underpinned by a "do no harm" principle.

In this regard, to demonstrate that we adhere to the highest standard and warrant the integrity and credibility of the research, which involves surveying and interactions with the human subject and human health, the research team reviewed the existing state-of-the-art literature to learn and identify if there have been prior notable serious side effects

known to be caused by the potential study to be conducted. It was understood that if the study procedures followed all routine processes for a survey, there was minimal to no risk for participating individuals. With that said, the study would not present any direct benefit to the participants either, yet the study would provide a better understanding of the current TFR level of the subpopulation, and the findings shall potentially and greatly contribute to the policy discussion in Cambodia. Indeed, the expected benefit outweighs the minimal risk to individual samples, and therefore, the study should be supported. As a side note, no injuries did occur as a direct result of participating in the study.

Following the initial desk review, a proposal/protocol was presented to CamTech's Institutional Review Board (IRB) to ensure that the survey will be conducted in compliance with the University's ethical principles and adhere to international ethical guidelines, including the Belmont Report. Next, the research protocol was submitted to the National Ethics Committee for Health Research (NECHR) for further ethical review before carrying out the field survey. After the research application was ethically approved, the research team proceeded to establish formal communication and collaboration with various regional authorities. This involved sending out official permission requests to eleven provincial governors, eleven local health departments, and a number of ART sites.

The purpose of these outreach efforts was twofold. Firstly, we aimed to build positive, cooperative relationships with the regional stakeholders who would be integral to the successful implementation of the data collection. In addition, by engaging directly with the provincial governors and local health departments, the research team demonstrated a commitment to transparency and to working in alignment with the priorities and protocols of the local authorities. Secondly, securing the formal approval and endorsement of these regional entities was a crucial step in legitimizing the research activities and ensuring access to the necessary study sites and populations. The permission requests allowed the researchers to formally obtain the consent and collaboration of the ART facilities and staff, who would be central to recruiting and building trust with the participants and collecting sensitive but accurate information for the study. To ensure smooth data collection, we also enlisted the help of NCHADS and NMCHC, who assisted with pre-fieldwork communication.

3.2. Questionnaire Development

The main questionnaire was first developed in English with a meticulous assessment of the questionnaire's effectiveness and flow. After that, it was carefully translated into Khmer. It should be highlighted that most questions used in the questionnaire are very similar to those found in the Cambodia Demographic and Health Survey (CDHS) to allow for a direct comparison of the results. We structured the closed-ended questionnaire into four sections, namely the general profile of individual women, birth history, antenatal and post-natal care, and HIV experience, all of which provided crucial and relevant information about the characteristics of the women under study in order to achieve the research objectives. The final questionnaire is attached in Appendix C.

The questionnaire was turned into a digital online format using programming software so that the information and results collected would be ready and convenient for data monitoring and analysis. A tablet with KoboToolbox application installed was used as the tool to facilitate the face-to-face data collection. Developed by the Harvard Humanitarian

Initiative, KoboToolbox is a suite of tools for field data collection, primarily used in challenging environments. It offers a range of functionalities useful for researchers and organizations operating in remote locations or disaster-stricken areas. These include creating and deploying mobile surveys, collecting data offline, geolocating survey responses, and designing custom reports. The toolbox is particularly favored by humanitarian and international development organizations because it is free and open source, allowing for a high degree of customization while also ensuring data security.

3.3. Sampling Design

Sample size calculation for this study strictly follows the Demographic and Health Survey: Sampling and Household Listing Manual published in 2012 by ICF International (ICF International, 2012). The sample size for a complex survey with stratification like DHS can be calculated by inflating the sample size using a design effect (*Deft)*. *Deft* is a measure of the efficiency of cluster sampling compared to a direct, simple random sampling of individuals. A *Deft* value of 1.0 indicates that the multi-stage sampling design is as efficient as simple random sampling. But multi-stage sampling also introduced sampling error, and thus it is less efficient. As a rule of thumb, we use a value of 1.5 for *Deft.* The formula is as follows:

$$n_0 = Deft^2 . \frac{(1-P)}{P.\alpha^2}$$

Where $\mathbf{n_0}$ is the initial sample size;

Deft is the design effect;

P is the currently estimated proportion; we set it to 15%;

$\boldsymbol{\alpha}$ is the desired Relative Standard Error (RSE); with statistical power equal to 90%, RSE equal 0.096.

The initial sample size calculation shows that we need to survey approximately 1,383 individuals. But generally, it is recommended by DHS that if we are doing a sub-national survey with a smaller target population, finite population correction of the above-calculated sample size should be applied. The final sample size is calculated by

$$n = \frac{n_0}{1 + n_0/N}$$

Where n is the sample size; **N** is the population of HIV-positive women between 15 – 49 years old who are receiving ART. The final sample size is **1,291** individuals. This value does not take into account the non-response rate. If we are to increase this figure by 10% to cope with potential non-response issues, we need about 1,420 samples for representativeness purposes. However, in reality, we managed to collect information on only **1,409 individual** women living with HIV and receiving ART within the time frame of three months, as discussed below. These women also have, in total, 3,756 children, which means, on average, they have about 2.7 children. The oldest child among them is 35 years old.

The sampling frame used for this survey was the latest updated list (updated in June 2023) of the number of women between 15 – 49 years old receiving ART from each ART site across all 25 provinces in Cambodia (NCHADS, 2023), comprising 73 sites with a total of

19,395 individual women. Of these, 30 percent are receiving the therapy in Phnom Penh. The sampling selection of the sample follows a two-stage procedure. In the first stage, ART sites in the 25 provinces were stratified into 73 sampling strata. We then selected 15 strata using a stratified random sampling with a probability proportional to size approach. In the second selection stage, a fixed sample size allocated to each stratum was surveyed using the simple random sampling method. This was achieved by asking the enumerator to survey all women between 15 – 49 years old who visited the ART sites for their scheduled appointment between January and April 2024. To prevent bias, no single site will be allowed to extend the duration. It should be highlighted that HIV patients come to the ART sites following their appointment with the medical personnel on a random date basis. This in itself created a randomization process since the appointment schedule was unlikely to correlate with the number of children they had. For example, women with a higher number of children tend to come to the ART site and acquire their therapy between January and March. If such a condition was true, we would likely overestimate the true TFR. However, we do not expect this to be the case.

Once the sampling design was initially concluded, it was put into consultation and discussion in October 2023 with NCHADS, NMCHC, and UNAIDS to gain insight into the local context, existing service delivery points, known barriers to healthcare access in the region, and feasibility for fieldwork. These discussions suggested that the sampling strategy should take into account factors such as geographic distribution and urban-rural dynamics. As a result, the study replaced one relatively smaller ART site in Battambang province with another one in Steung Treng province so that there was a representative site from both the plateau and mountainous regions of Cambodia. After this revision, we proceeded to allocate the sample size proportionally to each ART site, ensuring that the number of participants surveyed at each site matched the site's population. The sites with a higher number of women receiving ART were allocated a larger share of the sample. Table 1 outlines the population size, intended sample size, and actual sample size selected from each site, along with their locations. The population figure refers to the number of women aged 15-49 living with HIV and receiving ART at the respective sites.

Table 1: Selected ART Site with Intended and Actual Number of Selected Sample Size

No	Name of ART Site	Location		# of HIV positive women 15-49 years	# of Intended Sample	# of Actual Sample
		District	Provinces			
1	Serei Sophon RH	Krong Serei Sophon	Banteay Meanchey	390	74	74
2	Battambang PH	Krong Battambang	Battambang	932	177	177
3	Thmor Kol RH	Thmor Kol	Battambang	272	52	52
4	Kampong Cham PH	Krong Kampong Cham	KG Cham	667	126	129
5	Kampong Tralach RH	Kampong Tralach	Kampong Chhnang	24	5	5
6	Chey Chum Neash PH	Krong Takhmao	Kandal	627	119	90
7	NCHADS ART clinic 1	Khan Chroy Chongvar	Phnom Penh	717	136	137
8	Pochintong RH	Khan Po Sen Chey	Phnom Penh	450	85	88

9	NCHADS ART clinic 3	Khan Tuol Kork	Phnom Penh	612	116	121
10	Prey Veng PH	Krong Prey Veng	Prey Veng	316	60	47
11	Sihanouk PH	Sihanouk Ville	Preah Sihanouk	637	121	126
12	Siem Reap PH	Krong Siem Reap	Siem Reap	1187	225	223
13	Stung Treng PH	Krong Stung Treng	Stung Treng	143	27	30
14	Romeas Hek RH	Romeas Hek	Svay Rieng	54	10	10
15	Takeo PH	Krong Daun Keo	Takeo	464	88	90
		Total		**7492**	**1420**	**1409**

Source: Authors.

3.4. Data Collection

Following the successful approval from the authorities and ART site, t qualified, reliable, and committed enumerators were recruited. Concurrently, a detailed fieldwork plan was prepared by thoroughly examining the ART site beforehand. Ultimately, twelve enumerators were selected, and one was assigned as the team leader, responsible for regular data quality checks and progress monitoring in the field. Additionally, a field manager was appointed to carry out daily high-frequency checks and ensure smooth and complete data collection. The enumerators underwent a two-day training session covering the study overview, objectives, data collection plan, ethical principles, techniques for sensitive questioning, and the use of KoboToolbox on tablets. The training also involved a comprehensive review of the questionnaire on both paper and tablet formats, ensuring the enumerators' understanding of the questions and their purposes. Subsequently, a pilot test and a role-play exercise were conducted, with the enumerators acting as participants, to evaluate the questionnaire's effectiveness and flow, as well as to ensure consistent understanding among the enumerators. The questionnaire was then modified and finalized based on the feedback and discussions among the researchers and enumerators. The enumerator recruitment and initial data collection training were completed between mid- and late January 2024.

The full-scale implementation of the survey began in the first week of February 2024, initially at multiple ART sites in Phnom Penh, Kampong Cham, Sihanouk, Siem Reap, Steung Treng, and Takeo, and then expanded to the rest of the provinces. At each site, enumerators were tasked with waiting for and interviewing potential survey participants who came to the ART sites to collect their medication on a three-month rotating basis. The patients, women living with HIV, were confidentially identified through close collaboration with local health personnel, and they were approached and invited to participate in the survey in a strictly confidential manner at a quiet, suitable, and private space provided by the site staff. However, there were instances where patients did not come to pick up their medication themselves but sent their partners or someone they trusted, often due to work commitments. In such cases, the representatives were not interviewed. This challenge was encountered at all the ART sites. For those who were too busy to collect their medication during working hours and sent someone else to pick them up, the researchers interviewed them at their residence or the most convenient place after their working hours, provided that they agreed to do so via a phone call we obtained from

her trusted representative. Despite these challenges, the survey enjoyed a remarkably high response rate of 99 percent. Even though it is a sensitive topic, the participants are willing to partake in the survey.

Informed consent was obtained from the survey participants before the interview (appendix B). The enumerators were also obliged to ensure that all participants fully understood the project's nature, aims, and anticipated outcomes. All participants were also told that they had the right to withdraw their consent at any point during the survey or even after its completion, with the option of having their information deleted. Participants could also be withdrawn if the enumerator deemed it detrimental or risky for them to continue answering the questions. Additionally, every effort was made to make sure that survey time schedules were considerate of the participants' commitments and routines.

To ensure data quality, the research team accompanied a subset of data enumerator interviews in the first few weeks of the survey to monitor their performance and check for survey issues. Such supervision was scaled down as the survey progressed, but a monitoring mechanism that included spot-checks continued in Phnom Penh, Preah Sihanoukville, Banteay Meanchey, Battambang, Kandal, and Prey Veng. This monitoring mechanism was put in place to ensure that the quality of work undertaken by data enumerators continued throughout the fieldwork and that any problems that arose during the survey were immediately addressed. In addition, high-frequency checks (HFC) were carried out on a daily basis by leveraging digital supplements, in particular, through KoboToolbox data monitoring tools and a built-in dashboard. HFCs are meant to regularly analyze enumerators' performance, compliance with ethics requirements, response frequencies, outliers, duplicates, and other potential data quality issues such as typos that may trigger actions (e.g., outliers would trigger a re-interviewing of the participant). A random backcheck was also conducted by re-administering a selection of questions from the original questionnaire. It was also done to verify the eligibility of the sample. Those backcheck responses were compared to the original responses to identify discrepancies between answers. However, no significant discrepancies were spotted.

3.5. Data Analysis

The study examined two demographic measures used to determine the fertility rate within a (sub) population – the General Fertility Rate (GFR) and the Total Fertility Rate (TFR). The general fertility rate was defined as the number of births per 1,000 women of childbearing age, e between the ages of 15 to 49 years. Similar to the Cambodian Census's and Demographic and Health Survey's (DHS) method, only live births were considered with abortions, miscarriages, and stillbirths excluded. A live birth is defined as the complete delivery of a fetus from its mother, regardless of the duration of the pregnancy. After this separation, the newborn exhibits signs of life, such as breathing, a beating heart, pulsating umbilical cord, or voluntary muscle movements, regardless of whether the umbilical cord has been severed or the placenta remains attached. Mathematically speaking, the definition can be best understood using the following equation.

$$GFR = \frac{Number\ of\ livebirth}{Number\ of\ female\ population\ between\ 15-49\ years\ old} * 1{,}000$$

The total fertility rate was defined as the average number of children a woman would have if she experienced the current age-specific birth rates throughout her entire childbearing

age. This metric is popularly used to assess the fertility growth dynamics within a population because it is not affected by the population's age composition. A TFR of 2.1 or higher suggests that the childbearing population is replacing itself, as couples are producing at least two children on average. When the TFR remains above 2.1 for an extended period, the subsequent generation of childbearing age will likely be larger than the current one, assuming other factors like death rates and migration remain constant. In contrast, a TFR of less than 2.1 for many years means the number of populations is declining or starting to decrease. TFR can be estimated by first calculating the Age-Specific Fertility Rate (ASFR), sometimes called the age-period fertility rate and denoted by ${}_nF_x$, using the following formula:

$$ {}_nF_x[0,\ T] = \frac{Live\ birth\ in\ the\ period\ 0\ to\ T\ to\ women\ aged\ x\ to\ x+n}{Period-years\ lived\ in\ the\ period\ 0\ to\ T\ by\ women\ aged\ x\ to\ x+n} $$

Numerator: Births were tabulated based on the period of birth and the mother's age at the time of the birth. The former was calculated by subtracting the date of birth from the date of the interview, both in Century-Month Code (CMC) format. Only births that occurred between 0 to *T* period before the survey were included in the tabulation. The latter was calculated by subtracting the mother's date of birth from the child's date of birth, both in CMC format. This difference was then divided by 60 and truncated to whole numbers to determine the age group.

Denominator: Women's period-years lived was calculated as the sum of the number of months she has been exposed to the five-year age groups within the time period, divided by 12. Depending on the length of the period, a woman may contribute exposure to multiple age groups, but for periods shorter than five years, a woman will contribute to no more than two five-year age groups, referred to as the higher and the lower age groups.

> ***Higher age group:*** A woman's age minus one month at the time of the interview determines her higher age group. The minus one (-1) was there to ignore the month of the interview and use just the 0 to T period prior to the survey month. The number of months an individual spent in the higher age group was calculated by determining the difference, in months, between their age at the end of the exposure period (date of interview minus one) and the lower age limit of that age group plus one month. If the number of months in the age group was more than the *T*, the exposure is capped at *T*. If it was less than the *T* month, the woman's exposure was split between the higher and the lower age group.
>
> ***Lower age group:*** The contribution to the lower age group is *T* less than the number of months of exposure in the higher age group. If the number of months in the higher age group exceeded the duration of the time period *T*, then the exposure in the higher group was the full length of the period *T*, and the exposure in the lower age group was zero.

Operationally, once the ASFR for each age group of women from 15-19 to 45-49 was calculated, the Total Fertility Rate was calculated by summing up all the ASFR and multiplying the result by the interval *n*, $(\sum_n F_x) * n$, where *n* is 5 years. It should be highlighted that the time period (*T*) used to measure current fertility and total fertility rate (TFR) can vary across different analyses. For instance, the Cambodian Census collects data on children born in the 12 months preceding the census date to determine current

fertility and TFR. On the other hand, the Cambodia Demographic and Health Survey (DHS) uses a 36-month period to calculate these fertility metrics. The selected time period represents a balance between the need for recency and the desire to minimize sampling variation. This timeframe was initially established during the World Fertility Survey when the average sample size was approximately 5,000 women (Croft et al., 2023). For the sake of consistency over time and across different surveys, The DHS Program has maintained the use of this same time period.

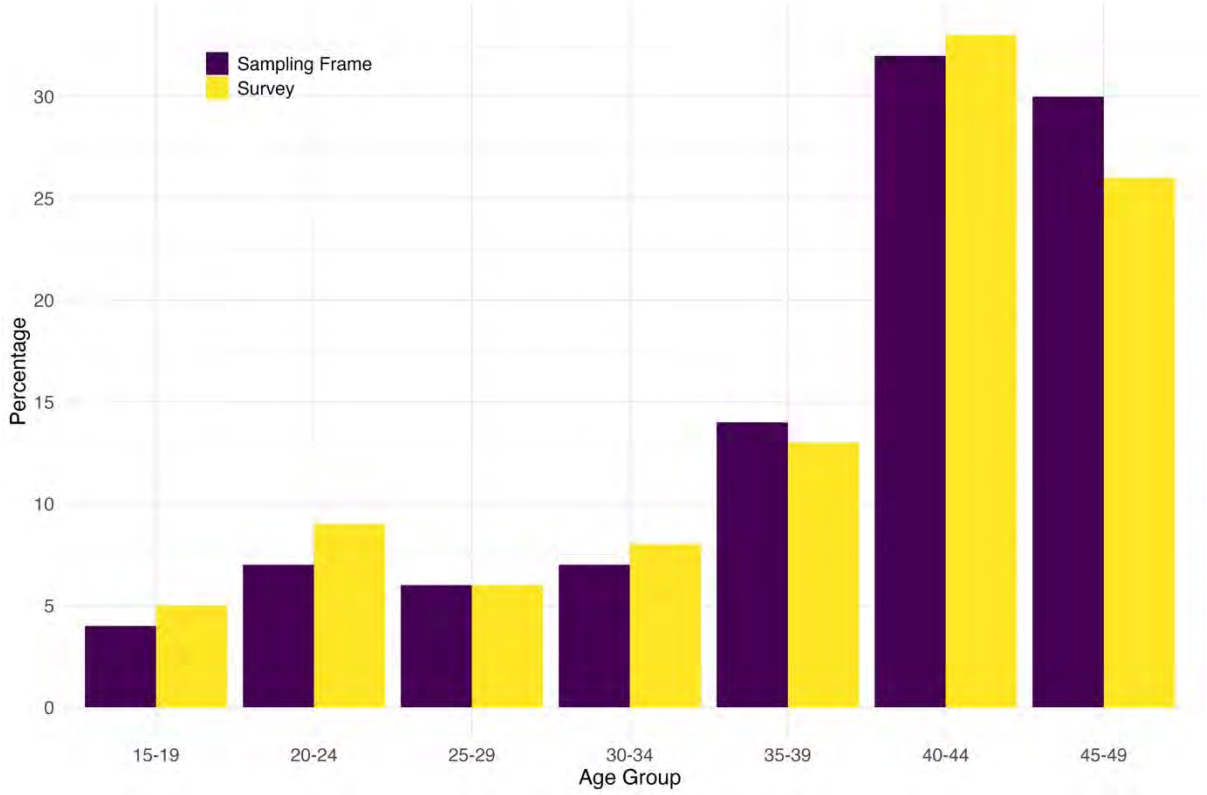
In addition to the current fertility calculation, there were additional descriptive statistics on certain fundamental and important variables, such as pregnancy outcome, breastfeeding practice, place of delivery, etc., to generate basic insight to add to this research study. The entire dataset and analysis process used the R programming language, which is currently a popular statistical package used by quantitative researchers. The code will be provided for republication purposes upon request.

4. Results and Discussion

4.1. Basic Characteristics of Women Living with HIV

This section presents the key findings and discussion of the survey exploring the fertility of women living with HIV who are receiving antiretroviral therapy (ART). As HIV treatment has improved, many women with HIV are living longer, healthier lives and considering pregnancy. However, there is limited research on the fertility patterns and reproductive intentions of this population. Once again, the survey aimed to better understand the birth history, reproductive experiences, desires, and challenges faced by women with HIV who are accessing ART.

Figure 1: Percentage Distribution of Women Living with HIV by Five-Year Age Group

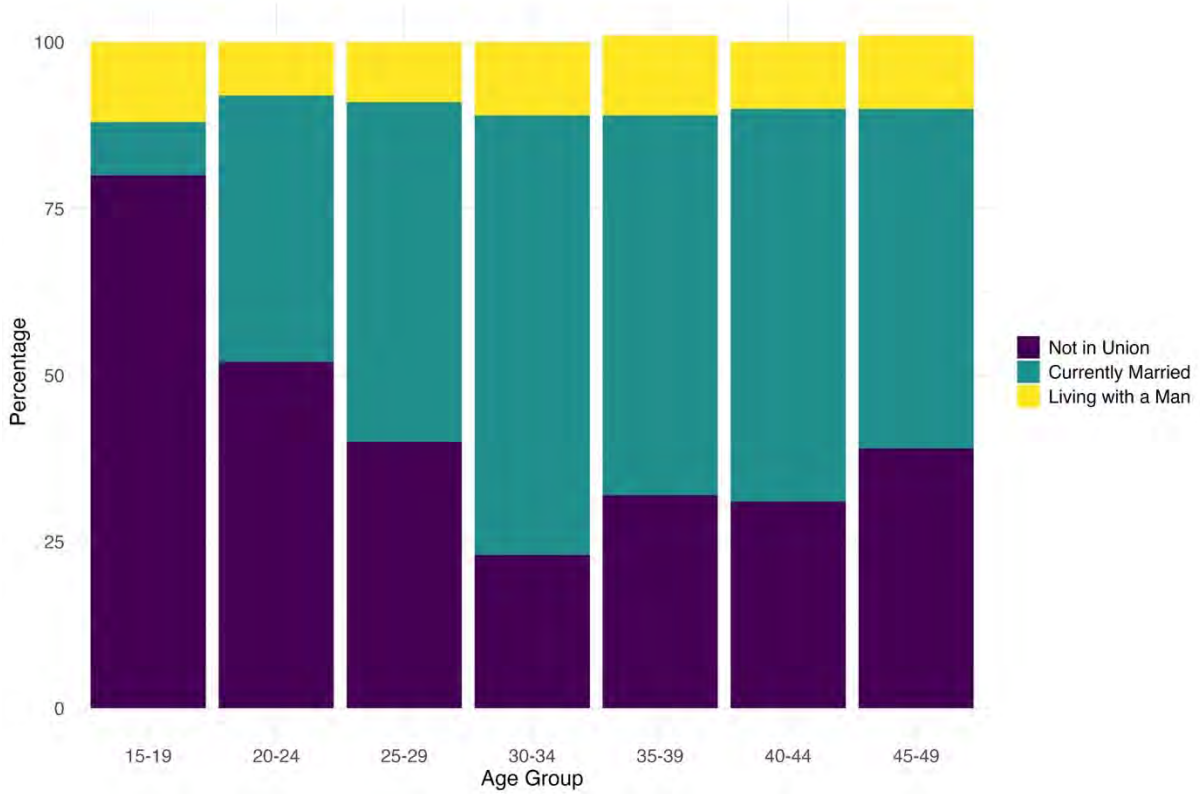


Source: NCHADS (2023); Authors.

Figure 1 illustrates the percentage distribution of women 15–49 years living with HIV/AIDS and receiving ART in Cambodia by five-year age group (purple bars) compared to the survey sample (yellow bars). Based on an important probability theory known as the Law of Large Numbers, the approximation between the population and survey sample confirms a proper and appropriate random sampling design. Note that Figure 1 identifies those women attending an ART clinic and thus the percentage distribution shown should not be used to compare with the age and sex distribution of the entire Cambodian population. The population pyramid typically depicts a greater number of women in the younger age groups compared to the older age cohorts. On the result itself, only five percent of women of childbearing age and living with HIV are adolescents, the majority of whom were never in a union or involved in sexual intercourse before, as will be discussed in Figure 2 below. As a result, it is assumed they got infected due to another factor, most likely mother-to-child transmission, also known as vertical transmission.

Indeed, Yi et al. (2018) assert that the majority (83%) of adolescents, both boy and girl, got HIV infection from their mother. The percentage distribution also increases with age. In fact, more than half of the women living with HIV are between 40 – 49 years old. In other words, as women grow older, they are more likely to be infected since older women are also more likely to be involved in sexual intercourse. This finding is in line with a previous study in Cambodia, which found the mean age of female HIV patients is 44 years old (Chhoun et al., 2017). But because of developments in medicine, especially the creation of the highly effective ART, HIV is no longer a fatal illness but rather a chronic condition that can be managed. People living with HIV have seen notable gains in their general health and life expectancy as a result of these developments.

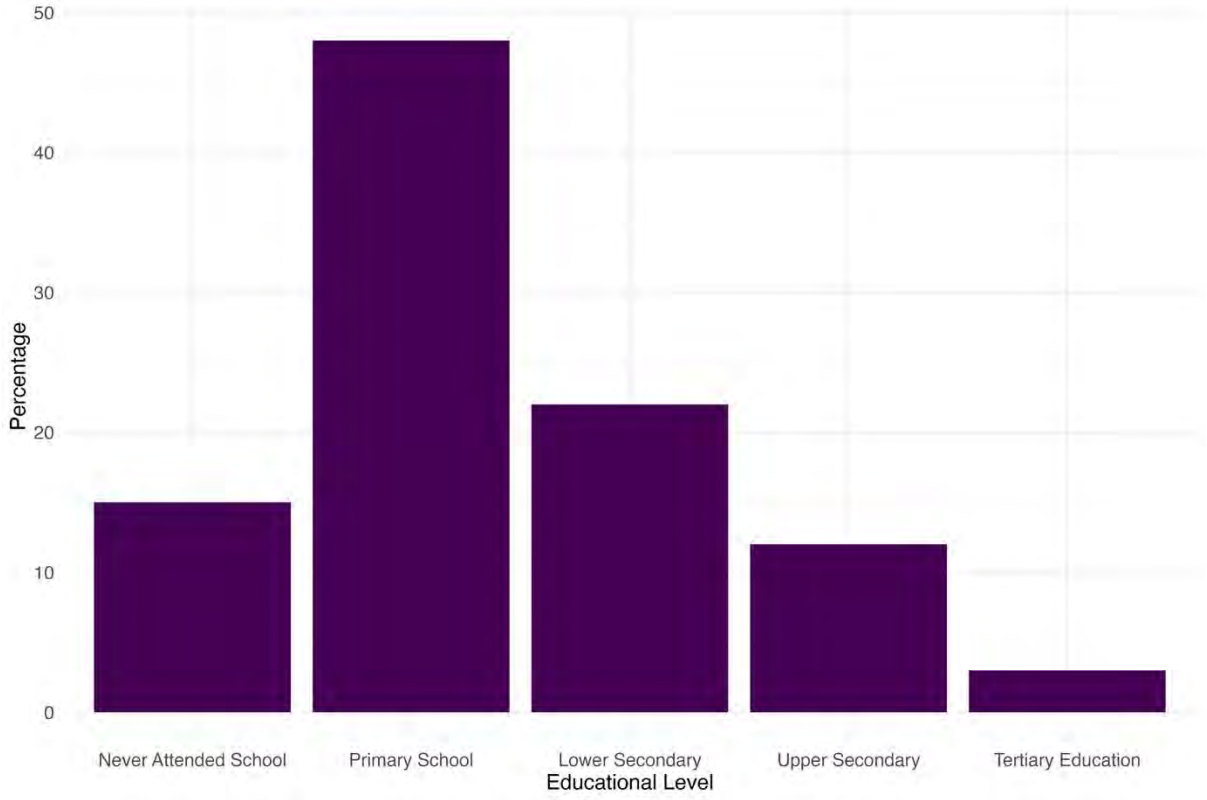
Figure 2: Percentage Distribution of Women Living with HIV by Age Group and Marital Status



Source: Authors.

Figure 2 demonstrates the percentage distribution of women living with HIV by age group and marital status. Overall, approximately two-thirds of the patients are still in a relationship. But if we break down further by age group, the data indicates that older women are more likely to be in a relationship. However, the survey did not elicit the HIV status of their r partners or if they were currently sexually active and whether they were using condoms. An informal interview with some patients revealed that they had not disclosed their current HIV status to their partners, fearing discrimination and the potential termination of the relationship. This is often the case when the male partner is unaware of the patient's previous relationship with the person who infected them. Nevertheless, it is unclear if HIV infection was the main reason for their breakup. For those who are currently not in a union, roughly 20 percent of younger women between 15 – 24 years old were either married or living with a man previously, while older women were mostly married or living with a man previously.

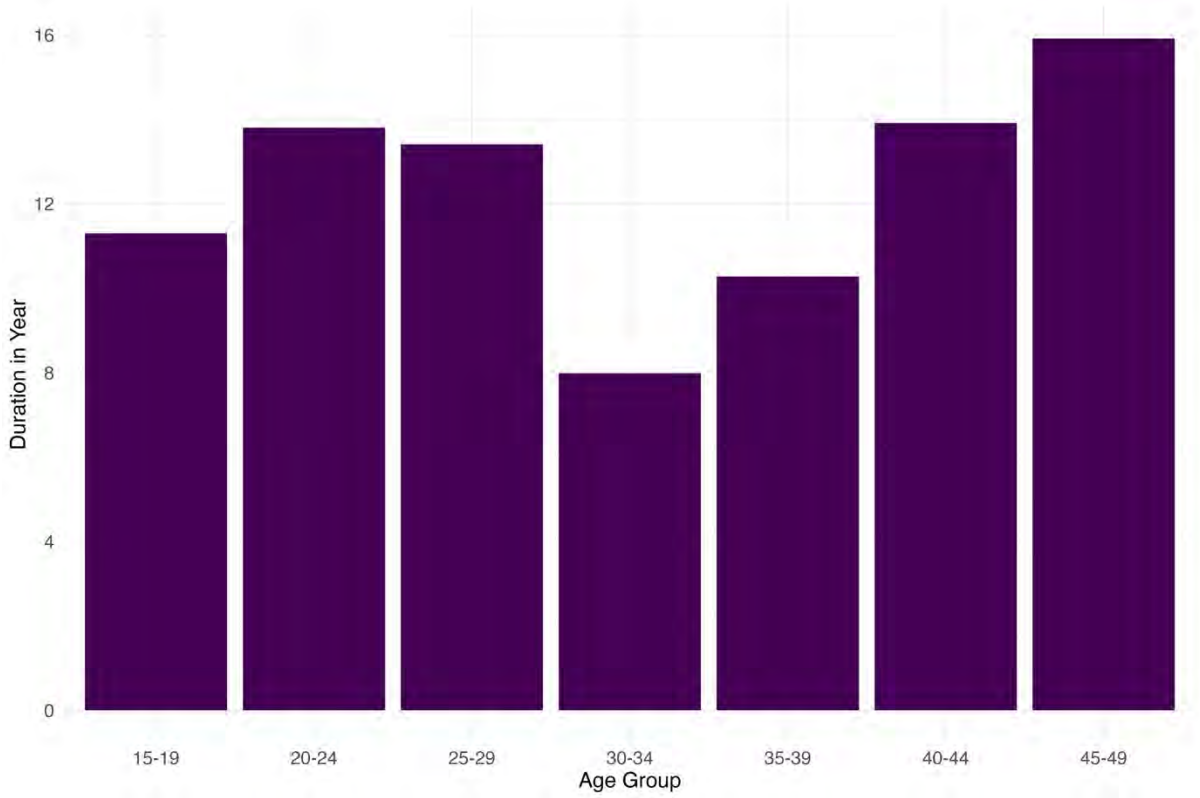
Figure 3: Percentage Distribution of Women Living with HIV by Educational Level



Source: Authors.

Figure 3 demonstrates the percentage distribution of women living with HIV by their educational level. The first group, roughly 15 percent of the sample, consists of those who have never attended school. The second group (48 percent) includes those who have completed between one and six years of primary education. The third group (22 percent) comprises those who have completed seven to nine years of lower-secondary education. The fourth group, which is 12 percent, consists of individuals who have completed ten to twelve years of upper-secondary education. Lastly, the fifth group encompasses those with tertiary education, which includes college dropouts, individuals with associate degrees, and those who have earned a bachelor's degree. None of the women in the sample have attained a master's degree or higher. Visibly, there is a negative relationship between a woman's educational attainment and her risk of contracting HIV. Generally, women living with HIV and receiving ART tend to have low levels of education. However, it is also important to note that the relationship between women's educational level and HIV status is not entirely straightforward. Intuitively, women with less education often have fewer economic opportunities, which can make them more vulnerable to engaging in high-risk behaviors, such as transactional sex, in order to support themselves and their families. Additionally, lower levels of education are associated with less access to comprehensive sexual and reproductive health information and services (Ung et al., 2014), as well as reduced agency and decision-making power within relationships (Chea & Sar, 2023).

Figure 4: Average Duration Since Initial HIV-Positive Diagnosis by Age Group



Source: Authors.

The data presented in Figure 4 shows the average duration of living with HIV since the first positive test, broken down by age group, for women. For the first two age groups (15-19 and 20-24), the average duration is 11 and 14 years, respectively. This confirms that the majority of women in these younger age groups were vertically transmitted, especially from their mothers, or through other means unrelated to sexual intercourse, as their first positive test was done during childhood. Having said that, the vast majority of them are also more likely to be on ART treatment, which is also why they can prolong their life. For women in the age group between 25 and 29, the duration suggests that many tests were done when the women were a child, and many others were done during adulthood. In contrast, for the age groups starting from 30-34 and above, it is more probable that the HIV infection occurred during their young adult years. This is because if they had been infected as children, they would not have survived to reach their current age without receiving ART treatment, as they would have succumbed to the disease at a younger age. In other words, the later positive test results for these older age groups indicate that the infection likely happened during their young adulthood rather than in childhood.

4.2. Current Fertility

Maintaining fertility and reproductive health is a critical concern for women living with HIV. While advancements in ART have dramatically improved the prognosis for those with HIV, unique challenges remain when it comes to pregnancy. This section will explore and provide an answer to the first main research objective concerning the fertility potential for women navigating HIV alongside their reproductive lives. We will start with the general situation of their current fertility rate.

Table 2: Current Fertility

Age Group	Age-Specific Fertility Rate (ASFR)				Duration Since Last Birth (Year)
	Birth in Last 12 Months		Birth in Last 36 Months		
	Census 2019	Survey 2024	DHS 2021-22	Survey 2024	
15-19	0.032150	0.070900	0.048000	0.060400	0.6
20-24	0.125950	0.111000	0.154000	0.124000	1.6
25-29	0.136610	0.080100	0.149000	0.070700	4.2
30-34	0.108110	0.071100	0.110000	0.067500	6
35-39	0.061920	0.015000	0.061000	0.038300	8.7
40-44	0.028000	0.014100	0.024000	0.015100	13.2
45-49	0.009620	0.003200	0.003000	0.002840	16.9
TFR	2.5	1.8	2.7	1.9	-
GFR	52	32	94	111	-

Source: National Institute of Statistics (2020); National Institute of Statistics, Ministry of Health, & ICF International. (2023); Authors.

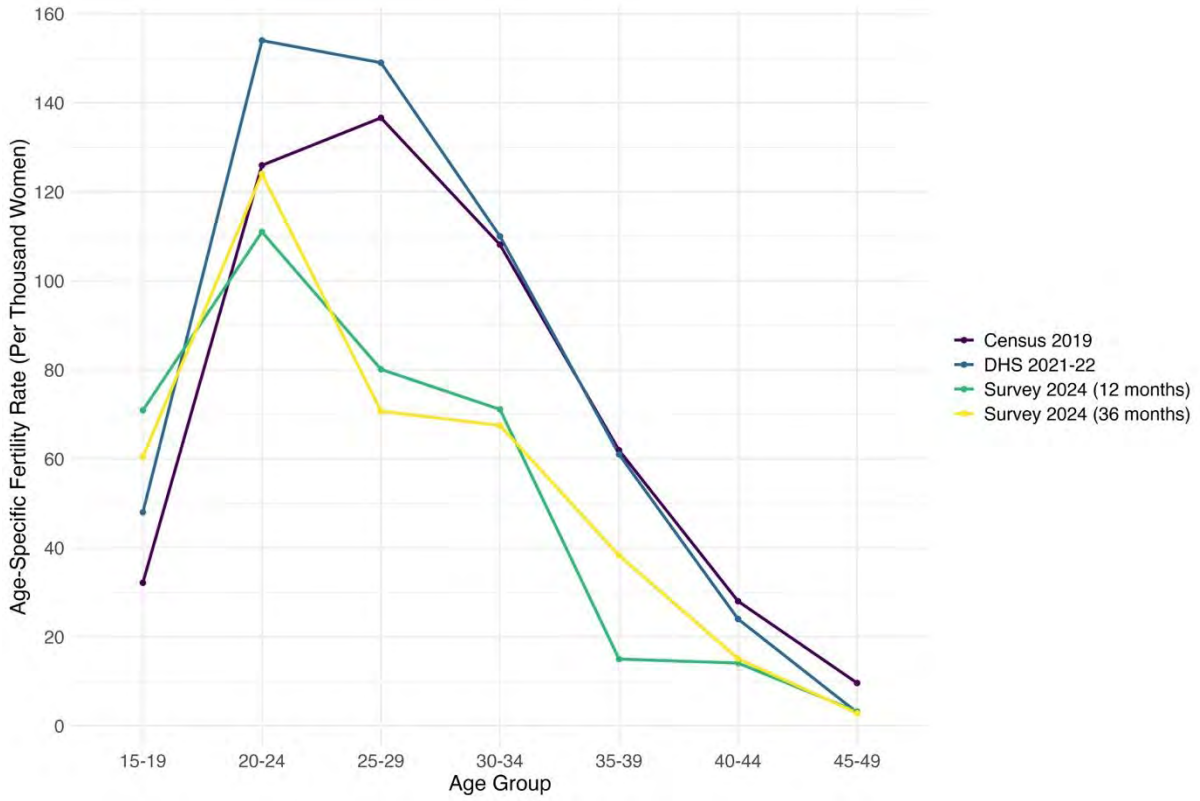
Table 2 presents the current fertility rate of women living with HIV in Cambodia. Additionally, the results from this survey are compared to previous reports, specifically the Cambodian Census 2019 and the Cambodia Demographic and Health Survey 2021 – 2022. It is important to note that the comparison with the census uses the same 12-month time frame (*T*), while the comparison with the DHS uses a 36-month period to guarantee apples-to-apples comparison. Furthermore, adjustments have been made to account for higher and lower age groups to which women's lived years of exposure contribute. But it is still worthwhile to note the differences in the data collection period when comparing results across various fertility studies.

The Total Fertility Rate (TFR). for women living with HIV who are receiving ART treatment appears to be within the range of 1.8 to 1.9, depending on the time period (*T*) considered. The longer duration of 36 months suggests a slightly higher TFR compared to shorter timeframes of 12 months. This figure is much lower than that of the general population, which is between 2.5 and 2.7. The result is in line with previous studies (Chen & Walker, 2010), including one done in Cambodia (Okada, 2012), because HIV/AIDS effect on reproduction goals and outcomes is still a complicated and multidimensional problem. Conceiving, getting pregnant, and raising a child provide special difficulties and choices for women living with HIV. Numerous studies have been carried out in the last 20 years better to understand the complex interaction between HIV infection and fertility (Marston et al., 2016). Research carried out in many fields has revealed that women living with HIV have reduced fertility rates in contrast to women who are HIV-negative. For instance, studies carried out in Uganda (Fabiani et al., 2006) and Cote d'Ivoire (Desgrées du Loû et al., 1999) revealed that HIV-positive women had a 15–17 percent lower fertility rate than those of HIV-negative women. These results imply that HIV infection negatively affects fertility on its own.

But it was documented that the differences in fertility between women who are HIV-positive and those who are HIV-negative have reduced as ART has become more accessible. It means the current fertility rate for women living with HIV in Cambodia could have been lower than those presented here without universal ART treatment available in the country. In support of this notion, Marston et al. (2016) discovered that married

women living with HIV but not on ART treatment had a much lower desire to have more children than ART-treated women living with HIV did. Even after accounting for variables such as income, age, education, and parity, this difference was still statistically significant. These results imply that women living with HIV have changed their aspirations and choices about reproduction as a result of the accessibility of ART. Having said that, an intriguing finding is the ASFR for adolescents, which is higher than the general population in any dataset. As a result, we decided to investigate further.

Figure 5: Age-Specific Fertility Rate by Age Group and Dataset

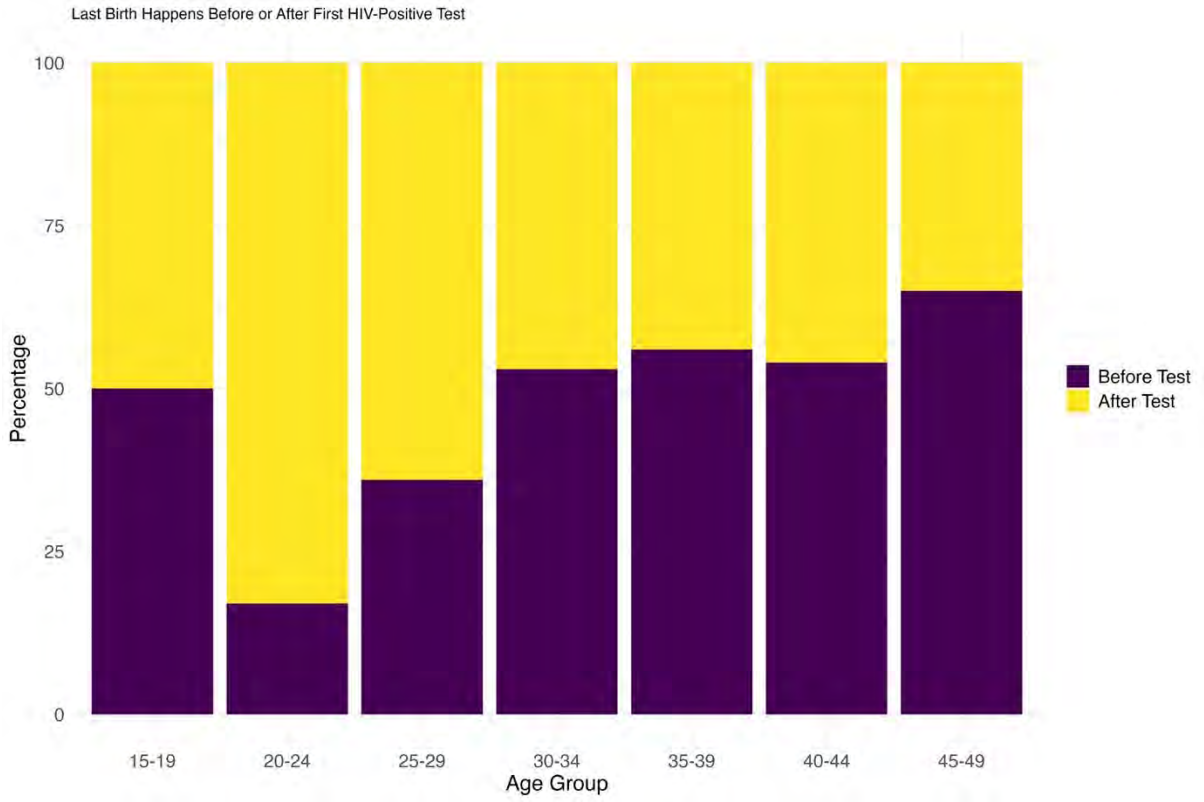


Source: National Institute of Statistics (2020); National Institute of Statistics, Ministry of Health, & ICF International. (2023); Authors.
Note: Age-Specific Fertility Rate (Per Thousand Women) measures the number of births to 1,000 women of a specified age group.

Figure 5 displays the ASFR for women living with HIV in Cambodia by age group and dataset. Overall, the patterns look similar to the ASFR found elsewhere in the world, but if we compare across different datasets, it reveals that the adolescent (15 – 19 years old) fertility rate is higher among HIV-positive women relative to those without HIV in Cambodia. Similar findings have also been reported in other studies in Africa (Lewis et al., 2004; Zaba & Gregson, 1998). In fact, using a number of studies conducted in sub-Saharan Africa which have investigated the fertility patterns of women living with HIV compared to those who are not infected, the Spectrum Manual for national estimation and project of HIV-related consequences also concludes and recommends any estimation to take in account two important piece of information that (1) the fertility rate is lower among HIV-positive women aged 20 to 45 years old compared to their HIV-negative counterparts. But (2) the fertility rate tends to be higher for HIV-positive women in the 15 to 19 age group (Bollinger et al., 2024).

Selection for the early start of sexual activity usually explains this remarkable pattern of higher fertility rate among teenage girls living with HIV as compared to those without. Simply put, girls with parents who have HIV tend to be from disadvantageous backgrounds and have lower education, and thereby get married or become sexually active at an earlier age. Many research studies also indicate that it is often done with men who are also significantly older, pressuring them into early pregnancy and shorter birth intervals (Gregson et al., 2005; Zaba & Gregson, 1998)., The Cambodia DHS 2021-22 indicates that the rate of teenage pregnancy, which refers to pregnancy among individuals aged 15 to 19 years regardless of the outcome, is 9.3 percent (National Institute of Statistics et al., 2023). However, our survey data shows that the rate is 23 percent among the same girl cohort living with HIV, which is more than twice as high as the figure reported in the recent DHS.

Figure 6: Percentage Distribution of Women Living with HIV by Age Group and Timing of Last Birth in Relation to Their Knowledge of HIV Status



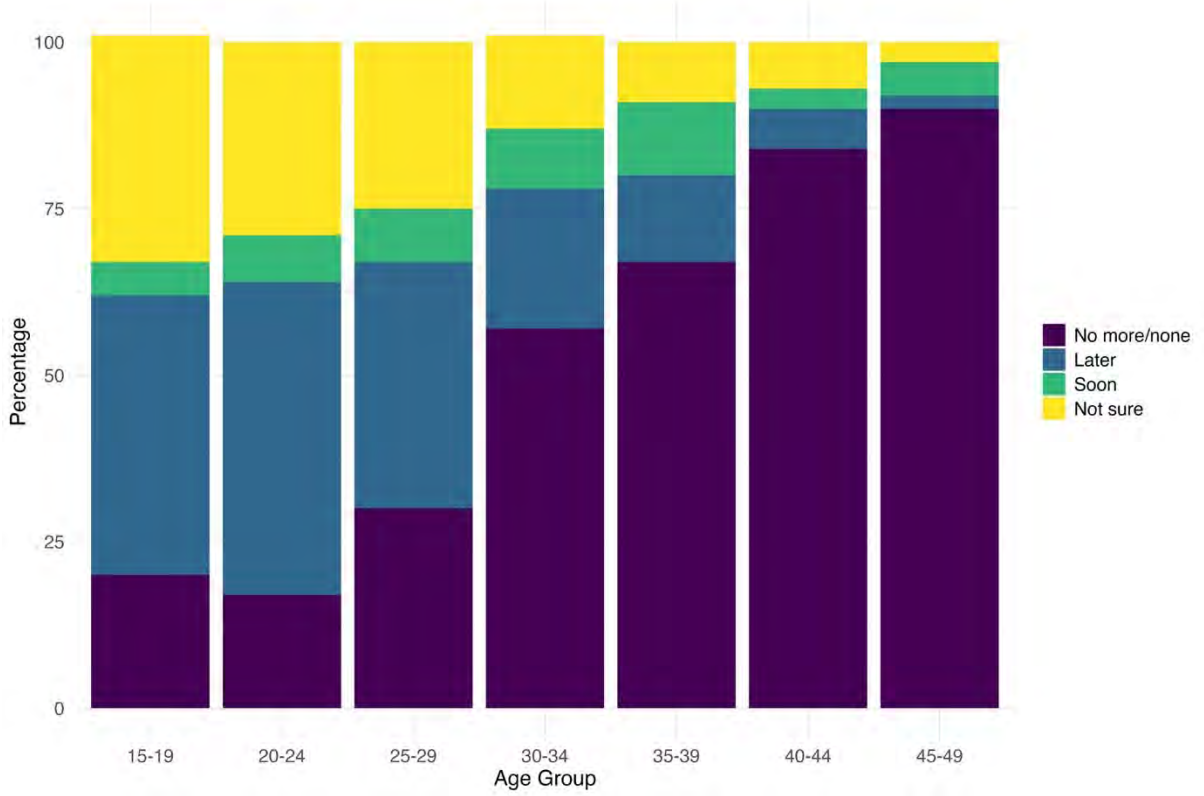
Source: Authors.

Figure 6 reveals the percentage distribution of women living with HIV based on their age group and the timing of their last birth in relation to their first positive HIV test result. Specifically, it examines whether the last birth occurred before or after the first HIV-positive test. It is worth noting that we have also taken into account the fact that some of them might have only known of their HIV-status during the antenatal care period after they had already realized they were pregnant. In these cases, the pregnancy occurred before the individual's HIV-positive status was known.

The data indicates that majority of Cambodian young women (15 – 24 years old) living with HIV have given birth after they were diagnosed with the virus. In contrast, most births

among older age groups of women occurred before they were aware of their HIV-positive status. This may be because either they believed they were too old to have children or they stopped giving birth due to concerns about the risks of vertical transmission, health complications, and/or a lack of information on safe labor and childcare methods. But it is more likely due to HIV. It should be noted that the most recent births could have happened a significant time ago, as the average duration since first testing positive is over 10 years for many age groups, and that they were much younger to have a child then. For once, this justifies the use of age-adjusted total fertility rate approaches for data analysis and calculation of ASFR, as we have done. Nonetheless, HIV may contribute to the lower fertility rates observed among HIV-positive women compared to their HIV-negative counterparts, as it reduces their potential childbearing lifespan.

Figure 7: Percentage Distribution of Women Living with HIV by Age Group and Their Fertility Desire

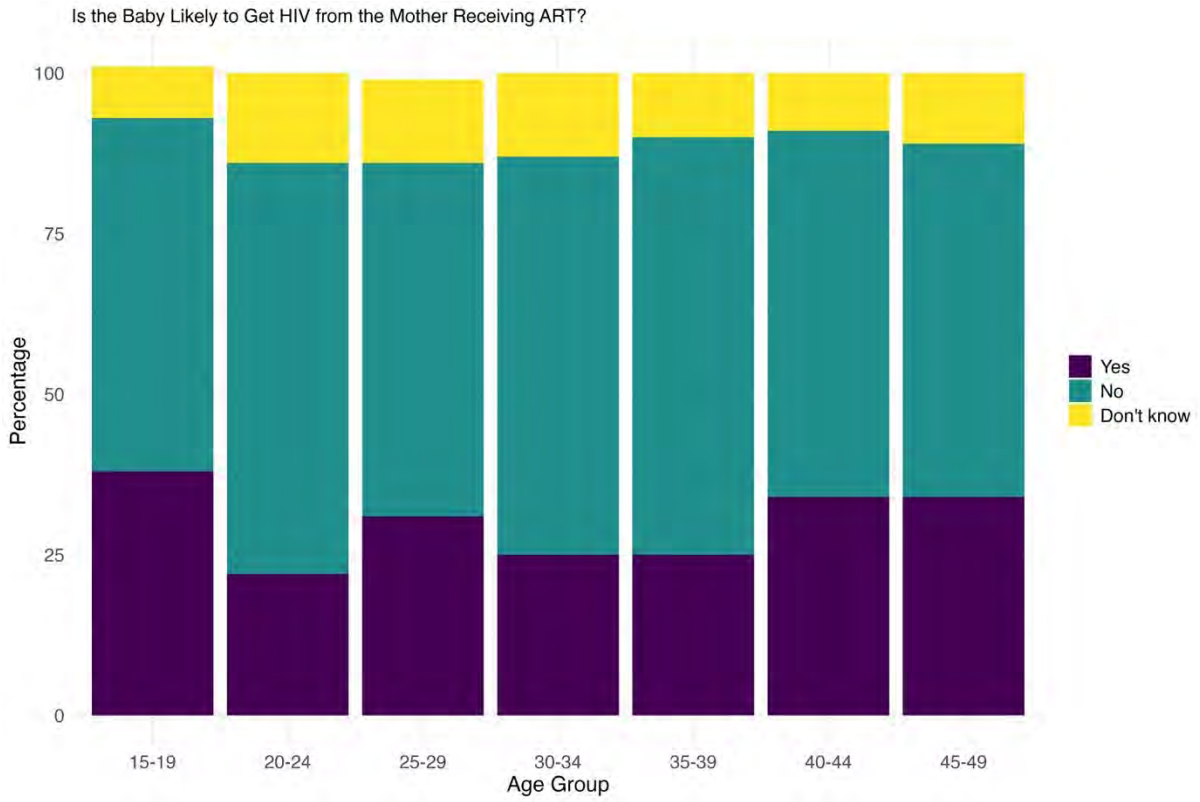


Source: Authors.

The statistic presented in Figure 7 shows the percentage distribution of women living with HIV based on their age group and their desire to have an additional child. This pattern is, in fact, quite common, with the intention to not have any more children increasing with age, which is similar to the general public's fertility desires as found in the CDHS. Since the question was asked of both women with and without children, it is difficult to determine the extent to which the experience of raising a child after testing positive for HIV contributes to their fertility intentions without further investigation. Generally, younger women tend to prefer having an (additional) child, often at a later time rather than immediately, while older women are more inclined to not have any more children. It is unclear whether this is due to age, HIV-related concerns, or a combination of both factors. Again, women living with HIV may choose to forgo or postpone childbearing due to concerns about the potential impact on their own health, the health of their child, or the

practical challenges of raising a child while managing their HIV. A key factor that may influence fertility desires is the knowledge of suitable delivery and breastfeeding mechanisms. With proper knowledge, treatment, and care, many of these women would be able to achieve viral suppression, enabling them to consider and pursue pregnancy. Unfortunately, knowledge about the impact of ART treatment on mother-to-child transmission is not universally acquired by all Cambodian women despite the ART virtually universal coverage.

Figure 8: Percentage Distribution of Women Living with HIV by Age Group and Knowledge of the Impact of ART on Vertical Transmission



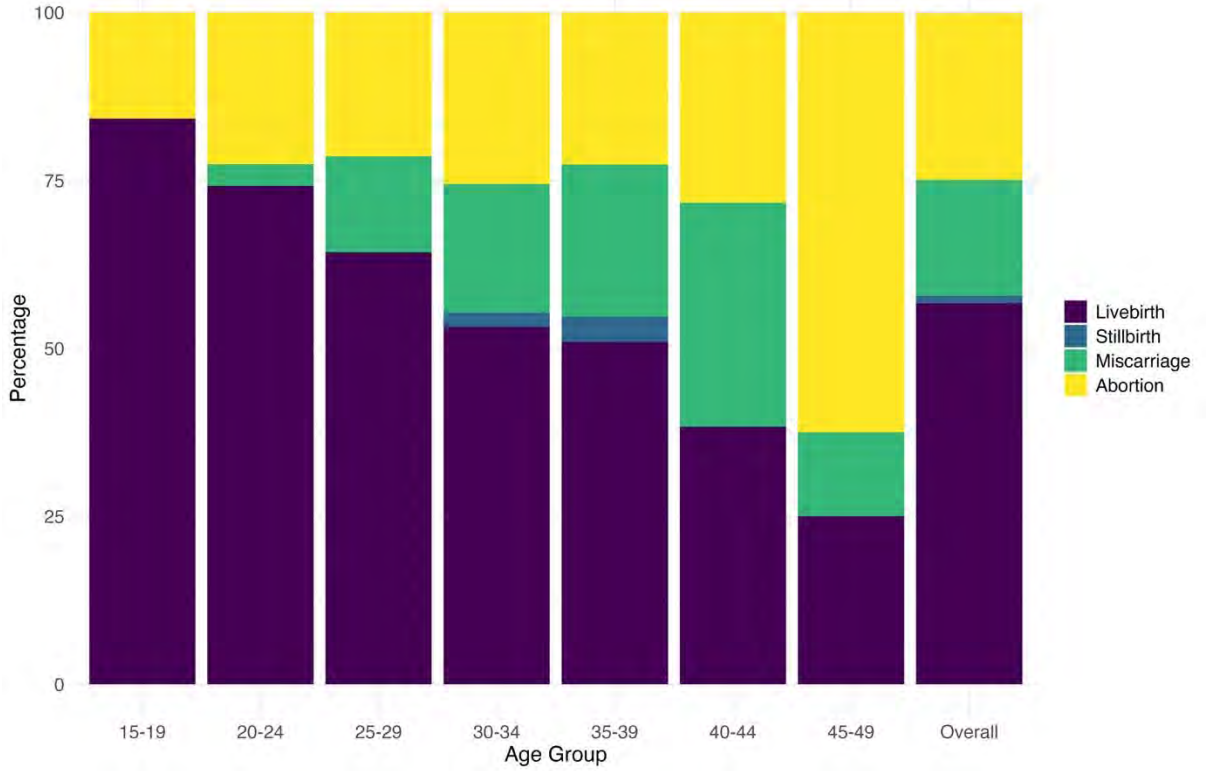
Source: Authors.

Figure 8 demonstrates the percentage distribution of women living with HIV and receiving ART by age group and knowledge about the impact of ART on vertical transmission. Consistently, for almost all age groups, one out of two women have an inadequate understanding that proper and effective ART treatment can suppress the HIV virus and prevent potential mother-to-child transmission, signaling limited knowledge of the full ART impact on reproductive health.

This is surprising since a recent study in Uganda found that many older HIV-positive people in Africa have more knowledge about the impact of ART as compared to young individuals living with HIV (Bwanika Naggirinya et al., 2022). Regardless of that, this figure provides important insights to inform clinical care, counseling, and policies to support the reproductive goals of women living with HIV. In other words, this is one big area where government prospective interventions and strategic plans can play a significant part, for possessing perfect knowledge about ART not only changes women's perception towards pregnancy and childrearing but also positively influences ART adherence and

reduces non-compliance to ART appointments. Ultimately, Cambodia will be able to achieve the 95-95-95 and future national agendas or targets.

Figure 9: Percentage Distribution of Women Living with HIV by Age Group and Pregnancy Outcome



Source: Authors.

Figure 9 shows the percentage distribution of women living with HIV by their age group and pregnancy outcome. It should be noted that demographic statistics on pregnancy outcomes distinguish between several key classifications. A live birth refers to a child who was born alive, even if they only lived for a short time. In contrast, a stillbirth denotes a child who was born deceased, with no signs of life, following a pregnancy of 28 weeks or longer duration. Miscarriage describes a pregnancy that ended involuntarily before reaching the 28-week threshold. Lastly, an abortion signifies a pregnancy that was voluntarily terminated. In addition, to be able to compare directly with CDHS, we only use pregnancies that occurred within the 36 months preceding the survey.

On the results, as initially expected, the survey indicates that the rate of induced abortion is significantly higher among women living with HIV, with an overall rate of 25 percent, compared to the general population. This tendency is particularly pronounced in the older age group of 40-49 years. Additionally, the rate of miscarriage, regardless of the underlying cause, is notably higher among women living with HIV at 17.3 percent, in contrast to HIV-negative women. In comparison with the results from the 2021-2022 Cambodia DHS, among women who had been pregnant in the past 36 months, 12 percent experienced miscarriages, 9 percent had induced abortions, and 80 percent of these abortions were either unwanted or mistimed. Apart from that, the results of the 2022 Integrated Biological and Behavioral Survey (IBBS) among Female Entertainment Workers (FEW) showed that

three out of five ever-pregnant FEW had undergone induced abortions. Another notable difference observed between the CDHS and our survey data is the decreasing trend in live births as the age of the women increases, as illustrated in the figure above, while the observed trend in the CDHS shows a relatively consistent percentage of live births across all age groups.

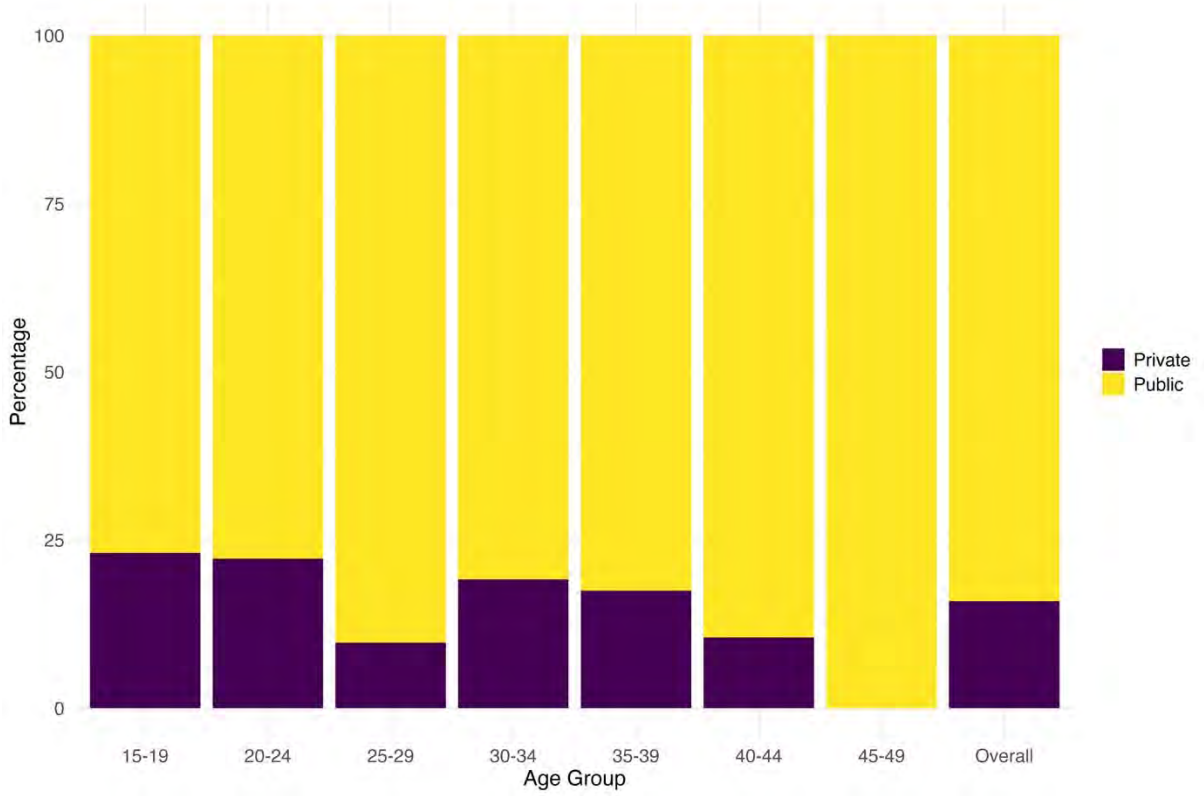
Surveying female entertainment workers in two major cities in Cambodia, namely Phnom Penh and Siem Reap as a case study, Yi et al. (2015) found that most of the induced abortions occurred at private clinics due to unwanted pregnancies from unprotected sex with romantic partners rather than from sex with commercial customers where condoms were purchased and used regularly. This suggests the unwanted pregnancies were not due to a lack of contraception but rather from not using it. Similarly, in India, Darak et al. (2016) found a high prevalence of unwanted pregnancies and induced abortions among HIV-infected women, which was linked to a low level of knowledge about the prevention of mother-to-child transmission. This highlights the need for preconception counseling and comprehensive family planning services for HIV-infected women. Additionally, a study by Kabunga et al. (2023) using a phenomenological approach explored the lived experiences of women living with HIV who had undergone induced abortions. The women cited various reasons for the abortions, including financial concerns, complicated relationships, and a fear of infecting their unborn babies.

4.3. Prenatal Care and Breastfeeding Practice

Results from a sub-sample of women with children under five years of age (<60 months) to minimize recall bias are presented below. It should also be highlighted that a woman may seek prenatal care services more than one time at both public and private facilities, and in this case, we include both in the data analysis.

Highlights from the CDHS 2021-22 indicate that similar to ART coverage, antenatal care coverage is exceptionally high, with 98 percent of women attending antenatal care services, of which 94 percent are offered in the public sector, where more than 90 percent of clients also undergo HIV testing. In comparison to our survey, the percentage of antenatal care coverage is identical, but only 84 percent of women living with HIV sought these services at public facilities. The remaining 16 percent used private clinics, perhaps due to their HIV status and conveniences, while non-governmental organization providers of antenatal care services play a negligible role. Pregnant women living with HIV are more inclined to seek antenatal care at for-profit private facilities relative to HIV-negative individuals.

Figure 10: Percentage Distribution of Women Living with HIV by Age Group and Type of Prenatal Facility

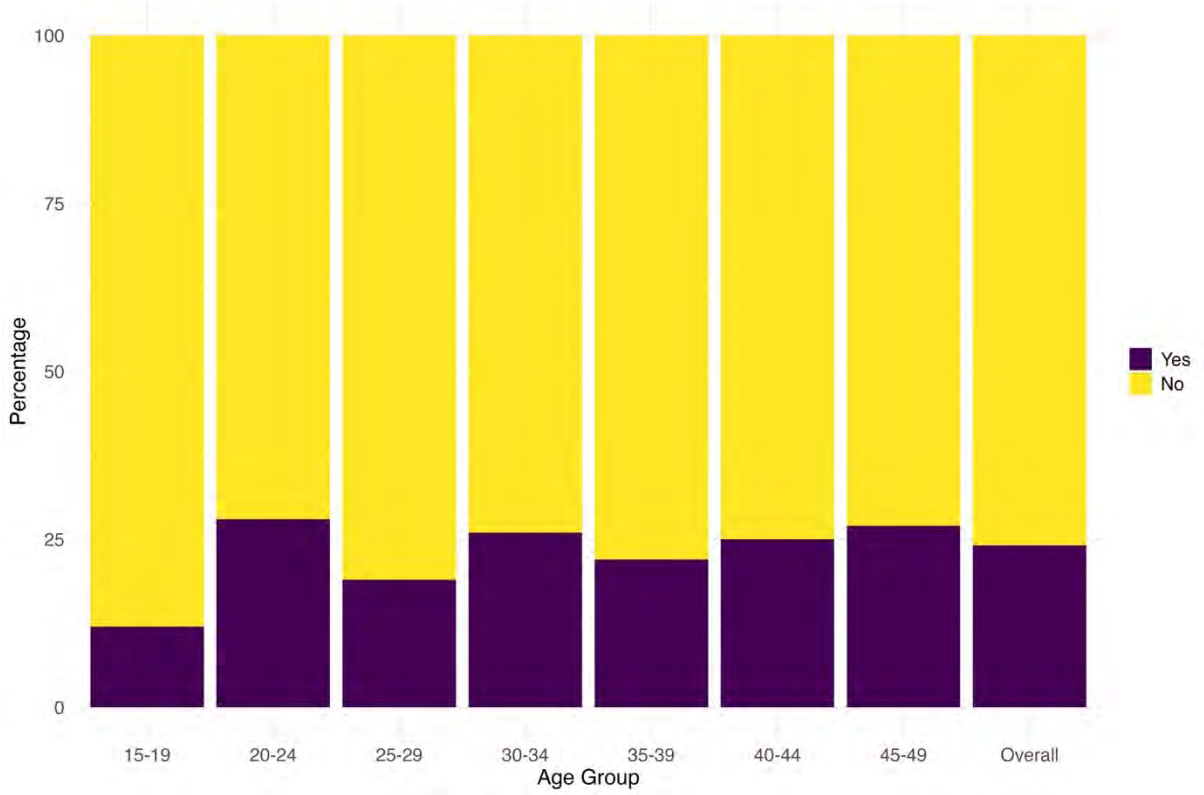


Source: Authors.

Figure 10 presents the percentage distribution of women living with HIV by their age group and the types of prenatal facilities they visited when they were pregnant. While the vast majority of women chose to seek care services at public facilities, including health centers, district referral hospitals, provincial hospitals, and national hospitals, women at younger ages tend to go to private caregivers, namely private hospitals or clinics. However, it is unsure why this is the case, but another study in Cambodia indicated that there was a challenge for HIV-positive adolescents in terms of the transition from pediatric to adult HIV care (Toth et al., 2018), while another one in sub-Saharan African countries suggested that these adolescents may perceive certain facilities as safer spaces for getting peer supports, obtaining HIV information, and gaining confidence (Mark et al., 2017). Anyhow, 73 percent of these antenatal care providers in Cambodia, whether private or public, talked to the individual women about breastfeeding their children at least once during the visit.

The survey results indicated that 94 percent of women living with HIV chose to deliver their babies at public health facilities, compared to only 6 percent who delivered at private clinics. Furthermore, all of the women in the younger age group had their babies delivered at provincial or national hospitals. This is an interesting finding, as they tend to seek antenatal care at private clinics. This discrepancy presents an intriguing subject for further research.

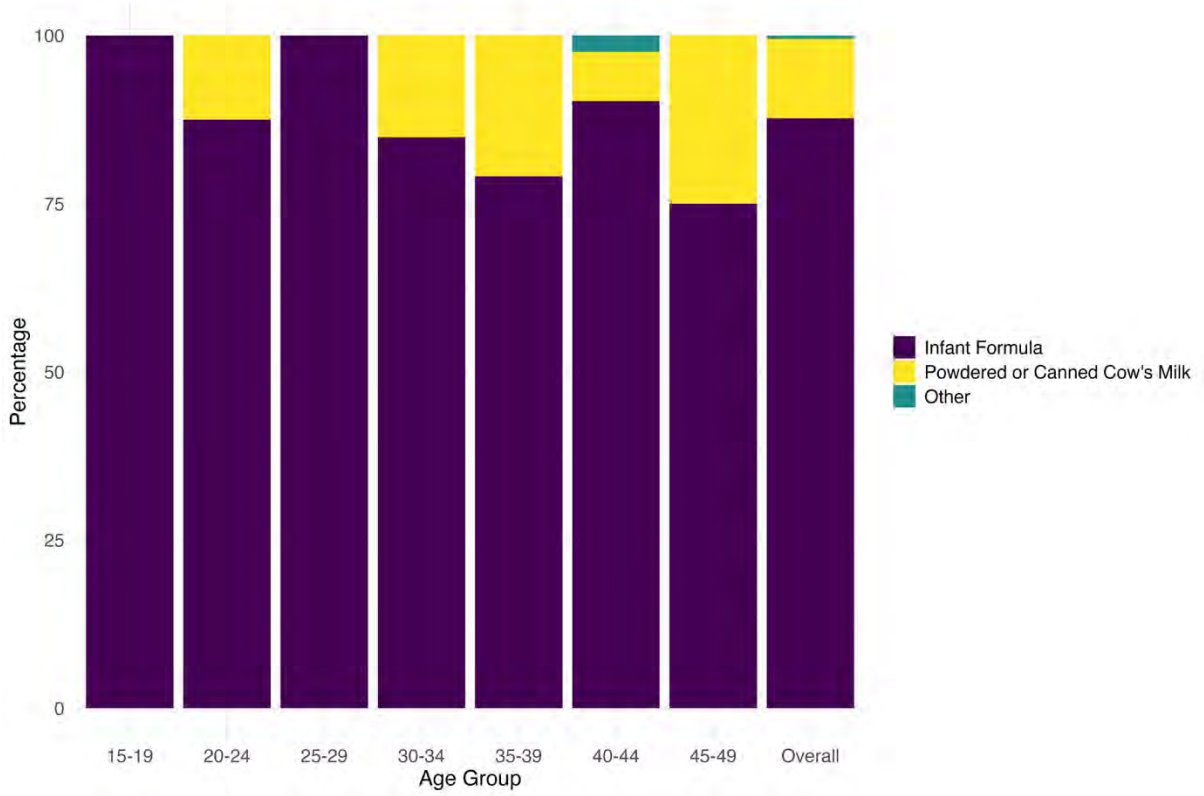
Figure 11: Percentage Distribution of Women Living with HIV by Age Group and Ever Breastfeeding



Source: Authors.

Figure 11 shows the percentage distribution of women living with HIV by age group and whether or not they have ever breastfed their child for any reason. Only 24 percent of women living with HIV have ever breastfed their child for any reason. This result is in sharp contrast to the CDHS, which indicated that more than 80 percent of the general population ever breastfed their child, although only half were exclusively breastfed. The survey results showed that those who did breastfeed typically initiated it within the first 24 hours after birth and continued for an average of around 10 months (the median is 12 months), after which they stopped, but the reasons are unclear. It is also unclear if they knew that prophylaxis interventions reduce HIV transmission through breastfeeding. The survey also found that some women were still breastfeeding their children at the time of the study, with the average age of the children being 32 months old. When examined by age group, the data further shows that adolescents and younger women <29 years tended to breastfeed their children even less compared to women in the older age groups, in which breastfeeding practice is more consistent. This suggests that age is a factor in the decision to breastfeed among women living with HIV.

Figure 12: Percentage Distribution of Women who Never Breastfed Their Children by Age Group and Infant Feeding Methods



Source: Authors.

Figure 12 shows the percentage distribution of HIV-positive women who never breastfed their babies and alternative feeding options by age group. It should be highlighted that 76% of all HIV-positive women receiving antiretroviral therapy (ART) did not breastfeed their children at all. When asked about their alternative feeding practices, the vast majority (88%) reported using infant formula, while a smaller proportion (12%) fed their infants powdered or canned cow's milk during the first six months of life. Additionally, the data suggests that younger women were more inclined to rely on infant formula, whereas older women tended to employ a mix of feeding methods, including porridge soup, but infant formula is still the prevalent dietary source of nutrition for their children.

In comparison with other similar studies, the percentage of women who have never attempted to breastfeed in Cambodia is even much higher than in some African countries where a large barrier to exclusive breastfeeding initiation was documented (Dlamini & Mokoboto-Zwane, 2019; Horwood et al., 2018; Remmert et al., 2020). Several social and structural factors were found to impede optimal breastfeeding practices, especially among adolescents. These include financial constraints, employment challenges, living conditions, and early motherhood while some of the girls are still enrolled in school (Kimani-Murage et al., 2015). Another reason for low breastfeeding practice is likely related to the concerns and recommendations around breastfeeding for women living with HIV from a third party. Because breastfeeding can carry a risk of HIV transmission to the infant, some older female family members (Lanktree et al., 2011) and, in the case of Thailand, healthcare providers (Suwankhong & Liamputtong, 2017) may have advised these women to use alternatives, such as formula or other milk substitutes. The individual women themselves may have chosen to do so to minimize the risk of vertical transmission

of the virus. As a consequence, the lower breastfeeding rates among younger women may be due to greater adherence to these false recommendations, a higher level of fear, or a lack of access to education about safe infant feeding options.

5. Conclusion and Policy Recommendations

5.1. Conclusion

Cambodia has come a long way in terms of fighting against HIV/AIDS, which was first documented in the country in the early 1990s, and it is now well on its way to achieving the global 95-95-95 target. The accomplishment is quite impressive, and the efforts truly deserve significant commendation. However, with an estimated MTCT rate of 8 percent[1] and questions on the assumptions used in the AEM-spectrum to generate HIV estimates, including the estimated number of women living with HIV, understanding the HIV-positive individual women's current fertility rate and breastfeeding practices, are important as Cambodia moves towards elimination of mother-to-child HIV transmission. In addition, by understanding the nuances of health-seeking behaviors and breastfeeding practices among HIV-positive pregnant and breastfeeding women, healthcare providers can offer enhanced, comprehensive, and patient-centered care and treatment.

Using nationally representative primary data, results from this survey (table 2 and Figure 5) show that the overall total fertility rate of HIV-positive women which is much lower relative to the general population (1.8 vs. 2.5 among those women with births with 12 months; 1.9 vs. 2.7 among women who gave birth within 36 months), despite some research suggesting that women on ART have a greater desire to have more children. However, the age-specific fertility rate for adolescents and young women living with HIV (15-19, 20-24 years old) is higher than that of the CDHS, signaling that the formers are more likely to be involved in sexual intercourse and become pregnant than their counterparts who are HIV-negative. Nevertheless, such distinctive behavior is not unusual and has also been documented and emphasized in the Spectrum Manual for better and more precise estimation (Bollinger et al., 2024). In addition, adolescent patients, on average, desire to have more children, and their pregnancy outcome is also more likely to be a livebirth as compared to older women living with HIV. Due to its clear and distinctive nature, female adolescents living with HIV's fertility experience and life course study should be an exclusive future topic for research study and exploration since it will have a significant impact on the procreation among women living with HIV in the upcoming years.

However, because they are still at a young age, many of them have limited knowledge of the fact that ART treatment can lead them to achieve viral suppression, which tends to hinder vertical transmission from a mother to a child. Furthermore, these young teenagers are also more likely to go to a private clinic for antenatal care but to a public facility for delivery. It is also unclear why they choose to do so. Is it because the private clinic refused to support the child delivery of a woman with HIV? Or because the patient is afraid of the private clinic knowing of their HIV status during the delivery.

[1] https://www.nchads.gov.kh/wp-content/uploads/2023/04/Cambodia-estimates-Joint-Press-Reelase.pdf (last visited on August 7, 2024).

Indeed, low awareness of the potential benefits of antiretroviral therapy (ART) treatment among women living with HIV is likely to help explain why the breastfeeding practice among them is uncommon in general. Our survey findings reveal that only a quarter of the women have ever breastfed their child, while the vast majority opted for infant formula instead. Because breastfeeding is known to offer significant health and economic advantages for the child, the low awareness of its impact on the ability to safely breastfeed may be hindering the child's potential development. This, in turn, can lead to long-term public health and monetary problems for society. In this regard, improving the awareness of the benefits of ART treatment among women living with HIV could potentially increase the rates of breastfeeding.

Our study findings also indicate a significant incidence of induced abortion and miscarriage among HIV-positive women, with rates standing at 25 percent and 17 percent, respectively. These findings are considerably higher than those found in the CDHS, which indicated an induced abortion rate of 9 percent and a miscarriage rate of 12 percent across the total sample. The survey results indicate a higher induced abortion rate for women >40 years of age. Notably, this rate is particularly higher among older age groups. As a side note, while a higher rate compared to the general population is expected, this high abortion prevalence among women living with HIV also carries certain societal implications. Such a rate can be attributed to a lack of awareness among HIV-positive women receiving antiretroviral therapy (ART) about the potential effects of ART itself on their reproductive health apart from virus suppression. However, in Asian culture, the decision to have an abortion, which is extremely sensitive both within and outside of the household circle, may also involve family members, such as the husband and parents, in which case the woman's awareness alone may not be sufficient to prevent induced abortions. Addressing these social and cultural barriers is crucial to ensuring that people living with HIV can make autonomous and informed decisions about their reproductive health. Nevertheless, solving such issues cannot be done in the short run. In such cases, encouragement of the use of contraceptive methods could be an immediate solution to help decrease the abortion rate.

5.2. Policy Recommendations

The findings serve as a call to action for policymakers, healthcare providers, and civil society organizations to work collaboratively in developing and implementing evidence-based strategies that address the limited awareness concerning the mother-to-child transmission of HIV, ultimately fostering a more resilient and equitable future for the people of Cambodia. 50 percent of HIV-positive women have an inadequate understanding that proper and effective ART treatment can both suppress the HIV virus and prevent potential MTCT. To address the low awareness of ART treatment on mother-to-child transmission, the government should consider:

- Developing an information awareness-raising campaign, including social media content writing and short videos highlighting success stories, to educate and inspire women living with HIV and emphasize the potential benefits of antiretroviral therapy in preventing vertical transmission.
- Producing a guideline illustrating completely safe childcare and support for women (people) living with HIV who aspire to be a mother so that they understand how HIV may not affect their children through breastfeeding if they are on proper and effective ART treatment.

- Providing counseling sessions to both husband and wife for them to make informed decisions regarding their reproductive health and family planning options and realize their ambitions to become parents.
- Engage with local healthcare providers, including physicians, nurses, and community health workers working at both public and private facilities, to ensure they are well-informed about the latest guidelines and recommendations for ART in women with HIV. Provide training and resources to help them effectively counsel and support their patients who want to become parents.
- Social and cultural factors, in addition to medical considerations, also influence fertility desires and outcomes among women living with HIV. Therefore, collaboration with local community and development partners to conduct outreach, such as co-hosting community events, can help leverage their existing networks and communication channels and thereby amplify the awareness-raising messages.
- Put in place a care and treatment service package tailored exclusively to HIV-positive adolescents, which includes sexual and reproductive health, HIV counseling and testing, antiretroviral treatment, antenatal care, and advice on infant nutrition, especially the benefits of exclusive breastfeeding.

REFERENCES

Berhan, Y., & Berhan, A. (2013). Meta-analyses of fertility desires of people living with HIV. *BMC Public Health*, *13*(1), 409. https://doi.org/10.1186/1471-2458-13-409

Bollinger, L., Pretorius, C., Sanders, R., Sonneveldt, E., Stover, J., Winfrey, B., & Institute for International Programs, Johns Hopkins University. (2024). *Spectrum Manual Spectrum System of Policy Models*. Glastonbury: Avenir Health.

Boutayeb, A. (2009). The impact of HIV/AIDS on human development in African countries. *BMC Public Health*, *9*(1), S3. https://doi.org/10.1186/1471-2458-9-S1-S3

Brown, T., Peerapatanapokin, W., Siripong, N., & Puckett, R. (2024). The AIDS Epidemic Model 2023 for Estimating HIV Trends and Transmission Dynamics in Asian Epidemic Settings. *JAIDS Journal of Acquired Immune Deficiency Syndromes*, *95*(1S). Retrieved from https://journals.lww.com/jaids/fulltext/2024/01011/the_aids_epidemic_model_2023_for_estimating_hiv.3.aspx

Bwanika Naggirinya, A., Waiswa, P., Meya, D., Parkes-Ratanshi, R., & Rujumba, J. (2022). Factors influencing ART adherence, acceptability and potential use of "Call for life IVR tool" among young people in rural Uganda. *Social Sciences & Humanities Open*, *6*(1), 100311. https://doi.org/10.1016/j.ssaho.2022.100311

Chea, V., & Sar, S. (2023). Women's Empowerment as a Determinant of Child's Nutrition: Evidence from a Cambodia Demographic and Health Survey. *Journal of Demography*, *39*(1), 1–18.

Chhoun, P., Ngin, C., Tuot, S., Pal, K., Steel, M., Dionisio, J., … Yi, S. (2017). Non-communicable diseases and related risk behaviors among men and women living with HIV in Cambodia: Findings from a cross-sectional study. *International Journal for Equity in Health*, *16*(1), 125. https://doi.org/10.1186/s12939-017-0622-y

Croft, T. N., Aileen, M., & Courtney, K. A. (2023). *Guide to DHS Statistics: DHS-8*. Maryland: ICF.

Danziger, R. (1994). The social impact of HIV/AIDS in developing countries. *Social Science & Medicine*, *39*(7), 905–917. https://doi.org/10.1016/0277-9536(94)90203-8

Darak, S., Hutter, I., Kulkarni, V., Kulkarni, S., & Janssen, F. (2016). High prevalence of unwanted pregnancies and induced abortions among HIV-infected women from Western India: Need to emphasize dual method use? *AIDS Care*, *28*(1), 43–51. https://doi.org/10.1080/09540121.2015.1066750

Desgrées du Loû, A., Msellati, P., Yao, A., Noba, V., Viho, I., Ramon, R., … Dabis, F. (1999). Impaired fertility in HIV-1-infected pregnant women: A clinic-based survey in Abidjan, Côte d'Ivoire, 1997. *AIDS (London, England)*, *13*(4), 517–521. https://doi.org/10.1097/00002030-199903110-00011

Dlamini, P., & Mokoboto-Zwane, T. S. (2019). Knowledge, attitudes and practices associated with post-natal PMTCT in breastfeeding mothers living with HIV. *International Journal of Africa Nursing Sciences*, *11*, 100150. https://doi.org/10.1016/j.ijans.2019.100150

Dwi Kartika Rukmi, Ike-Wuri-Winahyu Sari, & Afi Lutfiyati. (2020). Fertility desire and associated factors among HIV/AIDS women with Antiretroviral Therapy in Yogyakarta, Indonesia. *Philippine Journal of Nursing*, *90*(2), 51–58.

Fabiani, M., Nattabi, B., Ayella, E. O., Ogwang, M., & Declich, S. (2006). Differences in fertility by HIV serostatus and adjusted HIV prevalence data from an antenatal clinic in northern Uganda. *Tropical Medicine & International Health*, *11*(2), 182–187. https://doi.org/10.1111/j.1365-3156.2005.01554.x

Feyissa, T. R., Harris, M. L., Melka, A. S., & Loxton, D. (2019). Unintended Pregnancy in Women Living with HIV in Sub-Saharan Africa: A Systematic Review and Meta-analysis. *AIDS and Behavior*, *23*(6), 1431–1451. https://doi.org/10.1007/s10461-018-2346-4

Filteau, S. (2009). The HIV-exposed, uninfected African child. *Tropical Medicine & International Health*, *14*(3), 276–287. https://doi.org/10.1111/j.1365-3156.2009.02220.x

Gregson, S., Nyamukapa, C. A., Garnett, G. P., Wambe, M., Lewis, J. J. C., Mason, P. R., … Anderson, R. M. (2005). HIV infection and reproductive health in teenage women orphaned and made vulnerable by AIDS in Zimbabwe. *AIDS Care*, *17*(7), 785–794. https://doi.org/10.1080/09540120500258029

Guo, Y., Li, X., & Sherr, L. (2012). The impact of HIV/AIDS on children's educational outcome: A critical review of global literature. *AIDS Care*, *24*(8), 993–1012. https://doi.org/10.1080/09540121.2012.668170

Heuveline, P. (2004). Impact of the HIV epidemic on population and household structure: The dynamics and evidence to date. *AIDS*, *18*. Retrieved from https://journals.lww.com/aidsonline/fulltext/2004/06002/impact_of_the_hiv_epidemic_on_population_and.6.aspx

Horwood, C., Haskins, L., Engebretsen, I., Phakathi, S., Connolly, C., Coutsoudis, A., & Spies, L. (2018). Improved rates of exclusive breastfeeding at 14 weeks of age in KwaZulu Natal, South Africa: What are the challenges now? *BMC Public Health*, *18*(1), 757. https://doi.org/10.1186/s12889-018-5657-5

ICF International. (2012). *Demographic and Health Survey Sampling and Household Listing Manual*. Calverton, Maryland: ICF International.

Joint United Nations Programme on HIV/AIDS. (2023). *UNAIDS DATA 2023*. Geneva: UNAIDS.

Jose, H., Madi, D., Chowta, N., Ramapuram, J., Bhaskaran, U., Achappa, B., & Chandran, V. (2016). Fertility Desires and Intentions among People Living with HIV/AIDS (PLWHA) in Southern India. *Journal of Clinical and Diagnostic Research : JCDR*, *10*(6), OC19-22. https://doi.org/10.7860/JCDR/2016/20282.7968

Kabunga, A., Acanga, A., Akello Abal, J., Kambugu Nabasirye, C., Namata, H., Mwesigwa, D., … Udho, S. (2023). Phenomenology of Induced Abortion in Northern Uganda Among HIV-Positive Women Following an Unintended Pregnancy. *Open Access Journal of Contraception*, *14*(null), 73–82. https://doi.org/10.2147/OAJC.S407547

Kaida, A., Laher, F., Strathdee, S. A., Janssen, P. A., Money, D., Hogg, R. S., & Gray, G. (2011). Childbearing intentions of HIV-positive women of reproductive age in Soweto, South Africa: The influence of expanding access to HAART in an HIV hyperendemic setting. *American Journal of Public Health*, *101*(2), 350–358. https://doi.org/10.2105/AJPH.2009.177469

Katirayi, L., Namadingo, H., Phiri, M., Bobrow, E. A., Ahimbisibwe, A., Berhan, A. Y., … Tylleskär, T. (2016). HIV-positive pregnant and postpartum women's perspectives about Option B+ in Malawi: A qualitative study. *Journal of the International AIDS Society*, *19*(1), 20919. https://doi.org/10.7448/IAS.19.1.20919

Kendall, T., & Albert, C. (2015). Experiences of coercion to sterilize and forced sterilization among women living with HIV in Latin America. *Journal of the International AIDS Society*, *18*(1), 19462. https://doi.org/10.7448/IAS.18.1.19462

Kimani-Murage, E. W., Wekesah, F., Wanjohi, M., Kyobutungi, C., Ezeh, A. C., Musoke, R. N., … Griffiths, P. (2015). Factors affecting actualisation of the WHO breastfeeding recommendations in urban poor settings in Kenya. *Maternal & Child Nutrition*, *11*(3), 314–332. https://doi.org/10.1111/mcn.12161

Knodel, J., Zimmer, Z., Kim, K. S., & Puch, S. (2007). The Effect on Elderly Parents in Cambodia of Losing an Adult Child to AIDS. *Population and Development Review*, *33*(3), 479–500.

Lanktree, E., Ssebuko, A., Alibhai, A., Jhangri, G., Kipp, W., & Saunders, L. D. (2011). Breastfeeding practices of HIV-positive and HIV-negative women in Kabarole district, Uganda. *Maternal & Child Nutrition*, *7*(4), 378–388. https://doi.org/10.1111/j.1740-8709.2010.00245.x

Lewis, J. J., Ronsmans, C., Ezeh, A., & Gregson, S. (2004). The population impact of HIV on fertility in sub-Saharan Africa. *AIDS*, *18*. Retrieved from https://journals.lww.com/aidsonline/fulltext/2004/06002/the_population_impact_of_hiv_on_fertility_in.5.aspx

Magadi, M. A. (2011). Household and community HIV/AIDS status and child malnutrition in sub-Saharan Africa: Evidence from the demographic and health surveys. *Social Science & Medicine*, *73*(3), 436–446. https://doi.org/10.1016/j.socscimed.2011.05.042

Maier, M., Andia, I., Emenyonu, N., Guzman, D., Kaida, A., Pepper, L., … Bangsberg, D. R. (2009). Antiretroviral therapy is associated with increased fertility desire, but not pregnancy or live birth, among HIV+ women in an early HIV treatment program in rural Uganda. *AIDS and Behavior*, *13 Suppl 1*(Suppl 1), 28–37. https://doi.org/10.1007/s10461-008-9371-7

Makumbi, F. E., Nakigozi, G., Reynolds, S. J., Ndyanabo, A., Lutalo, T., Serwada, D., … Gray, R. (2011). Associations between HIV Antiretroviral Therapy and the Prevalence and Incidence of Pregnancy in Rakai, Uganda. *AIDS Research and Treatment*, *2011*, 519492. https://doi.org/10.1155/2011/519492

Mark, D., Armstrong, A., Andrade, C., Penazzato, M., Hatane, L., Taing, L., … Ferguson, J. (2017). HIV treatment and care services for adolescents: A situational analysis of 218 facilities in 23 sub-Saharan African countries. *Journal of the International AIDS Society*, *20*(Suppl 3), 21591.

Marston, M., Zaba, B., & Eaton, J. W. (2017). The relationship between HIV and fertility in the era of antiretroviral therapy in sub-Saharan Africa: Evidence from 49 Demographic and Health Surveys. *Tropical Medicine & International Health*, *22*(12), 1542–1550. https://doi.org/10.1111/tmi.12983

Marston, Milly, Nakiyingi-Miiro, J., Hosegood, V., Lutalo, T., Mtenga, B., Zaba, B., & on behalf of the ALPHA network. (2016). Measuring the Impact of Antiretroviral Therapy Roll-Out on Population Level Fertility in Three African Countries. *PLOS ONE*, *11*(3), e0151877. https://doi.org/10.1371/journal.pone.0151877

Mehta, N., Ho, J., Boonsuk, P., Fuller, S., & Sohn, A. H. (2018). Investigating the role of stigma on fertility desire among HIV-positive women in Bangkok, Thailand: A qualitative study. *Journal of Virus Eradication*, *4*(3), 165–169.

Mukandavire, Z., & Garira, W. (2007). Age and Sex Structured Model for Assessing the Demographic Impact of Mother-to-Child Transmission of HIV/AIDS. *Bulletin of Mathematical Biology*, *69*(6), 2061–2092.

Myer, L., Morroni, C., & Rebe, K. (2007). Prevalence and Determinants of Fertility Intentions of HIV-Infected Women and Men Receiving Antiretroviral Therapy in South Africa. *AIDS Patient Care and STDs*, *21*(4), 278–285.

National Center for HIV/AIDS, Dermatology and STD. (2006). *Standard operating procedure for the outreach/peer education and 100% condom use program to sex workers in Cambodia*. Phnom Penh: Ministry of Health.

National Center for HIV/AIDS, Dermatology and STD. (2016). *Strategic Plan for HIV/AIDS and STI Prevention and Control in the Health Sector 2016-2020*. Phnom Penh: Ministry of Health.

National Center for HIV/AIDS, Dermatology and STD. (2017). *National Consolidated Guidelines on HIV Testing Services in Cambodia*. Phnom Penh: Ministry of Health.

National Center for HIV/AIDS, Dermatology and STD. (2020). *Ending the Aids Epidemic In Cambodia Findings From An Optima HIV Modelling Analysis*. Phnom Penh: National Center for HIV/AIDS, Dermatology and STD.

National Center for HIV/AIDS, Dermatology and STD. (2023a). *National Report on Voluntary Confidential Counselling and Testing for HIV/AIDS 2023*. Phnom Penh: NCHADS.

National Center for HIV/AIDS, Dermatology and STD. (2023b). *Sampling Frame of Cambodian Women between 15—49 Years Old Living with HIV* [Data set].

National Center for HIV/AIDS, Dermatology and STD, & National Maternal and Child Health Center. (2021). *Technical Report on the Mock Review of Elimination of Mother-to-Child Transmission (eMTCT) of HIV and Syphilis in Cambodia*. Phnom Penh: Ministry of Health.

National Institute of Statistics. (2020). *National Report on Final 2019 Census Results*. Phnom Penh: Royal Government of Cambodia.

National Institute of Statistics, Ministry of Health, & ICF International. (2023). *Cambodia Demographic and Health Survey 2021-22*. Phnom Penh: National Institute of Statistics, Ministry of Health, and ICF International.

Nattabi, B., Li, J., Thompson, S. C., Orach, C. G., & Earnest, J. (2009). A Systematic Review of Factors Influencing Fertility Desires and Intentions Among People Living with HIV/AIDS: Implications for Policy and Service Delivery. *AIDS and Behavior*, *13*(5), 949–968. https://doi.org/10.1007/s10461-009-9537-y

Nguyen, R. H. N., Gange, S. J., Wabwire-Mangen, F., Sewankambo, N. K., Serwadda, D., Wawer, M. J., … Gray, R. H. (2006). Reduced fertility among HIV-infected women associated with viral load in Rakai district, Uganda. *International Journal of STD & AIDS*, *17*(12), 842–846.

Okada, K. (2012). The effects of female HIV/AIDS status on fertility and child health in Cambodia. *Journal of Asian Economics*, *23*(5), 560–570.

O'Shea, M. S., Rosenberg, N. E., Tang, J. H., Mukuzunga, C., Kaliti, S., Mwale, M., & Hosseinipour, M. C. (2016). Reproductive intentions and family planning practices of pregnant HIV-infected Malawian women on antiretroviral therapy. *AIDS Care*, *28*(8), 1027–1034. https://doi.org/10.1080/09540121.2016.1140891

Piot, P., Bartos, M., Ghys, P. D., Walker, N., & Schwartländer, B. (2001). The global impact of HIV/AIDS. *Nature*, *410*(6831), 968–973.

Preble, E. A. (1990). Impact of HIV/AIDS on African children. *Social Science & Medicine*, *31*(6), 671–680.

Remmert, J. E., Mosery, N., Goodman, G., Bangsberg, D. R., Safren, S. A., Smit, J. A., & Psaros, C. (2020). Breastfeeding Practices Among Women Living with HIV in

KwaZulu-Natal, South Africa: An Observational Study. *Maternal and Child Health Journal*, *24*(2), 127–134. https://doi.org/10.1007/s10995-019-02848-8

Ross, A., Van der Paal, L., Lubega, R., Mayanja, B. N., Shafer, L. A., & Whitworth, J. (2004). HIV-1 disease progression and fertility: The incidence of recognized pregnancy and pregnancy outcome in Uganda. *AIDS*, *18*(5). Retrieved from https://journals.lww.com/aidsonline/fulltext/2004/03260/hiv_1_disease_progression_and_fertility__the.12.aspx

Shisana, O., Zungu, N., & Pezi, S. (2009). Poverty and HIV and AIDS. In P. Rohleder, L. Swartz, S. C. Kalichman, & L. C. Simbayi (Eds.), *HIV/AIDS in South Africa 25 Years On: Psychosocial Perspectives* (pp. 89–104). New York, NY: Springer New York.

Suwankhong, D., & Liamputtong, P. (2017). 'I was told not to do it but…': Infant feeding practices amongst HIV-positive women in southern Thailand. *Midwifery*, *48*, 69–74. https://doi.org/10.1016/j.midw.2017.03.007

T Brown & W Peerapatanapokin. (2004). The Asian Epidemic Model: A process model for exploring HIV policy and programme alternatives in Asia. *Sexually Transmitted Infections*, *80*(suppl 1), i19. https://doi.org/10.1136/sti.2004.010165

Toth, G., Mburu, G., Tuot, S., Khol, V., Ngin, C., Chhoun, P., & Yi, S. (2018). Social-support needs among adolescents living with HIV in transition from pediatric to adult care in Cambodia: Findings from a cross-sectional study. *AIDS Research and Therapy*, *15*(1), 8. https://doi.org/10.1186/s12981-018-0195-x

Ung, M., Boateng, G., Armah, F., Amoyaw, J., Luginaah, I., & Kuuire, V. (2014). Negotiation for Safer Sex Among Married Women in Cambodia: The Role of Women's Autonomy. *Journal of Biosocial Science*, *46*(1), 90–106. Cambridge Core.

Vun, M. C., Fujita, M., Rathavy, T., Eang, M. T., Sopheap, S., Sovannarith, S., … Verbruggen, R. (2014). Achieving universal access and moving towards elimination of new HIV infections in Cambodia. *Journal of the International AIDS Society*, *17*(1), 18905.

Wei-Ju Chen & Neff Walker. (2010). Fertility of HIV-infected women: Insights from Demographic and Health Surveys. *Sexually Transmitted Infections*, *86*(Suppl 2), ii22.

Yan, X., Du, J., & Ji, G. (2021). Prevalence and factors associated with fertility desire among people living with HIV: A systematic review and meta-analysis. *PloS One*, *16*(3), e0248872. https://doi.org/10.1371/journal.pone.0248872

Yeatman, S., Eaton, J. W., Beckles, Z., Benton, L., Gregson, S., & Zaba, B. (2016). Impact of ART on the fertility of HIV-positive women in sub-Saharan Africa. *Tropical Medicine & International Health*, *21*(9), 1071–1085.

Yi, S., Tuot, S., Chhoun, P., Pal, K., Tith, K., & Brody, C. (2015). Factors associated with induced abortion among female entertainment workers: A cross-sectional study in Cambodia. *BMJ Open*, *5*(7), e007947.

Yi, S., Tuot, S., Pal, K., Khol, V., Sok, S., Chhoun, P., … Mburu, G. (2018). Characteristics of adolescents living with HIV receiving care and treatment services in antiretroviral therapy clinics in Cambodia: Descriptive findings from a cross-sectional study. *BMC Health Services Research*, *18*(1), 781.

Zaba, B., & Gregson, S. (1998). Measuring the impact of HIV on fertility in Africa. *AIDS*, *12 Suppl 1*, S41-50.

Appendix A: Ethical Approval

ព្រះរាជាណាចក្រកម្ពុជា
KINGDOM OF CAMBODIA
ជាតិ សាសនា ព្រះមហាក្សត្រ
NATION RELIGION KING

ក្រសួងសុខាភិបាល
MINISTRY OF HEALTH
គណៈកម្មាធិការជាតិក្រមសីលធម៌
សំរាប់ការស្រាវជ្រាវសុខភាពដែលពាក់ព័ន្ធនឹងមនុស្ស
National Ethics Committee for Health Research

ថ្ងៃព្រហស្បតិ៍ ៤កើត ខែ កត្តិក ឆ្នាំរោង ឆស័ក ព.ស.២៥៦៧
Phnom Penh November 16, 2023

N° 339 NECHR

Dr. Vatana Chea

Project: Sub-population fertility Survey 2023. Version N° 1, dated 30th October 2023.

Reference:
- Received your letter on 02nd November 2023
- Report of NECHR's secretaries on 10th November 2023

Dear Dr. Vatana Chea,

I am pleased to notify you that your study protocol entitled "Sub-population fertility Survey 2023. Version N° 1, dated 30th October 2023" has been approved by National Ethics Committee for Health Research (NCEHR).This approval is valid for twelve months after the approval date.

NECHR also wish to remind the Principal Investigator that all research activities to be conducted during the COVID-19 pandemic must strictly follow the latest prevention measures set by the MOH and the relevant load authorities.

The Principal Investigator of the project shall submit following document to the committee's secretariat at the National Institute of Public Health at #80, Samdach Penn Nouth Blvd (289), Sangkat Boeungkok2, Khan Tuol Kork, Phnom Penh. (Tel: 012 528 789, 086 762 113, 012 203 382 Email: nouthsarida@gmail.com , cheatasoft22@gmail.com):

- Annual progress report
- Final scientific report
- Patient/participant feedback (if any)
- Analyzing serious adverse events report (if applicable)

The Principal Investigator should be aware that there might be site monitoring visits at any time from NECHR team during the project implementation and should provide full cooperation to the team.

Regards,

Chairman

Prof. ENG HUOT

National Ethics Committee
for Health Research
(NECHR)

Appendix B: Consent Form

Hello. My name is ____[Name of data enumerator]____. I work for the Cambodia University of Technology and Science (CamTech). We are conducting a survey about the fertility of women living with HIV in Cambodia. The information we collect will help the government to provide public health services better and progress towards the Sustainable Development Goals. You are selected for the survey. I would like to ask you some questions about yourself, your birth history, and post-natal care. The questions usually take about 15 minutes. All of the answers you give will be confidential and will not be shared with anyone other than members of our survey team. You don't have to be in the survey, but we hope you will agree to answer the questions since your views are important. If I ask you any question you don't want to answer, just let me know, and I will go on to the next question, or you can stop the interview at any time.

In case you need more information about the survey, you may contact the person listed on this card.

Do you have any questions? May I begin the interview now?

_____
Signature of interviewee

Date: _____

To be filled in by data enumerator				
Exact time	Hours		Minutes	

Appendix C: Survey Questionnaire

CONFIDENTIAL
All information collected in this survey is strictly confidential and will be used only for statistical purposes

Questionnaire ID	
___ ___	___ ___ ___

A. To be completed by interviewer before interview	
Province / Capital:	
District / Khan / Municipality / City:	
Name of ART Site	

B. To be completed by interviewer						
Interviewer's ART Number:						
Interview Result: (Mark with √ in suitable box)	☐ Fully complete ..... 1 ☐ Partially complete . 2					
Day, Month, and Year of Interview:	DD		MM		YY	

C. To be completed by field supervisor after checking completed questionnaire thoroughly						
Supervisor's name:						
Day, Month, and Year of Checking:	DD		MM		YY	
Supervisor's Signature:						

D. To be completed by CamTech staff						
Recipient's name:						
Day, Month, and Year of Reception:	DD		MM		YY	
Recipient's Comment (if any):						

E. To be completed by Data Inputter							
Inputter's Name:		Date of Entry	DD		MM		YY	

Section 1: Individual General Information

(1.1) In what month and year were you born:
MM/YYYY: ___ ___ / ___ ___ ___ ___

(1.2) What is your age in a complete year?
Age: ___ ___

(1.3) In which province were you born?
(If a foreign country, write down the country name and ignore the code)
(name of province): _____ Province Code: ___ ___

(1.4) Where is your current residence?
(name of province): _____ Province Code: ___ ___

(1.5) Do you live in the provincial capital, district town, or rural area?
☐ Provincial capital 1
☐ District town.....2
☐ Rural area.....3

(1.6) How long have you been living continuously in your current address?
☐ Exact number of years: _____ _____
☐ Always 2
☐ Visitor 3

(1.6.1) Just before you moved here, which province did you live in?
(name of province): _____ Province Code: ___ ___

(1.6.2) Why did you move to this place?
☐Employment.....1
☐ Education/training 2
☐ Marriage.....3
☐ Family reunification/other family-related reason.....4
☐ Forced displacement 5
☐ Health/medical treatment reason.....6
☐ Avoid embarrassment 7
☐ Want to start over 8
☐ Other (please specify) 9

(1.7) Are you currently married or living together with a man as if married?
☐ Yes, currently married .....1➔ **GO TO Q1.7.3**
☐ Yes, living with a man .....2➔ **GO TO Q1.7.3**
☐ No, not in union.....3

(1.7.1) Have you ever been married or lived together with a man as if married?
☐ Yes, formerly married.....1
☐ Yes, lived with a man 2
☐ No.....3➔ **GO TO Q1.8**

Province Codes

01 = Banteay Meanchey	08 = Kandal	15 = Pursat	22 = Otdar Meanchey
02 = Battambong	09 = Koh Kong	16 = Ratanak Kiri	23 = Kep
03 = Kampong Cham	10 = Kratie	17 = Siem Reap	24 = Pailin
04 = Kampong Chhnang	11 = Mondol Kiri	18 = Preah Sihanouk	25 = Tbong Khmum
05 = Kampong Speu	12 = Phnom Penh	19 = Stueng Treng	
06 = Kampong Thom	13 = Preah Vihear	20 = Svay Rieng	
07 = Kampot	14 = Prey Veng	21 = Takeo	

(**1.7.2**) What is your marital status now? Are you widowed, divorced, or separated?

☐ Widowed ..... 1 ➔ **GO TO Q1.8**
☐ Divorced ..... 2 ➔ **GO TO Q1.8**
☐ Separated ..... 3 ➔ **GO TO Q1.8**

(**1.7.3**) Is your (husband/partner) living with you now, or is he staying elsewhere?

☐ Living with her 1
☐ Staying elsewhere 2

(**1.8**) Have you ever attended school?

☐ Yes 1
☐ No ..... 2 ➔ **GO TO Q1.9**

(**1.8.1**) What is the highest grade you completed?

Highest grade: _____

(**1.9**) Do you own a mobile phone?

☐ Yes 1
☐ No ..... 2 ➔ **GO TO Q1.10**

(**1.9.1**) Is your mobile phone a smart phone?

☐ Yes 1
☐ No 2

(**1.10**) In the last 12 months, have you used the Internet?

☐ Yes 1
☐ No ..... 2 ➔ **GO TO Q1.11**

(**1.10.1**) During the last one month, how often did you use the Internet: almost every day, at least once a week, less than once a week, or not at all?

☐ Almost every day 1
☐ At least once a week 2
☐ Less than once a week 3
☐ Not at all 4

(**1.11**) What is your religion?

☐ Buddhist 1
☐ Muslim 2
☐ Christian 3
☐ Other 4
☐ No religion 5

(**1.12**) In general, would you say your health is very good, good, moderate, bad, or very bad?

☐ Very good 1
☐ Good 2
☐ Moderate 3
☐ Bad 4
☐ Very bad 5

Codes for 1.8.1

00 = Pre-school/Kindergarten	12 = Class twelve completed
01 = Class one completed	13 = Associate degree
02 = Class two completed	14 = College/university undergraduate/Bachelor's degree (B.A., BSc, etc.)
…….....	15 = Advanced Degree (Master's or Doctoral)
11 = Class eleven completed	98 = Don´t know

Section 2: Fertility

(2.1) I would like to ask about all the births you have had so far. Have you ever given birth?

☐ Yes 1
☐ No .....2 ➔ **GO TO Q2.5**

(2.2) Do you have any sons or daughters to whom you have given birth who are now living with you?

☐ Yes 1
☐ No .....2 ➔ **GO TO Q2.3**

(2.2.1) How many sons live with you?
*(If none, please record **'00')***
Number of sons live with her: ___ ___

(2.2.2) How many daughters live with you?
*(If none, please record **'00')***
Number of daughters live with her: ___ ___

(2.3) Do you have any sons or daughters to whom you have given birth who are alive but do not live with you?

☐ Yes 1
☐ No .....2 ➔ **GO TO Q2.5**

(2.3.1) How many sons are alive but do not live with you?
*(If none, please record **'00')***
Number of sons do not live with her: ___ ___

(2.3.2) How many daughters are alive but do not live with you?
*(If none, please record **'00')***
Number of daughters do not live with her: ___ ___

(2.4) Do you have children aged less than 18 who do not live with you?

☐ Yes 1
☐ No .....2 ➔ **GO TO Q2.5**

(2.4.1) Where do they live?

☐ Extended family 1
☐ Non-relative 2
☐ Residential care 3
☐ Pagoda/Wat 4
☐ Boarding school 5
☐ Rehab center 6

(2.5) Have you ever given birth to a boy or girl who was born alive but later died?

☐ Yes 1
☐ No .....2 ➔ **GO TO Q2.6**

(2.5.1) How many boys have died?
*(If none, please record **'00')***
Number of sons who have died: ___ ___

(**2.5.2**) How many girls have died?

*(If none, please record '**00**')*

Number of daughters who have died: ___ ___

(**2.6**) Just to make sure that I have this right: you have had in total (*count 2.2.1, 2.2.2, 2.3.1, 2.3.2, 2.5.1, and 2.5.2*) births so far. Is that correct?

☐ Yes 1

☐ No .....2 ➔ **REPEAT FROM Q2.2**

(**2.7**) Women sometimes have a pregnancy that does not result in a live birth. For example, a pregnancy can end in a miscarriage, an abortion, or the child can be born dead. Have you ever had a pregnancy that did not end in a live birth?

☐ Yes 1

☐ No .....2 ➔ **GO TO SECTION 2.1**

(**2.7.1**) How many miscarriages, abortions, and stillbirths have you had?

Number of miscarriages, abortions, and stillbirths: ___ ___

(SUM UP 2.6 AND 2.7.1;
IF THE RESPONDENT HAS 00 CHILDREN, GO TO SECTION 3,
IF THE RESPONDENT HAS AT LEAST 01 CHILD, GO TO THE NEXT SECTION)

Section 2.1: Birth History

Now I would like to record all your pregnancies, including live births, stillbirths, miscarriages, and abortions, starting with your first pregnancy to the last pregnancy.

BIRTH ORDER	**(2.8)** Think back to your (first/next) pregnancy. Was that a single pregnancy, twins, or triplets?	**(2.9)** Was the baby born alive, born dead, or did you have a miscarriage or abortion?	**(2.9.1)** Did the baby cry, move, or breathe?	**(2.10)** What name was given to the baby?	**(2.11)** Is (NAME) a boy or a girl?	**(2.12)** **IF BORN ALIVE, ASK**: What is (NAME) date of birth? **IF BORN DEAD, MISCARRIAGE, OR ABORTION, ASK:** On what day, month, and year did the pregnancy end?	**(2.13)** **IF BORN DEAD, MISCARRIAGE, OR ABORTION, ASK:** How long did this pregnancy last in weeks or months? *Record in completed weeks or months*
1	☐ Single ☐ Twin ☐ Triplets	☐ Born alive ➔ **GO TO Q2.10** ☐ Born dead ➔ **GO TO Q2.9.1** ☐ Miscarriage ➔ **GO TO Q2.12** ☐ Abortion ➔ **GO TO Q2.12**	☐ Yes ☐ No ➔ **GO TO Q2.12**	_____	☐ Boy ☐ Girl	__ __/ __ __/ __ __ *(dd/mm/yy)*	**WEEK:** __ __ **MONTH:** __ __
2	☐ Single ☐ Twin ☐ Triplets	☐ Born alive ➔ **GO TO Q2.10** ☐ Born dead ➔ **GO TO Q2.9.1** ☐ Miscarriage ➔ **GO TO Q2.12** ☐ Abortion ➔ **GO TO Q2.12**	☐ Yes ☐ No ➔ **GO TO Q2.12**	_____	☐ Boy ☐ Girl	__ __/ __ __/ __ __ *(dd/mm/yy)*	**WEEK:** __ __ **MONTH:** __ __
3	☐ Single ☐ Twin ☐ Triplets	☐ Born alive ➔ **GO TO Q2.10** ☐ Born dead ➔ **GO TO Q2.9.1** ☐ Miscarriage ➔ **GO TO Q2.12** ☐ Abortion ➔ **GO TO Q2.12**	☐ Yes ☐ No ➔ **GO TO Q2.12**	_____	☐ Boy ☐ Girl	__ __/ __ __/ __ __ *(dd/mm/yy)*	**WEEK:** __ __ **MONTH:** __ __

BIRTH ORDER	(2.9E) *CHECK IF Q2.9=1 OR Q2.9.1 = 1, THEN PREGNANCY OUTCOME = BORN ALIVE; OTHERWISE, RECORD 'NO'*	(2.14) Is (NAME) still alive?	(2.15) How old was (NAME) at their last birthday? *Record age in complete years*	(2.16) Is (NAME) living with you?	(2.17) How old was (NAME) when (he/she) died? **IF LESS THAN TWO YEARS, PROBE:** Exactly how many months old was (NAME) when (he/she) died? *Record days if less than 1 month; months if less than two years; or years*
1	☐ Born alive ☐ No → **GO TO NEXT BIRTH**	☐ Yes ☐ No → **GO TO Q2.17**	___ ___	☐ Yes → **GO TO Q2.9E** ☐ No → **GO TO Q2.9E**	**DAY**: ___ ___ **MONTH**: ___ ___ **YEAR:** ___ ___
2	☐ Yes ☐ No → **GO TO NEXT BIRTH**	☐ Yes ☐ No → **GO TO Q2.17**	___ ___	☐ Yes → **GO TO Q2.9E** ☐ No → **GO TO Q2.9E**	**DAY**: ___ ___ **MONTH**: ___ ___ **YEAR:** ___ ___
3	☐ Yes ☐ No → **GO TO NEXT BIRTH**	☐ Yes ☐ No → **GO TO Q2.17**	___ ___	☐ Yes → **GO TO Q2.9E** ☐ No → **GO TO Q2.9E**	**DAY**: ___ ___ **MONTH**: ___ ___ **YEAR:** ___ ___

(CHECK IF THE RESPONDENT HAS ANY CHILDREN UNDER 5 YEARS OLD (60 MONTHS)
IF 'YES', GO TO THE NEXT SECTION;
IF 'NO', GO TO Q2.30)

Section 2.2: Children Under Five Years Old

CHECK IF ANY CHILD IS LESS THAN 5 YEARS OLD (60 MONTHS), IF YES, RECORD THE BIRTH ORDER	(2.18) Did you see any one for antenatal care for this pregnancy?	(2.18.1) Whom did you see? *Probe to identify each type of person and record all mentioned*	(2.18.2) Where did you receive antenatal care for this pregnancy? Anywhere else? *Probe to identify the type of source and name of the place*	(2.18.3) Where is it located? *Write down the name of the town/ district and province*	(2.18.4) As part of your antenatal care during this pregnancy, did a healthcare provider talk with you about breastfeeding at least once?	(2.18.5) As part of your antenatal care during this pregnancy, did a healthcare provider discuss with you the place you planned to deliver your child?
________	☐ Yes ☐ No ➔ **GO TO Q2.19**	☐ Doctor ☐ Nurse/Midwife ☐ Auxiliary midwife ☐ Traditional birth attendant ☐ Community health worker ☐ Other	________	District: ________ Province: _______	☐ Yes ☐ No ☐ Don't know	☐ Yes ☐ No ☐ Don't know
________	☐ Yes ☐ No ➔ **GO TO Q2.19**	☐ Doctor ☐ Nurse/Midwife ☐ Auxiliary midwife ☐ Traditional birth attendant ☐ Community health worker ☐ Other	________	District: ________ Province: _______	☐ Yes ☐ No ☐ Don't know	☐ Yes ☐ No ☐ Don't know
________	☐ Yes ☐ No ➔ **GO TO Q2.19**	☐ Doctor ☐ Nurse/Midwife ☐ Auxiliary midwife ☐ Traditional birth attendant ☐ Community health worker ☐ Other	________	District: ________ Province: _______	☐ Yes ☐ No ☐ Don't know	☐ Yes ☐ No ☐ Don't know

Codes for QUESTION Q2.18.2

01 = Her home
02 = Other home
03 = National hospital
04 = Provincial hospital
05 = District hospital
06 = Health center
07 = Health post
08 = Public mobile clinic
09 = Other public sector (Specify)
10 = Private hospital (Specify)
11 = Private clinic (Specify)
12 = Other private medical sector (Specify)
13 = NGO hospital
14 = NGO clinic
15 = Other NGO medical sector
98 = Don't know

CHECK IF ANY CHILD IS LESS THAN 5 YEARS OLD (60 MONTHS), IF YES, RECORD THE BIRTH ORDER	**(2.19)** Who assisted with the delivery of (NAME)? *Probe to identify each type of person and record all mentioned* *If the respondent says no one assisted, probe to determine whether any adults were present at the delivery.*	**(2.19.1)** Where did you give birth to (NAME)? *Write down the name of the hospital or clinic*	**(2.19.2)** Where is it located? *Write down the name of the town/ district and province*	**(2.19.3)** During delivery (NAME) in addition to health staff, did you have someone stay with you?	**(2.19.4)** Was (NAME) delivered by cesarean, that is, did they cut your belly open to take the baby out?
________	☐ Doctor ☐ Nurse/midwife ☐ Auxiliary midwife ☐ Traditional birth attendant ☐ Community health worker ☐ Other	______________	District: ________ Province: _______	☐ Yes ☐ No ☐ Don't know	☐ Yes ☐ No
________	☐ Doctor ☐ Nurse/midwife ☐ Auxiliary midwife ☐ Traditional birth attendant ☐ Community health worker ☐ Other	______________	District: ________ Province: _______	☐ Yes ☐ No ☐ Don't know	☐ Yes ☐ No
________	☐ Doctor ☐ Nurse/midwife ☐ Auxiliary midwife ☐ Traditional birth attendant ☐ Community health worker ☐ Other	______________	District: ________ Province: _______	☐ Yes ☐ No ☐ Don't know	☐ Yes ☐ No

Codes for QUESTION Q2.19.1

01 = Her home	07 = Health post	13 = NGO hospital
02 = Other home	08 = Public mobile clinic	14 = NGO clinic
03 = National hospital	09 = Other public sector (Specify)	15 = Other NGO medical sector
04 = Provincial hospital	10 = Private hospital (Specify)	98 = Don't know
05 = District hospital	11 = Private clinic (Specify)	
06 = Health center	12 = Other private medical sector (Specify)	

(2.20) Did you breastfeed (NAME)?	(2.20.1) What/how did you feed (NAME) instead of breastmilk during the first 6 months of life?	(2.20.2) Although you mostly did not breastfeed (NAME), did you ever for any reason, even just a few times, breastfeed?	(2.20.3) How long after birth did you first put (NAME) to the breast? *if less than 1 hour, record '00' hours;* *if less than 24 hours, record hours;* *otherwise, record days*	(2.20.4) In the first 6 months after delivery, was (NAME) given anything other than breast milk to eat or drink – anything at all like water, infant formula?	(2.20.5) Are you still breastfeeding (NAME)?	(2.20.6) How old was (NAME) when you stopped breastfeeding? *Record in months. If she does not remember exactly, probe to get an estimate*
☐ Yes ➔ **GO TO 2.20.3** ☐ No	☐ Infant formula ☐ Powdered or canned cow's milk ☐ Someone else breastfed the baby ☐ Other (specify)	☐ Yes ➔ **GO TO NEXT BIRTH** ☐ No ➔ **GO TO NEXT BIRTH** ☐ Don't remember ➔ **GO TO NEXT BIRTH**	☐ Immediately **HOURS**: __ __ **DAYS**: __ __	☐ Yes ☐ No	☐ Yes ➔ **GO TO NEXT BIRTH** ☐ No	___ ___
☐ Yes ➔ **GO TO 2.20.3** ☐ No	☐ Infant formula ☐ Powdered or canned cow's milk ☐ Someone else breastfed the baby ☐ Other (specify)	☐ Yes ➔ **GO TO NEXT BIRTH** ☐ No ➔ **GO TO NEXT BIRTH** ☐ Don't remember ➔ **GO TO NEXT BIRTH**	☐ Immediately **HOURS**: __ __ **DAYS**: __ __	☐ Yes ☐ No	☐ Yes ➔ **GO TO NEXT BIRTH** ☐ No	___ ___
☐ Yes ➔ **GO TO 2.20.3** ☐ No	☐ Infant formula ☐ Powdered or canned cow's milk ☐ Someone else breastfed the baby ☐ Other (specify)	☐ Yes ➔ **GO TO NEXT BIRTH** ☐ No ➔ **GO TO NEXT BIRTH** ☐ Don't remember ➔ **GO TO NEXT BIRTH**	☐ Immediately **HOURS**: __ __ **DAYS**: __ __	☐ Yes ☐ No	☐ Yes ➔ **GO TO NEXT BIRTH** ☐ No	___ ___

(2.21) Are you pregnant now?

☐ Yes 1
☐ No .....2 ➔ **GO TO Q2.23**

(**2.21.1**) How many weeks or months pregnant are you?

(record only number of week or of month)
Number of weeks: ___ ___
or
Number of months: ___ ___

(**2.22**) Before you became pregnant, did you want to have a baby then, later on or do you not want any (more) children?

☐ Then 1
☐ Later 2
☐ No more/None 3

(2.23) For the future, do you want to have another baby soon, later, or not at all?

☐ Soon 1
☐ Later 2
☐ No more/None 3
☐ Not sure 4

(2.24) As far as you know, if a woman who is HIV+ becomes pregnant after she has already been on ART for several months or more, is the baby likely to get HIV from the mother?

☐ Yes 1
☐ No 2
☐ Not sure/don't know 3
☐ Other, please specify 4

(2.25) What methods/treatments have you heard of that can help prevent mother-to-child transmission of HIV?

(multiple response answer is possible)

☐ Mother is on lifelong HIV treatment and takes ART regularly 1
☐ ARV prophylaxis to the baby after birth 2
☐ Have delivery at a hospital with ART services 3
☐ If the mother is on treatment and virally suppressed ..4
☐ Other, please specify 5

Section 3: HIV TEST

Now, I would like to ask you three quick questions about your HIV test. If I ask you any questions you don't want to answer, just let me know.

(3.1) For how many years have you had HIV/AIDS?
(If less than 1 year, record '00')
Number of years: ___ ___

(3.2) In what month and year did you receive your first HIV-positive test result?
(mm/yyyy): ___ ___ /___ ___ ___ ___

(3.3) Where was the test done?

- ☐ Public hospital.....1
- ☐ Health center.....2
- ☐ Stand-alone Public HTC Center.....3
- ☐ Family planning clinic.....4
- ☐ Mobile HTC Services.....5
- ☐ Other public sector.....6
- ☐ Private hospital.....7
- ☐ Private clinic.....8
- ☐ Private doctor.....9
- ☐ Stand-alone Private HTC Center.....10
- ☐ Pharmacy.....11
- ☐ Mobile HTC Services.....12
- ☐ Other public sector.....13
- ☐ NGO hospital.....14
- ☐ NGO clinic.....15
- ☐ Other NGO medical sector.....16
- ☐ Home.....17
- ☐ Workplace.....18
- ☐ Correctional facility.....19

(4.1) I have finished asking you questions. Do you have any questions to ask me? Or any comment you would like to make?

- ☐ Yes.....1
- ☐ No.....2

Please write down the interviewee's suggestions/comments/ questions in more detail