

Supplementary File S2:

Semi-structured interview working protocol: correlates of severe sex imbalance among notified HIV/AIDS patients and MSM population agglomeration in Xiamen

(This protocol is translated from core points of its Chinese version. The complete Chinese-language documents is available on request from the corresponding authors of this manuscript.)

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1 Study overview and interview design

1.1 Study background and objectives

Between 2003 and 2025, a cumulative total of 4 326 confirmed HIV/AIDS patients were officially notified in Xiamen, of whom 3 913 (90.45 %) were male and 413 (9.55 %) female. The overall male- to- female case ratio reached 9.47:1, peaking at 18.19:1 in 2017 — substantially higher than the national average ratio of 3.64:1. After 2008, male- to- male sexual contact (MSM) replaced heterosexual intercourse as the predominant local transmission pathway, accounting for 52.38 % of cumulative notified patients. Notified MSM cases demonstrate prominent patterns of cross- city in- migration and spatial clustering within central urban districts.

This mixed- methods study integrates routine public- health surveillance data with one- on- one semi- structured interviews. Through dialogue with front- line practitioners and community stakeholders, we explore multi- layered contributing factors driving the severe sex imbalance among notified local HIV patients. Findings aim to generate practical evidence for targeted HIV prevention in other Chinese coastal cities receiving large migrant populations. All interview materials are used exclusively for academic analysis and local public- health policy research, with no commercial application.

1.2 Interview participants and fieldwork period

We adopted data- saturation- driven sampling. The pre- specified sample range was 20- 40 participants; recruitment ceased once three consecutive interviews yielded no emergent new core themes. Five participant subgroups were targeted:

1. MSM peer- support volunteers
2. Operators of MSM- related social venues
3. People living with HIV who identify as MSM
4. Clinical healthcare staff undertaking HIV follow- up care
5. Full- time HIV prevention and control public- health practitioners

Planned fieldwork period: June 20, 2026 – July 19, 2026.

1.3 General interview specifications

1. Interview format: Private one-on-one semi-structured interviews; no third-party observers present.
2. Duration: 30-60 minutes per session.
3. Setting: Private consultation rooms within the Center for Disease Control and Prevention or community-based private interview spaces to guarantee quiet, undisturbed conditions.
4. Pilot interviews: Three pilot interviews were completed before formal participant recruitment. Question wording and sequence were iteratively adjusted according to participant feedback to improve interview flow.
5. Post-interview data handling: Audio-recording was permitted only with participant consent. Verbatim transcription was completed on the day of each interview, and transcripts were sent back to participants for review and factual correction.

1.4 Ethical approval information

Ethics review body: Medical Ethics Committee of the Xiamen Center for Disease Control and Prevention
Ethics approval ID: XJK/LLSC(2026) 008

2 Revised semi-structured interview guide

Prefatory notes

1. Five participant strata: ① MSM peer volunteers; ② MSM-venue operators; ③ HIV-positive MSM; ④ clinical follow-up healthcare providers; ⑤ full-time HIV prevention practitioners.
2. Three pilot interviews were performed prior to formal fieldwork to refine wording, duration and question sequencing.
3. Each interview lasted 30-60 min; audio-recording was optional. All questions were open-ended with supplementary follow-up probes.
4. All sessions took place in private rooms (CDC consultation suites, community or clinical interview rooms) without third-party attendance.

2.1 Standardized opening script (verbatim for consistency)

Thank you very much for agreeing to take part in this interview. I am a researcher from Xiamen Center for Disease Control and Prevention.

This study investigates drivers of the marked sex imbalance among notified HIV patients in Xiamen from 2003-2025. Results will inform academic research and local HIV prevention practice for migrant-receiving coastal cities across China. This discussion will last approximately 30-60 minutes. If you give permission, audio recordings will be made solely for verbatim transcription and academic analysis. All personal identifiers will be permanently anonymized and replaced by numeric participant IDs; no identifiable personal information will appear in any published outputs. During the interview you retain full rights: you may decline to answer any individual question, you may terminate the conversation at any point without adverse consequences for your work or personal interests, and you may

request to review a summary of your interview transcript after completion. May we audio-record this interview? Do you have any questions before we begin?

2.2 Module 1: basic background information

1. How many years have you been engaged in HIV-related work or MSM community services?

Probe: Which population groups do you routinely engage with? What are your day-to-day HIV-related work activities?

2. Roughly what scale of high-risk populations do you interact with in your routine practice?

Probe: What approximate proportions are represented by migrant MSM and female sex-workers respectively?

2.3 Module 2: perceptions of HIV sex imbalance in Xiamen

1. Local surveillance shows an overall male-to-female notified case ratio of 9.47:1, peaking at 18.19:1 in 2017, considerably higher than the national average of 3.64:1. From your observation, in which year did this pronounced male predominance among HIV patients become prominent? Are there clear turning-point periods?

Probe: What policy, demographic or screening-service changes occurred around those turning-point years?

2. Drawing on your front-line experience, what core factors widen the sex gap among notified HIV cases in Xiamen relative to national levels?

Probe: Beyond population mobility, what roles do screening-service conditions, epidemiological-investigation workflows and epidemiological transmission patterns play? Please elaborate.

2.4 Module 3: cross-city MSM inflow and intra-urban central-district Agglomeration

1. Surveillance data indicate that 73.66 % of notified local MSM HIV cases are migrants without Xiamen household registration. In your view, what key factors attract migrant MSM to settle long-term in Xiamen? (consider economic opportunities, social inclusiveness, social-network environment, geographic location and other dimensions).

Probe: What unique advantages does Xiamen offer migrant MSM compared with neighbouring cities?

2. Spatial analyses demonstrate clustering of MSM-associated HIV cases in central Siming and Huli Districts. How does this geographic concentration shape local HIV-transmission risks?

Probe: What transmission-related risks stem from the types of social venues and daily activity patterns among these clustered groups?

2.5 Module 4: transmission-route misclassification and behavioral non-disclosure

1. During epidemiological case investigations, some MSM do not disclose histories of same-sex sexual behavior. How commonly do you observe this non-disclosure in routine practice? What principal reasons underpin non-disclosure?

Probe: What biases in surveillance data arise from such non-disclosure? What existing workflows are used to correct initially misclassified transmission routes?

2. After 2008, MSM-related sexual transmission replaced injecting-drug use as the dominant HIV transmission pathway. What key factors drove this epidemiological shift?

Probe: What respective contributions came from expanded screening services, community-organisation activities and population mobility?

2.6 Module 5: disparities in screening resource allocation for high-risk men and women

1. What gaps exist in available screening resources and service coverage targeting MSM versus high-risk female populations?

Probe: Where do imbalances lie with respect to staffing, physical venues, funding and peer- outreach mechanisms?

2. Screening-service scale for high-risk women has grown slowly. Do you perceive under-detection and under- estimation of female HIV burden in routine surveillance? At which workflow stages are cases most likely to be missed?

Probe: How might resource re- allocation narrow sex-related gaps in testing access?

2.7 Module 6: intervention strategies and generalizable implications

1. For high-burden MSM hotspots within Siming and Huli Districts, what represents an optimal combined package of prevention interventions? (e.g., peer- led rapid testing, PrEP education, comprehensive sexual- partner tracing).

Probe: What bottlenecks limit current interventions, and how might implementation be improved?

2. Our dataset shows that 6.80 % of notified HIV-positive MSM report extramarital heterosexual contacts. What limitations exist within current partner-tracing workflows, and how could these be strengthened?
3. As a coastal city receiving large migrant inflows, what lessons from this Xiamen-based study are applicable to other comparable Chinese urban centers?

2.8 Closing segment

1. Have I accurately captured your perspectives? Are there viewpoints you wish to supplement or clarify?
2. Do you have any further observations or suggestions relevant to this study's research questions?

Thank you sincerely for sharing your front- line insights. This interview is now concluded. Upon request, we can provide you with a transcript summary for your review within two weeks.

3 Confidentiality management protocol

3.1 Confidentiality obligations for research personnel

1. All interviewers, transcription staff and qualitative analysts signed formal confidentiality agreements outlining accountability for unauthorized disclosure of raw interview materials. Access to audio-recordings and full verbatim transcripts is restricted exclusively to core project team members.
2. Need-to-know principle: Each researcher only accesses data required to complete their designated tasks; cross-role browsing of complete interview datasets is prohibited.
3. All manuscript outputs were reviewed by the ethics committee prior to submission; all information that could identify individuals, venues or organisations was redacted.

3.2 Data coding and anonymization rules

1. Every participant received a unique numeric **Participant Identifier (PID, ranging 001-032)**. Only PIDs appear in analytical documents; real-world names and work affiliations are never retained within analysis files. A separate encrypted master lookup table linking real identities to PIDs is physically segregated from all interview transcripts.
2. Transcript anonymization: Specific hospital names, community-site labels, entertainment-venue identifiers, precise job titles and administrative policy reference numbers were removed. Generic descriptions such as “central-district institution” or “local HIV service site” replace granular identifiable details.
3. Audio-recordings, raw verbatim transcripts and anonymized analytical documents were stored in three separate encrypted folder hierarchies.

3.3 Tiered data storage security requirements

1. Electronic data: Audio-files and transcripts reside on an institutional encrypted intranet server protected by dual-layer passwords. Transmission via personal instant-messaging software, private email or public cloud-storage platforms is strictly forbidden. Off-line encrypted laptop backups are maintained without public-network connectivity.

2. Paper-based materials: Signed informed-consent forms and handwritten field notes are secured within a password-locked filing cabinet; only the principal investigator holds physical access keys.
3. Data transfer: All internal file exchange occurs exclusively through institutional encrypted office systems; personal cloud-drive storage is prohibited.

3.4 Data retention and destruction procedures

1. Raw audio-recordings and non-anonymized verbatim transcripts are retained for 1 year after fieldwork completion, after which irreversible secure destruction is performed: electronic files are permanently shredded; hard-copy documents undergo professional physical shredding. A formal destruction log is kept for audit purposes.
2. Fully anonymized analytical transcripts (without any personal identifiers) may be retained long-term for academic reference and are not subject to the 1-year destruction rule.

3.5 Confidentiality boundaries disclosed to participants

Original interview records will only be released in response to formal, legally-mandated judicial summonses. No third-party actors (employers, media outlets or private individuals) are granted access to raw interview content under any other circumstances.

4 Revised informed consent form

Study Title: Mixed- methods Research on Severe sex Imbalance of
HIV/AIDS Notifications and Aggregation- related Factors among
MSM Populations in Xiamen Implementing Institution: Xiamen Center
for Disease Control and Prevention Principal Investigator: Guilin Ma
Ethics- approval reference number: XJK/LLSC(2026)008

4.1 Study background and objectives

From 2003—2025, Xiamen recorded a cumulative 4 326 notified HIV/AIDS patients with a male- to- female ratio of 9.47:1, substantially exceeding national benchmarks. This study combines semi- structured stakeholder interviews with routine quantitative surveillance data to identify multi- layered drivers of skewed sex distribution among notified HIV cases. Outputs deliver empirical evidence for HIV prevention within Chinese coastal cities receiving large migrant populations. All anonymized interview material is used solely for academic manuscripts and public- health policy analysis, with no commercial purposes.

4.2 Study procedures

1. Private one- on- one interview lasting 30- 60 minutes.
2. Audio- recording is optional; handwritten field notes will be taken if you decline recording.
3. Interview content is transcribed, anonymized via PID assignment, and processed for thematic qualitative analysis.
4. You may request to review a summary of your own interview transcript within two weeks after participation.

4.3 Voluntary participation and right to withdraw

1. Your participation in this research is entirely voluntary, with no compulsion of any kind.

2. You are entitled to terminate participation at any stage — before, during or after the interview — without providing justification, and this decision will carry no negative consequences for your work or personal interests.
3. Should you withdraw mid-interview: we will immediately delete all audio-files and incomplete written records associated with your session. Once data have been aggregated and anonymized for thematic analysis, individual participant perspectives cannot be selectively removed from pooled study outputs.
4. You retain the right to decline to respond to any sensitive question without explanation.

4.4 Potential risks and mitigation measures

1. No physical harm is anticipated. Interview themes cover HIV-related stigma and occupational stress and may trigger transient negative emotional responses. You are permitted to pause or end the interview at any moment; researchers can provide local mental-health support referrals upon request.
2. Strict multi-layered confidentiality safeguards minimise risks of privacy disclosure, as detailed in subsequent clauses.

4.5 Participant benefits

1. No monetary compensation is provided. A small souvenir will be offered in appreciation upon completion of your interview.
2. Your practical front-line insights will help optimise local HIV-prevention resource allocation and improve services for key high-risk populations.

4.6 Confidentiality safeguards

1. All personally-identifiable information will be permanently erased; only numeric PID codes appear in analysis outputs. Your real-name, workplace and specific venue details will never appear in published articles or conference materials.
2. Audio-recordings and raw transcripts are stored encrypted; viewing access is limited exclusively to core project-team researchers.
3. Original interview audio-files will be irreversibly destroyed 1 year after fieldwork. Fully anonymized analytical texts without personal markers will be preserved long-term for academic reference.

4. Raw interview material will only be released in response to formal legal judicial summonses; no third-party parties are permitted access under other conditions.
5. All transcription and analytical staff have executed formal confidentiality agreements and bear corresponding accountability for unauthorized information disclosure.

4.7 Permitted scope of data utilization

Anonymized interview content may be used for peer-reviewed journal manuscripts, academic conference presentations and internal CDC HIV-prevention research.

Separate written consent will be sought in advance if these materials are intended for science-popularisation outreach or commercial promotion.

4.8 Conflict-of-interest statement

This project received no external research funding. All study team members declare no relevant commercial or industry-related conflicts of interest.

4.9 Consultation contact information

Principal Investigator: Guilin Ma Tel: 2020727 Email: [redacted]

Ethics-committee appeal contact: Medical Ethics Committee, Xiamen CDC, Tel: 2020001. You may submit formal appeals to this committee if you believe your participant rights have been violated.

4.10 Separate audio-recording authorization (tick-box option)

- ☐ I consent to audio-recording of this interview for transcription and academic analysis
- ☐ I decline audio-recording; only handwritten notes will be taken during our discussion

4.11 Consent declaration

I have fully read and understood all content set out above. The research team has answered all my questions. I volunteer to take part in this study and acknowledge all participant rights and confidentiality provisions described in this document.

Participant Signature: _____ Date: _____

Researcher Signature: _____ Date: _____

Two identical hard- copy versions of this consent form are generated:
one retained by the participant and one filed within the project records.

5 Workflow for qualitative data analytical

1. **Transcription and anonymization:** All interview audio- files are transcribed verbatim. All personally- identifiable names and place labels are redacted; each transcript receives a unique PID.
2. **Participant member-checking:** Transcripts are returned to respective participants for factual review and correction of recording or transcription inaccuracies.
3. **Thematic coding:** A combined deductive- inductive thematic coding approach was adopted, including open coding, axial coding and selective coding, which are applied across fully anonymized transcripts to distil core study themes.
4. **Data-saturation confirmation:** Participant recruitment stops once three consecutive interviews generate no new coding themes.
5. **Triangulation:** Qualitative interview findings are cross-referenced against quantitative surveillance outputs to strengthen interpretive trustworthiness.
6. **Result presentation:** Interview narratives serve only as descriptive supporting evidence; no standalone causal inferences are drawn purely from qualitative material.