The Digital Marketplace: Online Solicitation, Anonymity, and HIV Prevention in Hong Kong's Indoor Sex Industry

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1. Introduction and Conceptual Framework

The landscape of sex work has undergone a profound digital transformation over the past two decades, fundamentally reshaping how sexual services are advertised, negotiated, and delivered (Koenig et al., 2022). In Hong Kong, this shift has been particularly pronounced, with sex work increasingly moving from street-based venues to indoor settings facilitated by online platforms, including dedicated forums, mobile applications, and social media (Katumba et al., 2024). This digital migration presents both opportunities and challenges for HIV prevention efforts, as traditional outreach methods struggle to reach this increasingly hidden population.

Hong Kong's sex industry is predominantly characterized by indoor operations, including one-woman apartments, escort services arranged through online forums, and high-end services coordinated via mobile applications (T. Kwan & Lee, 2019). Unlike street-based sex work, which has historically been the focus of public health interventions, indoor sex work facilitated by digital platforms operates with greater anonymity and discretion, making it difficult for health authorities to provide targeted HIV prevention services (Peters et al., 2022). This operational invisibility, while offering sex workers enhanced safety from law enforcement and some forms of violence, simultaneously creates barriers to accessing essential health information and services, including HIV testing, pre-exposure prophylaxis (PrEP), and post-exposure prophylaxis (PEP) (Lee et al., 2019).

Despite the global proliferation of digital platforms in sex work, there remains a significant research gap concerning female sex workers in Asian contexts, particularly in settings where sex work operates primarily indoors (Katumba et al., 2024). Most existing literature on digital health interventions for HIV prevention has focused on men who have sex with

men (MSM), given their disproportionate HIV burden (T. Kwan et al., 2022; T. Kwan & Lee, 2019). However, the unique socio-cultural context of Hong Kong, combined with its advanced digital infrastructure and high internet penetration rates, creates an urgent need to understand how digital platforms mediate HIV risk negotiation, client screening practices, and access to prevention services among female sex workers operating in indoor venues.

The Information-Motivation-Behavioral Skills (IMB) model provides a robust theoretical framework for understanding HIV prevention behaviors in digital contexts (Hassler et al., 2026). Originally developed to explain health behavior change, the IMB model posits that HIV-preventive behavior is determined by information about HIV transmission and prevention, motivation to engage in prevention activities, and behavioral skills necessary to perform preventive actions (Jiang et al., 2019; X. Liang et al., 2020). In the context of digital sex work, the IMB model can illuminate how online platforms affect: (1) access to accurate information about HIV risks and prevention technologies; (2) personal and social motivation to engage in protective behaviors such as consistent condom use, HIV testing, and PrEP uptake; and (3) behavioral skills for negotiating safer sex with clients and navigating digital health services (Wang et al., 2019).

This literature review examines how digital platforms mediate HIV risk negotiation, client screening, and access to prevention services in Hong Kong's predominantly indoor and online-based sex industry. By synthesizing evidence from digital health interventions, online sex work studies, and behavioral health research, this review addresses critical questions: How do digital platforms shape HIV risk perception and prevention behaviors among indoor sex workers? What role does anonymity play in both facilitating safer client

screening and creating barriers to accessing HIV care? And how can public health systems leverage digital channels to reach this hidden population with evidence-based prevention services, including HIV self-testing and PrEP?

2. The Digital Transformation of Sex Work: From Street to Screen

The migration of sex work from physical spaces to digital platforms represents one of the most significant transformations in the contemporary sex industry (Cheung et al., 2024). This shift has been driven by technological advancements, changing social norms, and the practical advantages that online platforms offer for both sex workers and clients, including enhanced safety, broader reach, and greater control over working conditions (Koenig et al., 2022). In Hong Kong and across Asia, digital platforms have become the primary mechanism through which indoor sex work is organized, with implications for how sex workers manage occupational risks, including HIV exposure (Nugroho et al., 2025).

Digital platforms used for sex work solicitation span a diverse ecosystem, from dedicated forums and classified advertisement websites to mainstream social media platforms and geosocial networking applications (Katumba et al., 2024). In the Asian context, platforms such as online forums specifically dedicated to escort reviews, WeChat groups, specialized mobile applications, and even social media platforms like Instagram and Facebook have become venues for advertising sexual services (Ure & Somorija, 2025). These platforms vary considerably in their features, target demographics, and the degree of anonymity they afford users (Zhu et al., 2024). Understanding this digital ecosystem is essential for designing effective HIV prevention interventions tailored to the specific contexts in which sex workers and clients interact.

The transformation from outdoor to indoor sex work fundamentally alters the visibility of sex workers to public health outreach workers (Peters et al., 2022). Street-based sex work, while stigmatized and often subject to criminalization, has historically been accessible to outreach programs through venue-based interventions and peer educator networks (McBride et al., 2021). In contrast, indoor sex workers operating through digital platforms remain largely invisible to traditional outreach methods (Katumba et al., 2024). Research from Uganda illustrates this challenge, documenting how women who meet clients through online platforms face distinct risks compared to those working in physical venues, including cybersecurity threats, extortion, and unique patterns of violence from clients (Katumba et al., 2024). These findings underscore the need for innovative outreach strategies that can penetrate digital spaces where sex work is organized.

The online-to-offline (O2O) model has emerged as a particularly relevant framework for understanding how digital platforms mediate sexual health services in Asia (Khati et al., 2024; Luo et al., 2022). Originally developed for e-commerce, the O2O model describes how online platforms facilitate offline transactions and service delivery (Luo et al., 2022). In the context of sex work, clients use online platforms to identify, screen, and negotiate with sex workers before meeting in person (Katumba et al., 2024). This model has important implications for HIV prevention, as it creates opportunities for digital interventions to reach sex workers and clients during the online phase of interaction, potentially influencing risk negotiation and prevention behavior before sexual encounters occur (Khati et al., 2024).

Research on MSM in Hong Kong demonstrates how digital platforms have become integral to sexual networking and HIV prevention (T. Kwan & Lee, 2019). A cross-sectional survey

of 453 HIV-negative MSM found that those who used internet channels for sex networking, particularly location-based social network apps, were more likely to accept PrEP, suggesting that digital platforms can facilitate engagement with biomedical prevention technologies (T. Kwan & Lee, 2019). However, the same study found that MSM who used online forums to seek sex partners had lower awareness of PrEP compared to those visiting physical venues, highlighting the heterogeneity of digital platforms in their capacity to disseminate health information (T. Kwan & Lee, 2019). These findings suggest that not all digital platforms are equally effective as venues for HIV prevention messaging, and that platform-specific strategies may be necessary.

The shift to digital platforms has also transformed client screening practices among sex workers (Bernier et al., 2022). Online platforms enable sex workers to vet potential clients through reviews, ratings, and communication before meeting in person, potentially enhancing their safety (Koenig et al., 2022). Research from British Columbia, Canada, found that online solicitation facilitates sex workers' ability to mitigate workplace violence by allowing them to remain in control of client interactions and screen clients more effectively (Koenig et al., 2022). However, the same study noted that criminalization, stigma, and restrictive website policies can compromise these safety strategies, highlighting the intersection of legal frameworks and digital platform design in shaping sex workers' occupational health (Koenig et al., 2022).

Table 1: Digital Platforms Used for Sex Work Solicitation in Asia—Features and HIV Prevention Implications

Platform Type	Examples	Key Features	HIV Prevention Opportunities	Challenges
Dedicated forums	Escort review sites, local forums	Anonymous posting, client reviews, detailed profiles	High user engagement; community norms can be leveraged for health messaging	May reinforce stigma; limited reach to non-forum users
Social media	Facebook, Instagram, Twitter	Wide reach, multimedia content, networking	Can integrate health campaigns; peer influence mechanisms	Privacy concerns; content moderation policies may restrict sex work content
Geosocial apps	Grindr, Blued (MSM-focused)	Location-based matching, real-time chat	Can target by geography; immediate communication for interventions	Primarily developed for MSM; limited options for female sex workers (T. Kwan & Lee, 2019)
Messaging apps	WeChat, WhatsApp, Telegram	Private encrypted communication, group chats	Can provide confidential counseling; distribute HIVST kits	Relies on individual contacts; difficult to scale
Classified sites	General classified platforms	Low barrier to entry, wide audience	Broad reach; can integrate prevention messaging	Transactional focus; less community engagement

Note: Based on synthesis from (Katumba et al., 2024; T. Kwan & Lee, 2019; Ure & Somorija, 2025; Zhu et al., 2024)

The implications of this digital transformation for HIV prevention are profound. Traditional venue-based outreach, which has been the cornerstone of sex worker health

programs, must adapt to reach populations operating primarily in digital spaces (Vannakit et al., 2020). Moreover, the anonymity and discretion afforded by digital platforms, while beneficial for sex workers' safety and autonomy, create challenges for public health surveillance and targeted intervention delivery (C. A. Liang et al., 2020). Understanding how to navigate these tensions between privacy, autonomy, and public health is essential for developing ethical and effective HIV prevention strategies in the digital era (C. A. Liang et al., 2020).

3. Digital Platforms and HIV Risk Negotiation

Digital platforms fundamentally reshape how HIV risk is perceived, communicated, and negotiated in sex work contexts. The affordances of online environments—including asynchronous communication, textual rather than face-to-face interaction, and the ability to share health information digitally—create novel opportunities for safer sex negotiation while also introducing unique challenges (Salway et al., 2012). Understanding these dynamics is critical for designing interventions that leverage digital platforms to reduce HIV transmission risk in Hong Kong's indoor sex industry.

HIV risk perception among sex workers operating through digital platforms is influenced by multiple factors, including the information available through online communities, the characteristics of clients met through different platforms, and the broader social norms communicated in digital spaces (Kahle et al., 2018). Research from Malaysia examining HIV risk assessment among MSM using online dating applications found that self-reported risk behaviors, including multiple sexual partners and inconsistent condom use, were common among platform users (Shrestha et al., 2020). However, the same study revealed significant gaps in HIV knowledge and misperceptions about transmission routes,

suggesting that despite high digital engagement, accurate health information does not automatically reach all platform users (Shrestha et al., 2020).

The concept of anonymity operates as a double-edged sword in digital sex work platforms (C. A. Liang et al., 2020). On one hand, anonymity can enhance sex workers' safety by allowing them to screen clients, control disclosure of personal information, and minimize exposure to stigma and violence (Bernier et al., 2022; Koenig et al., 2022). Research from Canada documented how male and non-binary sex workers who solicit clients online use various strategies to maintain safety, including requiring deposits, checking references, and using encrypted communication (Koenig et al., 2022). On the other hand, anonymity can create barriers to HIV prevention by making it difficult for sex workers to verify clients' health status, reducing accountability for unsafe sexual practices, and complicating efforts to link individuals to testing and treatment services (C. A. Liang et al., 2020).

Client screening practices in digital environments have important implications for HIV risk negotiation (McBride et al., 2021). A longitudinal study from Vancouver found that seeing pre-screened, regular clients was associated with significantly lower odds of workplace sexual violence and client condom refusal, even in the context of criminalization (McBride et al., 2021). The ability to establish relationships with regular clients, facilitated by digital communication platforms, may create opportunities for ongoing negotiation of sexual health practices, including HIV testing, disclosure of status, and use of prevention technologies like PrEP (McBride et al., 2021). However, these protective benefits must be weighed against research from Uganda showing that women who meet clients online face additional risks, including cybersecurity attacks and extortion, which may compromise their bargaining power in sexual health negotiations (Katumba et al., 2024).

Condom negotiation in digital sex work contexts is mediated by the communication patterns established through online platforms (Huang, 2022). Research from Taiwan on the visual culture of social networking applications found that digital platform designs can either reinforce or challenge HIV-related stigma, affecting users' willingness to discuss sexual health (Huang, 2022). The study noted that while some platforms incorporated features to facilitate safer sex discussions, such as health reminders or links to testing services, others prioritized sexual connection over health messaging, potentially undermining prevention efforts (Huang, 2022). This suggests that platform design choices—including user interface elements, content moderation policies, and integration of health resources—play a crucial role in shaping HIV risk behaviors.

The Information-Motivation-Behavioral Skills (IMB) model provides a useful framework for understanding how digital platforms influence HIV prevention behaviors among sex workers (Hassler et al., 2026). Applied to the digital sex work context, information about HIV risks and prevention can be disseminated through platform-integrated health messaging, peer discussions in online forums, and links to external health resources (X. Liang et al., 2020). Motivation to engage in HIV prevention may be enhanced by social norms within online communities, concerns about health and economic security, and the desire to protect regular clients (Jiang et al., 2019). Behavioral skills necessary for HIV prevention—such as negotiating condom use, accessing HIV testing, and using PrEP correctly—can be supported through digital tools including instructional videos, online counseling, and virtual peer support (Ampt et al., 2020).

Evidence from Hong Kong's MSM community illustrates how digital platforms mediate HIV risk behaviors. A study examining PrEP awareness and acceptance found that MSM

who used location-based social network apps were more likely to accept PrEP, suggesting that certain digital platforms may facilitate engagement with biomedical prevention technologies (T. Kwan & Lee, 2019). However, the same study identified chemsex (sexualized drug use) as a critical factor linked to both PrEP awareness and HIV risk, highlighting the need for digital interventions to address substance use in conjunction with sexual health (T. Kwan & Lee, 2019). The factor network analysis revealed that chemsex was central to the relationships between PrEP awareness, acceptance, and HIV testing behaviors, suggesting that interventions targeting MSM through digital platforms should integrate substance use prevention with HIV prevention messaging (T. Kwan & Lee, 2019).

Risk compensation—the phenomenon whereby individuals engage in riskier behavior when using prevention technologies—is a concern in both digital and offline sex work contexts (Lee et al., 2019). A pilot study of partially self-financed PrEP delivery among MSM in Hong Kong found that while PrEP users had satisfactory adherence and no HIV infections occurred during the study period, there was evidence of risk compensation, with an STI incidence of 3.17 per 100 person-years (Lee et al., 2019). This finding suggests that digital platforms facilitating PrEP access must also provide ongoing counseling about the continued importance of condom use for STI prevention (Lee et al., 2019).

The role of peer influence in digital environments cannot be overstated (Lu et al., 2020). Online communities create opportunities for social learning, where sex workers share strategies for client screening, condom negotiation, and accessing health services (Bernier et al., 2022). Research from Eastern Canada found that sex workers value online communities as sources of harm reduction information and peer support, though fragmentation across multiple platforms and concerns about platform stability (due to legal

threats or provider policies) can undermine these benefits (Bernier et al., 2022). This suggests that public health interventions should support the development of stable, moderated online spaces where sex workers can safely exchange health information and peer support (Bernier et al., 2022).

4. Digital Health Interventions for HIV Prevention

Digital health interventions have emerged as a promising strategy for reaching populations at high risk for HIV who may not access traditional health services (Veronese et al., 2019). For sex workers operating in Hong Kong's indoor industry, digital interventions offer potential solutions to barriers posed by stigma, criminalization, and the need for discretion (Khati et al., 2024). This section reviews evidence on HIV self-testing platforms, online PrEP delivery models, and the application of behavioral health frameworks in digital contexts, with particular attention to their relevance for Hong Kong's indoor sex work population.

HIV self-testing (HIVST) represents one of the most significant innovations in expanding HIV testing access (T. Kwan et al., 2022). Digital platforms can facilitate HIVST distribution through online ordering systems, virtual counseling during the testing process, and linkage to confirmatory testing and care (Khati et al., 2024). A study from Hong Kong evaluating different user interface (UI) designs for an HIV self-test referral program among MSM found that both gamification and neumorphism UI designs were well-accepted, with neumorphism showing broader appeal across different MSM subcommunities (T. Kwan et al., 2022). The study demonstrated that appropriate UI/UX design significantly influences users' willingness to promote the application within their peer networks, suggesting that

design elements are critical for the viral spread of digital health interventions (T. Kwan et al., 2022).

The integration of digital platforms with HIVST has shown promise in reaching previously untested individuals (Hecht et al., 2024). The TakeMeHome program in the United States, which partners with dating apps to promote self-collected, laboratory-processed HIV and STI testing, achieved a 1.4% HIV positivity rate and 15.3% per-person STI positivity rate among users, demonstrating the platform's effectiveness in identifying new cases (Hecht et al., 2024). While this program focused on MSM using dating apps, the model of integrating health services with platforms where sexual networking occurs has clear applications for reaching sex workers who use similar digital platforms (Hecht et al., 2024).

Online-to-offline (O2O) models for PrEP and PEP delivery offer innovative approaches to increasing access to biomedical prevention (Khati et al., 2024; Luo et al., 2022). These models typically involve online risk assessment, virtual counseling, and either mail delivery of medications or facilitated linkage to in-person services for prescription and monitoring (Luo et al., 2022). The CINTAI platform in Malaysia exemplifies this approach, providing MSM with online ordering of HIVST kits, real-time e-counseling, and linkage to offline HIV care services (Khati et al., 2024). The platform's hybrid design addresses common barriers to HIVST, including concerns about self-efficacy, result interpretation, and lack of follow-up counseling (Khati et al., 2024).

Evidence from Hong Kong's PrEP pilot programs demonstrates both the feasibility and challenges of biomedical prevention delivery in this context (T. H. Kwan et al., 2021; Lee et al., 2019). A study of partially self-financed PrEP among MSM found that 80% of participants were retained at the end of 28 weeks, with satisfactory adherence and no HIV

infections (Lee et al., 2019). However, the high cost of PrEP (with only half of participants considering HK$500 per month as reasonable) highlighted financial barriers to sustainable PrEP use (Lee et al., 2019). This finding underscores the importance of exploring innovative financing models, including subsidies, insurance coverage, and potentially crowd-funding or community-based financial support mechanisms that could be coordinated through digital platforms.

A randomized controlled trial comparing daily versus on-demand PrEP regimens among MSM in Hong Kong found that both approaches achieved high coverage of condomless anal intercourse (92% in both arms), with no significant difference between regimens (T. H. Kwan et al., 2021). Importantly, the study found that participants' preferences for PrEP regimens varied, with about half favoring each approach, suggesting that offering flexible, user-driven choices—which can be facilitated through digital platforms that allow personalized risk assessment and regimen selection—may optimize PrEP uptake and persistence (T. H. Kwan et al., 2021).

The application of the Information-Motivation-Behavioral Skills (IMB) model to digital HIV prevention interventions has shown consistent effectiveness across diverse populations (Jiang et al., 2019; X. Liang et al., 2020). A national study in China evaluating ICT-based HIV education using WeChat found that a six-month intervention significantly improved information scores (from 15.68 to 18.54), motivation scores (from 14.47 to 16.06), behavioral skills scores (from 2.26 to 4.74), and condom use scores (from 2.19 to 2.64) (X. Liang et al., 2020). Structural equation modeling revealed that ICT use had significant effects on motivation, behavioral skills, and information, which in turn had significant effects on condom use (X. Liang et al., 2020). These findings suggest that well-

designed digital interventions can influence the full chain of determinants in the IMB model, ultimately improving HIV prevention behaviors (X. Liang et al., 2020).

Tailoring digital interventions to specific behavioral and social contexts is essential for effectiveness (Puttkammer et al., 2022). A qualitative study applying the Situated IMB Model to HIV care in Haiti identified culturally specific factors affecting antiretroviral therapy adherence, including conflicts with traditional medicine, material advantages as motivators, and challenges in navigating health service utilization (Puttkammer et al., 2022). For Hong Kong's indoor sex work context, a situated IMB approach would need to address the specific information needs (e.g., knowledge about Hong Kong's HIV services landscape, legal protections), motivations (e.g., economic sustainability, protecting regular clients), and behavioral skills (e.g., negotiating condom use in power-imbalanced client relationships, navigating digital health platforms) relevant to this population.

Table 2: Digital HIV Prevention Interventions—Features, Theoretical Basis, and Outcomes

Intervention Name	Setting	Target Population	Key Features	Theoretical Framework
Primary Outcomes	Citation	HIVSmart!	South Africa	General population
Digital risk assessment tool, app-based	Risk staging model	Sensitivity 91.0%, Specificity 91.6% when	(Soo et al., 2023)	CINTAI

Intervention Name	Setting	Target Population	Key Features	Theoretical Framework
self-testing program		combined with HIVST		
Malaysia	MSM	HIVST kit ordering, real-time e-counseling, O2O linkage	O2O model	Feasibility and acceptability demonstrated in pilot
(Khati et al., 2024)	TakeMeHome	USA	MSM	Dating app promotion, self-collected testing kits, laboratory processing
Community-based outreach	1.4% HIV positivity, 15.3% STI positivity	(Hecht et al., 2024)	WeChat HIV Education	China
General population	6-month educational program via WeChat	IMB model	Significant improvements in information, motivation, behavioral skills, condom use	(X. Liang et al., 2020)
Gamification/Neumorphism UI	Hong Kong	MSM	HIV self-test referral, peer promotion	UI/UX design principles
High usability (SUS score 80); neumorphism preferred	(T. Kwan et al., 2022)	O2O-PEP Model	China	MSM
Gamification education, online risk assessment, online booking, offline prescription	O2O model	Protocol development; RCT planned	(Luo et al., 2022)	PrEP Pilot
Hong Kong	MSM	Partially self-financed PrEP, clinical monitoring	80% retention at 28 weeks; no HIV infections	(Lee et al., 2019)

Note: IMB = Information-Motivation-Behavioral Skills; HIVST = HIV self-testing; O2O = Online-to-offline; MSM = Men who have sex with men; UI/UX = User Interface/User Experience; SUS = System Usability Scale

Digital platforms also enable novel approaches to peer-based interventions (Lu et al., 2020). A study in China on secondary distribution of HIVST using digital networks found that peer referral and monetary incentives could effectively promote HIV testing among MSM social networks (Lu et al., 2020). Participants (index MSM) could distribute actual HIVST kits to members of their social network or share referral links encouraging others to apply for kits themselves (Lu et al., 2020). This model leverages the social connectivity inherent in digital platforms while addressing the challenge of reaching hidden populations who may not access traditional testing services.

The integration of multiple intervention modalities through digital platforms may enhance effectiveness (Stocks et al., 2023). The PrEPresent intervention for sexual and gender minority youth in Los Angeles combines PrEP navigation and patient activation through a digital platform (Stocks et al., 2023). By addressing both knowledge/awareness barriers (through education) and structural barriers (through navigation assistance), the intervention aims to bridge gaps in PrEP eligibility and uptake (Stocks et al., 2023). This multi-component approach aligns with evidence suggesting that addressing multiple levels of the IMB model simultaneously produces stronger effects than single-component interventions (Jiang et al., 2019).

5. Barriers and Facilitators to Digital HIV Prevention

While digital platforms offer significant potential for HIV prevention in Hong Kong's indoor sex work industry, numerous barriers must be addressed to realize this potential

(Salway et al., 2012). Simultaneously, understanding facilitators can guide the design and implementation of more effective interventions (Bernier et al., 2022). This section examines the multi-level factors that influence the uptake and effectiveness of digital HIV prevention services among sex workers, drawing on evidence from diverse contexts and populations.

Stigma remains one of the most significant barriers to HIV prevention, operating at multiple levels—individual (internalized stigma), interpersonal (enacted stigma), and structural (institutional discrimination) (T. Kwan & Lee, 2019; Wei & Raymond, 2018). In the context of digital sex work, stigma intersects with both occupation and HIV status, creating compounded barriers (Sevelius et al., 2024). Research from China examining PrEP implementation among MSM found that HIV-related stigma and homophobia persist despite anti-stigma campaigns, deterring many from accessing prevention services for fear that taking PrEP would lead others to assume they are living with HIV (Wei & Raymond, 2018). For sex workers, the additional layer of occupational stigma may further discourage engagement with HIV services, even when delivered through ostensibly anonymous digital channels (Peters et al., 2022).

Privacy and confidentiality concerns represent critical barriers in digital environments (C. A. Liang et al., 2020; Salway et al., 2012). Research on digital platform design for HIV status disclosure found that many platforms fail to adequately consider state surveillance practices and privacy risks when designing for data disclosure (C. A. Liang et al., 2020). For sex workers operating in legal grey zones or under criminalization regimes, concerns about data security and the potential for law enforcement access to health information can significantly deter engagement with digital health services (Koenig et al., 2022). A study

from the Netherlands examining barriers to sexual healthcare services for male sex workers found that lack of self-identification and perceived stigma were significant barriers, even when services were provided free and anonymously (Peters et al., 2022).

Digital literacy and access to technology, while generally high in Hong Kong, may not be evenly distributed across all segments of the sex worker population (Katumba et al., 2024). Research from Uganda documented significant differences between sex workers with higher education and professional jobs (more likely to use online platforms) and those with less education who predominantly worked in physical venues (Katumba et al., 2024). The former group, while having greater digital literacy, also faced unique risks including cybersecurity attacks and online extortion (Katumba et al., 2024). This suggests that digital interventions must be designed with varying levels of digital competency in mind, providing support for users who may be less familiar with digital health tools.

Criminalization and legal frameworks fundamentally shape how sex workers engage with both digital platforms and health services (Koenig et al., 2022; McBride et al., 2021). In jurisdictions where sex work is criminalized or heavily regulated, sex workers may be reluctant to access health services that require disclosure of their occupation, even when those services are provided through digital channels that promise anonymity (Peters et al., 2022). Research from Canada found that end-demand criminalization (which targets clients) compromises sex workers' ability to screen clients online and negotiate safer conditions, as clients become more reluctant to provide identifying information that could be used for verification (Koenig et al., 2022). Conversely, evidence from contexts with more supportive legal environments suggests that decriminalization can enhance sex workers' ability to prioritize their health and safety (Koenig et al., 2022).

Trust in digital health services emerges as a complex facilitator that must be actively cultivated (Hughes et al., 2020; Salway et al., 2012). Research examining client experiences with internet-based PrEP services found that many users initially expressed skepticism about whether online health services could be legitimate or how they would work (Hughes et al., 2020). However, once users engaged with the service, they reported high satisfaction, particularly appreciating the balance between efficiency (simplicity, speed, convenience) and humanity (personalized, responsive interaction) (Hughes et al., 2020). The study found that the messaging platform function was crucial for creating feelings of personalized care while maintaining the convenience of digital interaction (Hughes et al., 2020). This suggests that digital HIV prevention services for sex workers should prioritize responsive, personalized communication while maintaining the efficiency and discretion that digital platforms afford.

Cost and financial barriers significantly influence uptake of HIV prevention services, including those delivered digitally (Durosinmi-Etti et al., 2022; Lee et al., 2019). The Hong Kong PrEP pilot study found that only half of MSM participants considered HK$500 (approximately US$64) per month as reasonable, despite being motivated to use PrEP (Lee et al., 2019). Research from Nigeria examining willingness to pay for HIV prevention commodities among key populations (including female sex workers) found that while 73% were willing to pay for PrEP services, there was a significant gap between the maximum amount they were willing to pay and retail prices (Durosinmi-Etti et al., 2022). The study concluded that bridging this gap through price reductions, subsidies, or innovative financing mechanisms is essential for increasing uptake (Durosinmi-Etti et al., 2022).

Language and cultural relevance of digital interventions represent important facilitators or barriers (Cantos et al., 2023). Research on developing a mobile HIV prevention app for Latino sexual minority men found that cultural concordance—including availability in Spanish, representation of Latino staff at clinics, and perception of clinics as safe spaces for Latino LGBTQ individuals—significantly influenced willingness to use digital health tools (Cantos et al., 2023). For Hong Kong's diverse sex worker population, which may include migrants from mainland China and other Asian countries, providing interventions in multiple languages (Cantonese, Mandarin, English) and ensuring cultural sensitivity will be essential for broad reach.

Social support, both online and offline, emerges as a consistent facilitator of HIV prevention behaviors (Cheung et al., 2024; Pollard et al., 2021). Research from Vietnam examining sexual risk burdens among young MSM who find sex online found that patterns of online sex seeking moderated the protective effects of social support on condomless anal sex (Cheung et al., 2024). Specifically, the protective effect of social support was strongest among "gay app users" who likely had more cohesive online communities (Cheung et al., 2024). This suggests that fostering supportive online communities around HIV prevention—through moderated forums, peer educator networks, or virtual support groups—could enhance the effectiveness of digital interventions for sex workers.

Table 3: Information-Motivation-Behavioral Skills (IMB) Model Components in Digital HIV Prevention for Sex Workers

IMB Component	Digital Application for Sex Workers	Examples from Literature	Barriers	Facilitators
Information	• Online HIV education modules• Forum-based peer knowledge sharing• Chatbot-delivered health information• Links to testing/PrEP resources	WeChat HIV education improved knowledge scores (X. Liang et al., 2020);Digital literacy varies (Katumba et al., 2024)	• Misinformation on platforms• Information overload• Low health literacy• Language barriers	• Peer-validated content• Interactive formats• Culturally tailored messaging• Multi-language support
Motivation	• Personal: Risk perception tools, testimonials• Social: Online community norms, peer support groups• Financial: Economic incentives for prevention uptake	PrEP acceptance linked to concern for partner health (T. Kwan & Lee, 2019);Economic security as motivator (Puttkammer et al., 2022)	• Stigma (HIV, sex work)• Fear of disclosure• Lack of perceived risk• Competing priorities	• Peer influence online• Protection of regular clients• Linkage to other benefits• Positive community norms
Behavioral Skills	• Video tutorials for HIVST• Virtual counseling for condom negotiation• Step-by-step guidance for PrEP use• Digital navigation to services	Digital platform enabled HIV testing skills (T. Kwan et al., 2022);Navigation improved linkage (Stocks et al., 2023)	• Privacy concerns limiting disclosure• Complex health system navigation• Lack of practice opportunities	• Interactive self-tests• Real-time chat support• Peer mentorship• Integration with trusted platforms

Based on synthesis from (Hassler et al., 2026; Jiang et al., 2019; X. Liang et al., 2020; Wang et al., 2019)

Platform-specific features and policies can either facilitate or hinder HIV prevention efforts (Huang, 2022; Koenig et al., 2022). Research from Canada found that restrictive website policies, content moderation that prohibits sexual health discussions, and platform instability (sites being shut down due to legal pressures) all compromise sex workers' ability to use digital platforms for safety and health purposes (Koenig et al., 2022). Conversely, platforms that integrate health resources, facilitate anonymous communication, and explicitly support sex worker safety can enhance HIV prevention (Huang, 2022). This highlights the importance of engaging platform providers as stakeholders in public health interventions and advocating for policies that support health promotion within sex work spaces.

6. Implications for Public Health Policy and Future Directions

The evidence reviewed in this paper reveals significant gaps between the reality of Hong Kong's predominantly indoor, digitally-mediated sex industry and the current public health infrastructure for HIV prevention (T. Kwan & Lee, 2019; Vannakit et al., 2020). Traditional outreach models, designed for street-based sex work and venue-based interventions, are ill-equipped to reach sex workers who operate primarily through online platforms and indoor venues (Peters et al., 2022). This section synthesizes the implications of the reviewed evidence for public health policy and identifies critical priorities for future research and practice.

The invisibility of indoor sex workers to conventional outreach represents perhaps the most fundamental challenge (Katumba et al., 2024). While digital platforms create this

invisibility by enabling discretion and anonymity, these same platforms also offer novel pathways for public health engagement (Veronese et al., 2019). The key policy implication is that HIV prevention programs must develop digital outreach capacity that mirrors the digital organization of sex work itself (Vannakit et al., 2020). This requires investment in several areas: (1) training outreach workers in digital engagement strategies, including use of online forums, social media, and messaging apps; (2) developing partnerships with platform providers to integrate health messaging and services; (3) creating dedicated digital spaces (websites, apps, online communities) specifically designed for sex worker health support; and (4) ensuring that digital services are seamlessly linked to offline care through robust O2O models (Khati et al., 2024; Luo et al., 2022).

Hong Kong's experience with PrEP delivery among MSM offers important lessons for expanding services to other key populations, including female sex workers (T. H. Kwan et al., 2021; Lee et al., 2019). The finding that partially self-financed PrEP achieved good retention (80% at 28 weeks) despite cost concerns suggests that when services are designed to be accessible and user-friendly, uptake can be substantial even without full subsidization (Lee et al., 2019). However, the research also clearly indicates that cost remains a significant barrier for many potential users (Lee et al., 2019). Policy options to address financial barriers include: expanding insurance coverage for PrEP; negotiating lower drug prices through bulk purchasing or generic substitution; implementing tiered pricing based on ability to pay; and exploring innovative financing mechanisms such as community-based health financing schemes or crowd-funding platforms that could be coordinated digitally.

The importance of offering flexible, user-driven options for HIV prevention is underscored by research showing that individuals have diverse preferences and needs (T. H. Kwan et al., 2021). The RCT comparing daily versus on-demand PrEP found that both regimens were equally effective at covering condomless anal intercourse, but user preferences were evenly split between the two approaches (T. H. Kwan et al., 2021). This finding supports a policy of offering multiple prevention modalities (including condoms, PrEP in different regimens, PEP, and emerging technologies like long-acting injectable PrEP) and allowing users to choose based on their sexual patterns, preferences, and life circumstances (T. H. Kwan et al., 2021). Digital platforms are particularly well-suited to facilitate this personalized approach through online risk assessment tools, decision aids, and virtual counseling that can guide users to the most appropriate prevention options for their needs (Soo et al., 2023).

Addressing stigma must be central to any HIV prevention strategy for sex workers (Wei & Raymond, 2018). The reviewed evidence consistently shows that stigma—both HIV-related and sex work-related—operates as a primary barrier to service uptake (T. Kwan & Lee, 2019; Peters et al., 2022). Digital interventions offer some advantages in reducing stigma-related barriers by providing anonymous access to information and services (Hughes et al., 2020). However, poorly designed digital services can inadvertently reinforce stigma, for example by using judgmental language, failing to protect privacy, or creating user interfaces that mark users as “high risk” in stigmatizing ways (C. A. Liang et al., 2020). Policy recommendations include: mandating non-stigmatizing content and user experiences in publicly funded digital health platforms; investing in stigma reduction campaigns that normalize HIV prevention technologies like PrEP and HIVST; ensuring

that digital platforms protect user privacy through encryption and strict data governance policies; and engaging sex workers as co-designers of digital services to ensure that interventions are empowering rather than stigmatizing (Tucker et al., 2021).

The legal and regulatory environment fundamentally shapes the possibilities for HIV prevention (Koenig et al., 2022). Evidence from jurisdictions with different legal approaches to sex work suggests that criminalization undermines sex workers' health and safety by making them reluctant to access services, limiting their ability to screen clients, and reducing their bargaining power in sexual health negotiations (Koenig et al., 2022; McBride et al., 2021). While comprehensive sex work law reform may be beyond the immediate scope of HIV prevention programs, public health advocates can support incremental changes that create a more enabling environment for health service delivery. These might include: ensuring that HIV prevention services are not conditional on cessation of sex work; advocating for legal protections that allow health professionals to serve sex workers without fear of prosecution; working with law enforcement to create protocols that do not penalize sex workers for carrying condoms or accessing health services; and supporting policy reforms that prioritize health and safety over criminalization.

Future research priorities emerge clearly from the gaps identified in this review. First, while substantial research has examined digital HIV prevention among MSM, there is a striking paucity of evidence specifically addressing female sex workers in Asian contexts (Katumba et al., 2024). Research is urgently needed to understand how female sex workers in Hong Kong use digital platforms, what their HIV prevention needs and preferences are, and what barriers and facilitators influence their engagement with digital health services. Second,

most existing digital interventions have been evaluated through short-term pilot studies with limited follow-up (T. Kwan et al., 2022; Lee et al., 2019). Rigorous, adequately powered randomized controlled trials with longer follow-up periods are needed to establish the effectiveness and cost-effectiveness of digital HIV prevention interventions for sex workers (Veronese et al., 2020). Third, research is needed on the integration of digital and offline services, examining how O2O models can be optimized to ensure seamless linkage between online engagement and offline care (Khati et al., 2024; Luo et al., 2022).

Fourth, the role of digital platform design in shaping health behaviors deserves deeper investigation (Huang, 2022; T. Kwan et al., 2022). Studies comparing different UI/UX designs, messaging strategies, and platform features can inform the development of more engaging and effective digital health interventions (T. Kwan et al., 2022). Fifth, implementation science research is needed to understand how digital interventions can be scaled up and sustained beyond pilot studies, including examination of workforce training needs, integration with existing health systems, and sustainable financing models (Vannakit et al., 2020). Finally, ethical research on the privacy and data governance implications of digital health services for criminalized populations is essential to ensure that interventions intended to improve health do not inadvertently expose vulnerable individuals to legal or social harms (C. A. Liang et al., 2020).

The COVID-19 pandemic has accelerated the adoption of digital health services globally, creating both challenges and opportunities for HIV prevention (Gao et al., 2022; Li et al., 2025). Research from Hong Kong and Beijing examining changes in sexual behaviors and HIV prevention service utilization among MSM in the post-pandemic era found that more MSM in Beijing reported increases in HIV testing, PrEP use, and other HIV prevention

services compared to Hong Kong (Li et al., 2025). This finding suggests that the disruption caused by the pandemic may have catalyzed greater engagement with digital health services in some contexts (Li et al., 2025). Going forward, public health systems should build on pandemic-related innovations in telehealth and digital service delivery to create permanent, improved pathways for HIV prevention that are accessible to sex workers and other key populations.

Designing culturally appropriate and contextually relevant digital interventions requires deep engagement with the target community (Cantos et al., 2023; Tucker et al., 2021). The principle of "nothing about us without us," which has been foundational in HIV activism, must guide the development of digital health services for sex workers (Tucker et al., 2021). This means involving sex workers in all stages of intervention design, from formative research and prototype development to pilot testing and implementation (Tucker et al., 2021). It also means recognizing the diversity within sex work populations and ensuring that interventions are responsive to differences in age, gender identity, nationality, migration status, and other characteristics that shape health needs and preferences (Katumba et al., 2024).

The integration of HIV prevention with broader sexual and reproductive health services represents an important opportunity (Ampt et al., 2020). Research on mobile health interventions for female sex workers in Kenya found that addressing comprehensive sexual and reproductive health rights (SRHR)—not just HIV and STI prevention—was viewed as essential and empowering by sex workers (Ampt et al., 2020). Digital platforms are well-suited to providing integrated services, as they can incorporate information and resources on contraception, pregnancy care, gender-based violence, and other SRHR topics alongside

HIV prevention content (Ampt et al., 2020). This holistic approach may be more appealing to sex workers and more effective at improving overall health outcomes than narrow, disease-focused interventions (Ampt et al., 2020).

In conclusion, Hong Kong's predominantly indoor and online-based sex industry presents both unique challenges and significant opportunities for HIV prevention. Digital platforms that mediate sex work solicitation can also serve as channels for innovative health interventions, including HIV self-testing, online PrEP delivery, and peer-based support. However, realizing this potential requires addressing substantial barriers related to stigma, privacy, cost, and the legal environment. The Information-Motivation-Behavioral Skills model provides a useful framework for designing interventions that address the full range of determinants of HIV prevention behavior in digital contexts. Moving forward, public health systems must develop digital outreach capacity, engage platform providers as partners, ensure that services are user-driven and non-stigmatizing, and invest in rigorous research to establish the effectiveness and cost-effectiveness of digital HIV prevention for sex workers. Only through such comprehensive efforts can Hong Kong's public health system apt to the digital realities of contemporary sex work and effectively reduce HIV transmission in this hidden yet substantial population.

Recommended Methodological Approaches for Future Research

Given the identified gaps in evidence specifically addressing Hong Kong's indoor sex work context, future research should employ mixed-methods approaches that combine digital ethnography with direct engagement with sex workers and clients (Khanna et al., 2018). Digital ethnography—involving systematic analysis of online advertisements, forum discussions, and social media content related to sex work—can provide insights into how

sex workers present themselves online, what information they share about health and safety practices, and how clients discuss risk and prevention in digital spaces (Kostakos et al., 2018). This approach can be complemented by semi-structured interviews with sex workers who operate primarily online and their clients to understand subjective experiences of HIV risk negotiation, decision-making around prevention technologies, and barriers to accessing health services (Choi et al., 2021).

Community-based participatory research approaches are essential for ensuring that interventions are responsive to sex workers' actual needs and priorities (Tucker et al., 2021). Research partnerships between academic institutions, community-based organizations serving sex workers, and sex worker-led groups can ensure that studies are designed ethically, data collection methods are appropriate and safe, and findings are translated into actionable interventions (Tucker et al., 2021). The success of key population-led health services in Thailand demonstrates the potential of community-based models to overcome barriers of stigma and accessibility (Vannakit et al., 2020). Similar approaches could be adapted for Hong Kong's context, with digital platforms serving as organizing tools for peer-led health promotion and service navigation.

Finally, evaluation frameworks for digital interventions must extend beyond simple efficacy measures to examine implementation outcomes, including reach, adoption, fidelity, and sustainability (Hightow-Weidman & Bauermeister, 2020). Research should assess not only whether digital HIV prevention interventions work under controlled conditions, but also whether they can be effectively deployed at scale within Hong Kong's existing health infrastructure, maintain engagement over time, and achieve equitable outcomes across diverse segments of the sex worker population (Hightow-Weidman & Bauermeister, 2020).

Only through such rigorous, comprehensive research can evidence-based digital HIV prevention services be developed and sustained for Hong Kong's indoor sex work industry.

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