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SCIENTIFIC RATIONALE FOR AN ORGANIZATIONAL AND FUNCTIONAL MODEL TO IMPROVE ANTIRETROVIRAL-BASED HIV PREVENTION IN UKRAINE

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Abstract

Background. Improving antiretroviral-based HIV prevention requires coordinated prevention and treatment services, sustained access to interventions, continuity of care, and adequate professional competencies among healthcare and social service workers.

Aim. To provide a scientific rationale for an organizational and functional model to improve antiretroviral-based HIV prevention in Ukraine.

Materials and Methods. The study combined an analytical synthesis of published evidence on pre-exposure prophylaxis (PrEP), an analysis of regulatory and organizational requirements for timely antiretroviral therapy (ART) initiation in HIV/tuberculosis coinfection, and cross-sectional surveys assessing the professional capacity of 3,478

healthcare workers and 203 social workers. Descriptive statistics, Pearson's chi-square test, Cramér's V, and structural-functional modeling were applied.

Results. Potential organizational bottlenecks affecting PrEP access and continuity were identified, taking into account changes in individual HIV acquisition risk. Five groups of potential barriers to timely ART initiation in HIV/tuberculosis coinfection were systematized. Among healthcare workers, 60.5% demonstrated an intermediate level of professional capacity, 27.2% a high level, and 12.2% a low level. Differences and shared competency gaps among healthcare and social workers highlighted the need for differentiated professional development and interprofessional collaboration. Integration of the findings informed a six-component model comprising epidemiological and analytical, clinical and preventive, organizational and referral, retention and continuity of prevention and treatment, workforce capacity, and monitoring and management components.

Conclusions. The proposed model integrates clinical, organizational, workforce-related, and managerial mechanisms for antiretroviral-based HIV prevention. Its distinguishing feature is the linkage between critical service delivery gaps, organizational interventions, monitoring indicators, and management decisions. Its effectiveness requires further evaluation in real-world implementation settings.

Keywords: HIV infection; antiretroviral-based prevention; antiretroviral therapy; pre-exposure prophylaxis; organizational and functional model.

BACKGROUND

Despite substantial advances in HIV testing, antiretroviral therapy (ART), and biomedical prevention, HIV infection remains a major public health challenge [1-3]. Achieving global targets for ending the HIV epidemic requires more than expanding the coverage of prevention and treatment interventions. It also depends on ensuring timely and equitable access, continuity of services, and responsiveness to the epidemiological characteristics and needs of different populations [4-8]. These considerations are particularly relevant to Ukraine, where the HIV epidemic is characterized by regional heterogeneity, a substantial burden among key populations, and persistent social and structural barriers to accessing HIV services [9-15].

Contemporary HIV prevention is based on a combination approach that integrates biomedical, behavioral, and structural interventions across different stages of the epidemic process [3, 5, 16, 17]. Antiretroviral-based prevention represents a central element of this approach and encompasses complementary strategies addressing both HIV transmission and

acquisition. Early initiation of ART in people living with HIV provides clinical benefits and, when sustained viral suppression is achieved, prevents sexual transmission in accordance with the Undetectable = Untransmittable (U=U) principle [18–21]. Pre-exposure prophylaxis (PrEP) reduces the risk of HIV acquisition among HIV-negative individuals at increased risk, while post-exposure prophylaxis (PEP) provides an opportunity to prevent infection following potential exposure [22-26].

The efficacy of PrEP has been established in randomized clinical trials, providing a strong evidence base for its integration into combination HIV prevention programs [23, 27-35]. Subsequent advances, including long-acting antiretroviral formulations, have expanded opportunities to tailor prevention strategies to individual risk profiles, preferences, and circumstances [36-41]. Nevertheless, the population-level impact of PrEP depends not only on pharmacological efficacy but also on timely access, appropriate use, and sustained protection during periods of increased HIV acquisition risk [42-44].

Evidence indicates that PrEP uptake and use are shaped by interacting individual, interpersonal, and organizational factors. Limited awareness, stigma, concerns about confidentiality, geographical barriers, and service delivery arrangements may hinder both PrEP initiation and subsequent engagement with prevention services [45–50]. Importantly, PrEP discontinuation does not necessarily indicate poor adherence or program failure, as individual prevention needs may change over time. Consequently, program evaluation should extend beyond initial uptake to consider the broader prevention continuum, including initiation, use, discontinuation, and reinitiation in relation to changing HIV acquisition risk [43, 44, 51-53].

Timely ART initiation and continuity of treatment are equally important to realizing the preventive benefits of antiretroviral medicines. Effective ART-based prevention depends on progression through interconnected stages of HIV diagnosis, linkage to care, treatment initiation, and sustained viral suppression [1, 3, 4, 54–56]. These organizational requirements are particularly important in HIV/tuberculosis (TB) coinfection, where timely ART initiation may be affected by diagnostic pathways, coordination between HIV and TB services, referral processes, and continuity of clinical care.

A common requirement across ART and PrEP strategies is a coordinated and person-centered service delivery pathway. International approaches increasingly emphasize differentiated service delivery, integration of healthcare and social support, decentralization, and the reduction of barriers between successive stages of prevention and treatment [4, 6, 57–60]. Their implementation also depends on the professional capacity of healthcare and social

workers, encompassing relevant knowledge and competencies, effective communication, interprofessional collaboration, and organizational support for professional practice [6, 61-63].

Although substantial evidence supports the effectiveness of individual antiretroviral interventions, their integration into coherent prevention systems remains an important organizational challenge. Addressing this challenge requires a framework that connects epidemiological needs assessment, selection of appropriate clinical and preventive strategies, service accessibility, retention and continuity of prevention and treatment, workforce capacity, and performance monitoring. An organizational and functional model may provide such a framework by linking identified service delivery gaps with targeted interventions, measurable indicators, and management decisions.

Aim of the study. To provide a scientific rationale for an organizational and functional model to improve antiretroviral-based HIV prevention in Ukraine, drawing on evidence regarding contemporary prevention strategies, organizational requirements for timely ART initiation, and the professional capacity of healthcare and social workers.

MATERIALS AND METHODS

Study design and data sources. This study employed a multi-component analytical design integrating published scientific and epidemiological evidence, a review of clinical and regulatory frameworks, cross-sectional surveys of healthcare and social workers, and structural-functional modeling.

The evidence base comprised publicly available HIV surveillance data from Ukraine, international clinical and prevention guidelines, peer-reviewed publications addressing the delivery of pre-exposure prophylaxis (PrEP), national regulatory documents governing HIV care, including services for patients with HIV/tuberculosis (TB) coinfection, and survey data on the professional capacity of workers involved in HIV service delivery.

Analysis of PrEP evidence and service delivery. A focused analytical synthesis of published studies and international recommendations was undertaken to identify biomedical, behavioral, and structural factors influencing PrEP accessibility and use. Particular attention was given to engagement of HIV-negative individuals at increased risk of HIV acquisition, individualized prevention strategies, adherence support, and the alignment of PrEP use with changing prevention needs.

The analysis distinguished between PrEP coverage, duration of use, and the maintenance of effective prevention during periods of increased HIV acquisition risk. Evidence was examined to identify potential organizational barriers and service delivery

mechanisms supporting timely access, continuity of prevention services, and PrEP reinitiation when indicated.

Regulatory and organizational analysis of ART initiation. Organizational requirements for timely ART initiation in patients with HIV/TB coinfection were examined through a comparative analysis of international clinical guidelines and Ukrainian regulatory documents.

The analysis addressed diagnostic and treatment pathways, HIV diagnosis confirmation, TB diagnostic procedures, patient referral arrangements, coordination between HIV and TB services, information exchange, continuity of clinical follow-up, and workforce-related requirements.

Potential organizational barriers were categorized according to the stages of diagnosis, treatment initiation, and subsequent care, taking into account staffing arrangements and interservice coordination. This component was based on documentary analysis rather than direct measurement of treatment delays in a patient cohort.

Assessment of professional capacity among healthcare and social workers. The empirical component consisted of two cross-sectional surveys conducted in May 2026 using voluntary, anonymous online questionnaires. The study included 3,478 healthcare workers and 203 social workers, representing 25 and 18 regions of Ukraine, respectively.

Separate questionnaires were administered to the two professional groups. They assessed HIV-related knowledge and competencies, including HIV testing, ART, PrEP, post-exposure prophylaxis (PEP), adherence support, counseling, confidentiality, and interprofessional collaboration. Additional domains included psychological well-being, access to individual, interpersonal, and organizational support resources, and participation in continuing professional development.

For healthcare workers, professional capacity was assessed using individual competency indicators and an overall score based on the proportion of correct responses. Three levels were defined: low (less than 60%), intermediate (60-80%, inclusive), and high (greater than 80%).

Comparisons between healthcare and social workers were restricted to indicators addressing comparable competencies. Because the questionnaires differed in structure and content, overall professional capacity scores were not directly compared between the two groups.

Statistical analysis. Survey findings were summarized using absolute frequencies and percentages. Differences in the proportions of correct responses between healthcare and social

workers were examined using Pearson's chi-square test. Statistical significance was defined as $p < 0.05$.

Cramér's V was used to assess the strength of associations between categorical respondent characteristics and competency indicators. Findings were interpreted with consideration of statistical significance, association strength, and the substantive comparability of the indicators.

Development of the organizational and functional model. The model was developed through an integrated synthesis of findings across four interrelated domains: epidemiological, clinical and preventive, organizational, and workforce-related.

Within each domain, factors potentially limiting access to, timely initiation of, and continuity of antiretroviral-based HIV prevention were systematically identified and organized into critical service delivery gaps.

Structural-functional modeling was then used to define the model's principal components, their respective functions, interrelationships, and implementation mechanisms. Two complementary clinical and preventive pathways were considered: ART for treatment and prevention of HIV transmission among people living with HIV, and PrEP for prevention of HIV acquisition among HIV-negative individuals at increased risk.

Organizational and workforce-related mechanisms were incorporated across both pathways to support service accessibility, coordination, and continuity.

To translate the conceptual model into an operational framework, each identified critical point was linked to a corresponding organizational intervention, monitoring indicator, and management decision. This approach informed the proposed implementation mechanisms and opportunities for adaptation to different epidemiological, organizational, and workforce conditions.

The resulting model represents an evidence-informed organizational framework. Its effectiveness was not evaluated through implementation or field testing at this stage.

Ethical considerations. Participation in the surveys was voluntary and anonymous, with confidentiality maintained throughout data collection and analysis. The ethical aspects of the study and the use of its findings for scientific publication were reviewed by the Ethics Committee of the First European University (Protocol No. 1, November 2, 2026).

RESULTS

The integrated analysis identified critical points in antiretroviral-based HIV prevention related to PrEP accessibility and continuity, organizational requirements for timely ART initiation, professional capacity among healthcare and social workers, and the resources

supporting their work. These findings provided the basis for defining the structural components and operational mechanisms of the proposed organizational and functional model.

Organizational determinants of PrEP access and continuity. The synthesis of published research and international recommendations identified several interrelated factors influencing PrEP access and use among HIV-negative individuals at increased risk of HIV acquisition. Beyond the availability of antiretroviral medicines, effective prevention requires timely engagement, individualized service delivery, appropriate follow-up, and alignment of PrEP use with changing prevention needs.

An important distinction emerged between PrEP coverage and continuity of use. While program enrollment reflects access to prevention services, the duration of PrEP use alone does not establish whether protection was maintained during periods of increased HIV acquisition risk. Discontinuation may reflect a reduction in individual risk or the end of a period requiring prophylaxis rather than inadequate adherence.

Accordingly, the assessment of PrEP continuity should consider the reasons for discontinuation, opportunities for reinitiation, and the maintenance of preventive protection during periods of increased risk.

The analysis identified four potential organizational bottlenecks: insufficient identification of individuals who could benefit from PrEP, barriers between HIV testing and PrEP initiation, limited availability of individualized follow-up, and gaps in continuity of prevention services. Corresponding improvement mechanisms include differentiated approaches to engagement, person-centered counseling, coordinated healthcare and social support, continuity monitoring, and accessible pathways for PrEP reinitiation.

Organizational requirements for timely ART initiation in HIV/TB coinfection. The regulatory and organizational analysis identified five interrelated categories of potential barriers to timely ART initiation among patients with HIV/TB coinfection: HIV diagnosis, TB diagnosis, treatment initiation, continuity of clinical follow-up, and workforce capacity.

At the HIV diagnostic stage, additional referral requirements for diagnosis confirmation may contribute to delays. During TB diagnosis, insufficient coordination of diagnostic procedures and specialized services may create further organizational obstacles. Timely ART initiation requires coordinated action between HIV and TB services in accordance with clinical indications, while subsequent care depends on effective information exchange and continuity of treatment.

Workforce-related barriers constitute a separate category, reflecting the need for professional capacity in applying current clinical algorithms and coordinating care across services.

The analysis identified corresponding organizational mechanisms: expanding HIV testing opportunities at points of care, improving access to rapid molecular TB diagnostics, coordinating ART initiation with TB treatment in accordance with clinical guidelines, strengthening continuity of follow-up, and providing targeted professional development.

These findings indicate that potential delays may arise at transitions between diagnostic and treatment stages. Their systematic identification supports the organizational integration of HIV and TB services as a strategy for improving timely access to care. As these barriers were derived from regulatory and organizational analysis, their actual contribution to treatment delays was not directly measured.

Professional capacity of healthcare and social workers. Assessment of healthcare workers revealed substantial variation in HIV-related knowledge and competencies. Based on the overall professional capacity score, 60.5% of respondents were classified at the intermediate level, 27.2% at the high level, and 12.2% at the low level. Correct response rates were below 60% for 13 of the 41 competency indicators (31.7%).

The most pronounced knowledge gaps concerned factors contributing to inadequate ART adherence (14.6%), recommended intervals for routine monitoring of ART effectiveness (20.0%), indications for provider-initiated HIV testing (40.0%), identification of key populations (43.6%), and eligibility for event-driven PrEP (49.9%). Higher correct response rates were observed for knowledge of oral PrEP medications (87.3%), appropriate actions in cases of inadequate ART adherence (82.9%), and management of occupational exposure to HIV (91.9%).

The type of healthcare workers' involvement in HIV service delivery showed its strongest association with knowledge of the HIV diagnosis confirmation and ART initiation algorithm (Cramér's $V = 0.346$). Associations with most other competency indicators were very weak or negligible.

Comparative analysis of healthcare and social workers, restricted to indicators with comparable content, identified statistically significant differences in several professional competencies alongside shared knowledge gaps.

The need for an individualized approach to ART adherence support was correctly identified by 92.6% of social workers and 82.9% of healthcare workers ($p < 0.001$). However, only 23.2% and 14.6%, respectively, identified the complete set of factors negatively

affecting adherence ($p < 0.001$). Eligibility for event-driven PrEP was correctly identified by 44.3% of social workers and 49.9% of healthcare workers, with no statistically significant difference between the groups ($p = 0.122$).

Differences were also observed in communication-related knowledge. Compared with healthcare workers, social workers demonstrated higher correct response rates for communicating difficult information (89.7% vs. 67.5%; $p < 0.001$), active listening (84.7% vs. 67.5%; $p < 0.001$), shared decision-making (72.9% vs. 62.4%; $p = 0.003$), and motivational counseling (64.0% vs. 56.5%; $p = 0.036$).

Knowledge of confidentiality principles was demonstrated by 61.6% of social workers and 50.1% of healthcare workers ($p = 0.002$). Despite the between-group difference, these findings indicate a need to strengthen confidentiality-related competencies in both professional groups.

Among social workers, high correct response rates for counseling on ART and PrEP (99.5%) and comprehensive prevention in HIV-serodifferent couples (99.5%) contrasted with lower rates for identifying the full set of recommendations associated with the U=U principle (63.1%) and recognizing risks related to voluntary partner notification (52.2%).

Respondents identified fear of stigma, potential disclosure of HIV status, limited perception of HIV risk, logistical difficulties, and insufficient support resources as major barriers to partner engagement in HIV testing.

The assessment of psychological well-being and professional support resources revealed additional differences between healthcare and social workers. Persistent psychological strain was reported by 27.1% of healthcare workers and 17.2% of social workers ($p = 0.002$). Managerial support was reported by 41.2% and 67.5%, respectively ($p < 0.001$), while access to shelters or safe working conditions was reported by 32.8% and 41.4% ($p = 0.011$).

Participation in formal continuing professional development activities was higher among healthcare workers than social workers (92.2% vs. 77.0%; $p < 0.001$).

Taken together, the findings demonstrate differences in the functional profiles of healthcare and social workers, alongside complementary competencies and shared professional development needs. Gaps in HIV prevention knowledge, adherence support, individualized counseling, and confidentiality, together with differences in access to professional support resources, provide an empirical rationale for combining differentiated continuing professional development, organizational support, and stronger interprofessional collaboration within the workforce capacity component of the proposed model.

Integrated development of the organizational and functional model. Integration of the study findings enabled the identification of critical points across the antiretroviral-based HIV prevention continuum, including assessment of prevention needs, access to interventions, timely initiation, and continued engagement with prevention and treatment services.

The synthesis of published PrEP evidence highlighted the importance of tailoring prevention to periods of HIV acquisition risk. The regulatory and organizational analysis of ART initiation in HIV/TB coinfection emphasized the need for coordinated referral pathways and integration between specialized services. Findings from the workforce surveys demonstrated the importance of differentiated competency development, organizational support, and complementary professional roles.

On this basis, a six-component organizational and functional model was developed (Figure 1).

The epidemiological and analytical component is intended to identify prevention needs and establish implementation priorities according to epidemiological, demographic, and geographical characteristics.

The clinical and preventive component encompasses ART, PrEP, and PEP, selected according to clinical indications, HIV status, and individual HIV acquisition risk.

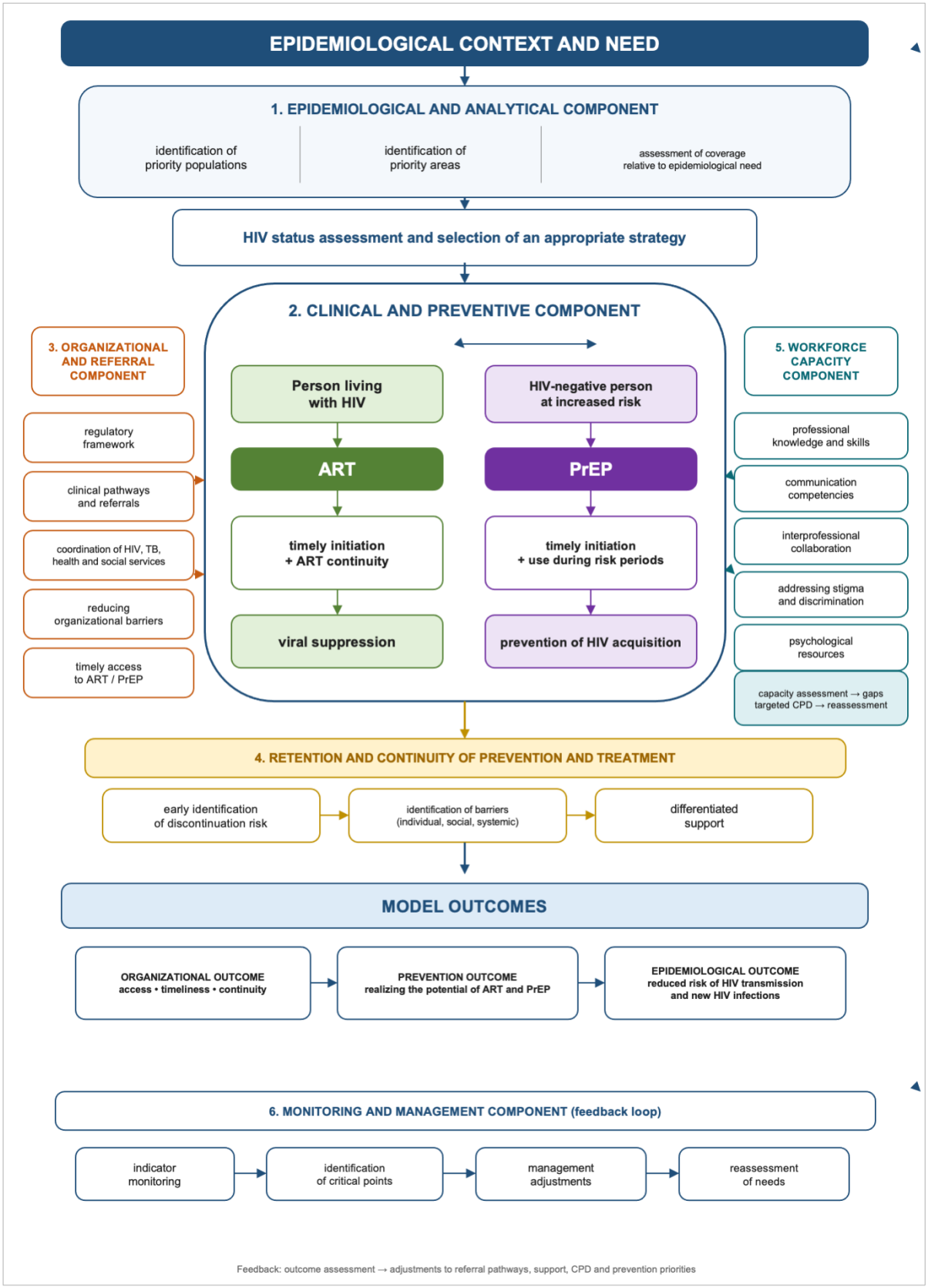
The organizational and referral component coordinates successive stages of diagnosis, prevention, treatment, and social support, with particular attention to transitions between services.

The retention and continuity component provides differentiated support for recipients of prevention and treatment services, taking into account the risk of interruption and changes in individual needs.

The workforce capacity component integrates assessment of professional capacity, targeted competency development, interprofessional collaboration, and organizational resources supporting professional practice.

The monitoring and management component establishes mechanisms for assessing prevention processes and outcomes, identifying critical service delivery gaps, and adjusting organizational interventions.

For each component, implementation mechanisms, key monitoring indicators, and corresponding management actions were defined (Table 1).



Note: ART, antiretroviral therapy; PrEP, pre-exposure prophylaxis; CPD, continuing professional development.

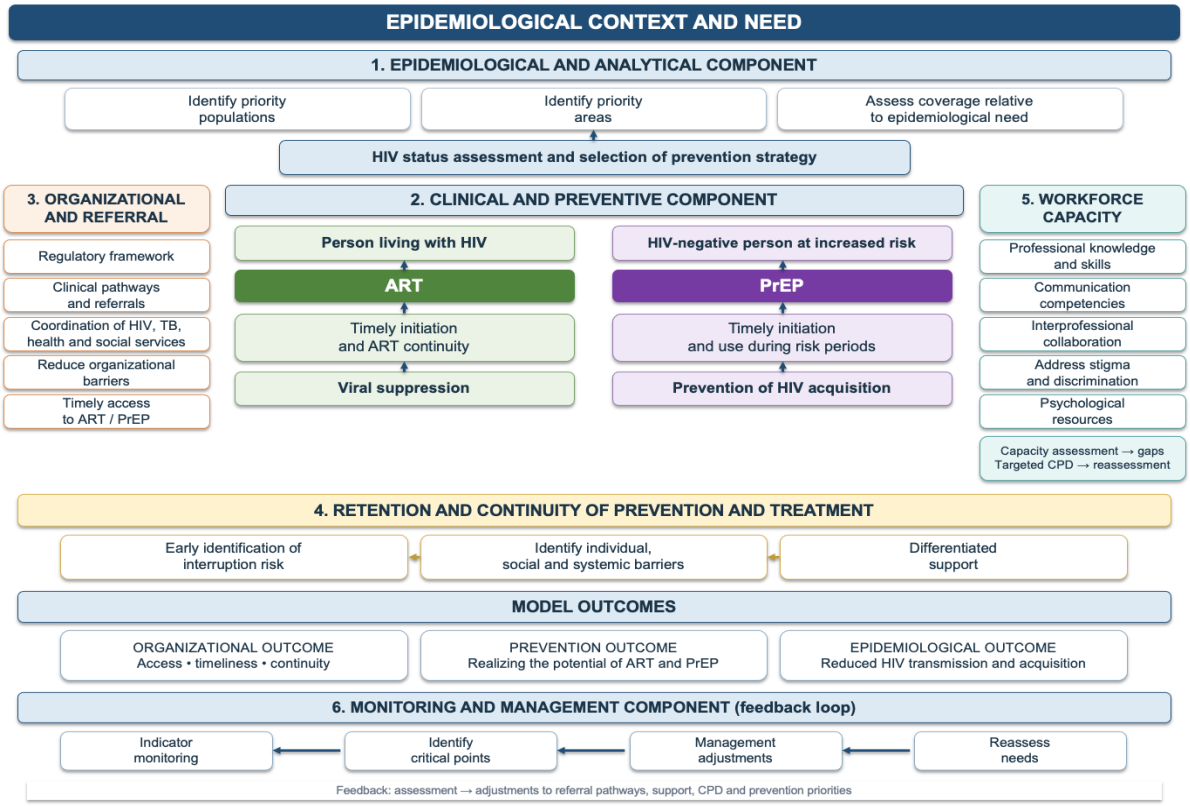


Figure 1. Organizational and functional model to improve antiretroviral-based HIV prevention in Ukraine

Table 1. Operational mechanisms of the organizational and functional model for antiretroviral-based HIV prevention

Model component	**Operational mechanism**	**Key indicator**	**Management action**
Epidemiological and analytical	Assessment of epidemiological needs and prevention coverage	Alignment of coverage with identified needs	Allocation of resources according to needs
Clinical and preventive	Differentiated ART and PrEP pathways	Timeliness of ART initiation and engagement in PrEP	Optimization of access to prevention services
Organizational and referral	Coordinated referral pathways and service integration	Delays between service delivery stages	Removal of organizational barriers
Retention and continuity of prevention and treatment	Identification of interruption risks and individualized follow-up	ART continuity and alignment of PrEP use with periods of risk	Differentiated support for service recipients
Workforce capacity	Assessment of professional capacity and targeted continuing professional development	Identified competency gaps	Adjustment of professional development programs
Monitoring and management	Systematic monitoring of performance indicators	Trends in key indicators	Adjustment of prevention service organization

The functional integration of these components is intended to align prevention needs assessment, access to appropriate interventions, and their use according to clinical indications and changing individual risk.

A fundamental distinction is maintained between ART and PrEP. Continuity of ART is necessary to sustain viral suppression, whereas the duration of PrEP use should correspond to periods of increased HIV acquisition risk. Monitoring the proposed indicators provides a basis for identifying critical points and adapting management decisions to epidemiological, organizational, and workforce conditions.

The proposed model integrates clinical and preventive, organizational, workforce-related, and management mechanisms within a unified framework for antiretroviral-based HIV prevention. Its practical effectiveness remains to be evaluated through implementation in real-world service delivery settings.

DISCUSSION

The findings of this study suggest that improving antiretroviral-based HIV prevention requires more than expanding access to effective medicines. Equally important is the coordination of prevention and treatment services across the continuum of care. This perspective is consistent with the principles of combination HIV prevention, which integrate biomedical, behavioral, and structural interventions according to population needs. Godfrey-Faussett et al. (2022) emphasized the importance of person-centered approaches to combination prevention, while Bulstra et al. (2021) highlighted the value of integrating HIV services with other areas of healthcare [57, 64]. Our findings extend this perspective by identifying accessibility, timely initiation, and continuity as interconnected organizational priorities rather than separate service delivery objectives.

An important implication for PrEP programs is the need to distinguish between initial uptake, duration of use, and effective prevention during periods of increased HIV acquisition risk. In their systematic review and meta-analysis, Zhang et al. (2022) examined PrEP discontinuation, suboptimal adherence, and reinitiation, demonstrating the importance of considering these processes together [43]. Similarly, Kiggundu et al. (2024) highlighted re-engagement in PrEP services as an important aspect of prevention delivery [52]. These findings support a more differentiated interpretation of PrEP discontinuation: stopping PrEP may be appropriate when HIV acquisition risk declines, whereas interruptions during periods of increased risk may compromise protection. Consequently, prevention programs should monitor changing risk, identify reasons for discontinuation, and facilitate timely PrEP reinitiation when needed.

The organizational requirements for ART differ from those of PrEP because sustained treatment is essential for maintaining viral suppression. These requirements are particularly relevant to HIV/TB coinfection, where timely ART initiation depends on coordinated diagnostic pathways, patient referral, and collaboration between specialized services. Kadia et al. (2021) identified individual and organizational factors influencing engagement in ART within integrated HIV/TB treatment programs [65]. Our regulatory and organizational analysis complements this evidence by identifying potential critical points at transitions between diagnosis and treatment. However, these findings should be interpreted as organizational risks identified through documentary analysis rather than empirically demonstrated causes of treatment delay.

Another important finding concerns variation in the professional capacity of healthcare and social workers involved in HIV service delivery. Knowledge gaps related to ART adherence, specific aspects of PrEP, confidentiality, and communication indicate opportunities for targeted professional development. These observations are consistent with international evidence on workforce competencies in biomedical HIV prevention. Habtie et al. (2025) synthesized evidence on healthcare workers' knowledge, attitudes, and practices concerning PrEP, while Mendez-Lopez et al. (2025) examined healthcare workers' knowledge of biomedical HIV prevention across Europe and Central Asia [66, 67]. Our study adds context-specific evidence from Ukraine by identifying particular competency gaps and professional development needs relevant to the workforce component of the proposed model.

Differences between healthcare and social workers should not be interpreted as indicating the overall superiority of either professional group. Rather, they reflect complementary responsibilities within HIV prevention and care. Healthcare workers provide clinical assessment, prescribe and monitor antiretroviral interventions, and manage treatment-related decisions. Social workers contribute to counseling, adherence support, addressing barriers to access, and maintaining engagement with services. The importance of these complementary functions is consistent with the systematic review by Adaranijo et al. (2025), which examined the contribution of social workers to addressing social determinants of health [68]. In our study, differences in selected communication and interprofessional indicators reinforce the need for coordinated professional roles and shared competency development to support continuity across HIV services.

Workforce capacity must also be considered in the context of the ongoing war in Ukraine. Lazarus et al. (2024) documented the importance of adaptive responses by community-based organizations in maintaining HIV prevention and treatment services during

wartime [69]. Barsukova et al. (2024) examined the effects of the war on HIV services and healthcare workers in eastern Ukraine, while Sydorenko et al. (2025) addressed psychosocial challenges and the need for managerial support among healthcare professionals [70, 71]. Our findings concerning psychological strain and access to professional support resources are consistent with these broader challenges. They suggest that workforce development strategies should combine competency-based education with organizational support and stronger interprofessional collaboration.

The principal contribution of the proposed organizational and functional model lies in bringing clinical, organizational, workforce-related, and management mechanisms into a coherent framework for antiretroviral-based HIV prevention. The model connects epidemiological needs assessment with access to appropriate interventions, timely initiation, and retention and continuity of prevention and treatment, while recognizing the distinct requirements of ART and PrEP. Its operational structure links identified critical points to targeted organizational interventions, monitoring indicators, and management decisions. This approach is consistent with the work of Vanhamel et al. (2023) on monitoring indicators for PrEP programs and with broader approaches to evaluating the implementation and sustainability of prevention services [72, 73].

From a practical perspective, the model offers a framework for adapting prevention services to epidemiological needs, organizational conditions, and the characteristics of service recipients. Its proposed mechanisms may inform differentiated service delivery, resource allocation, workforce development, and monitoring practices. However, their application will require adaptation to regional circumstances, available resources, and existing healthcare and social service arrangements. The model's effectiveness should therefore be assessed using the proposed indicators during future implementation.

Several limitations should be acknowledged. First, the organizational analysis of PrEP was based on published evidence rather than a separate empirical assessment of PrEP programs within this study. Second, potential barriers to timely ART initiation in HIV/TB coinfection were identified through regulatory and organizational analysis and were not verified through patient-level measurements of treatment delays. Third, the workforce surveys primarily assessed knowledge and self-reported experiences rather than directly observed professional performance. Differences in the structure and content of the questionnaires also precluded direct comparison of overall professional capacity scores between healthcare and social workers. Finally, the proposed model has not yet undergone field testing, and its effectiveness and feasibility require evaluation under real-world service delivery conditions.

Conclusions

1. The integrated analysis identified critical organizational challenges in antiretroviral-based HIV prevention in Ukraine, including barriers to PrEP accessibility and continuity, potential delays in ART initiation among patients with HIV/TB coinfection, and gaps in the professional capacity of healthcare and social workers. These findings demonstrate the need for coordinated approaches linking clinical interventions, service delivery, and workforce development.

2. Effective antiretroviral-based HIV prevention requires differentiated approaches to continuity. Sustained ART is essential for maintaining viral suppression and preventing HIV transmission, whereas PrEP use should be aligned with periods of increased HIV acquisition risk, with opportunities for timely reinitiation. Organizational mechanisms should therefore address the distinct requirements of prevention and treatment pathways.

3. The assessment of professional capacity revealed both differences and shared competency gaps among healthcare and social workers. These findings support targeted continuing professional development, stronger interprofessional collaboration, and organizational measures to sustain workforce capacity and improve the coordination of HIV prevention and treatment services.

4. A six-component organizational and functional model was scientifically substantiated, integrating epidemiological and analytical, clinical and preventive, organizational and referral, retention and continuity of prevention and treatment, workforce capacity, and monitoring and management components. The model establishes a structured relationship between critical service delivery gaps, organizational interventions, monitoring indicators, and management decisions. Its feasibility and effectiveness require further evaluation in real-world implementation settings.

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