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# IMPROVEMENT OF THE HEALTH SERVICES FOR THE PREVENTION OF HIV TRANSMISSION FROM MOTHER TO CHILD AT THE LEVEL OF PRIMARY HEALTH CARE

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## ABSTRACT

**The aim:** To analyze the problems of PMTCT of HIV and to clarify the ways for their solving through the increasing their obstetrical and gynecological services at the primary health care level.

**Materials and methods:** Bibliosemantic, statistical and method of structural and logical analysis. The research materials are the data of the statistical reports for the period 2016-2020.

**Conclusions:** The analysis of the problems of PMTCT for HIV demonstrated that in Ukraine there is insufficient availability of pregnant women for HIV testing, the excessive duration of the existing algorithm for testing pregnant women for HIV, the imperfect system of referrals of pregnant women for timely diagnosis, as a result, late and therefore less effective the prophylactic antiretroviral therapy (ART), defects in the effectiveness of standardization of health care for the prevention of mother-to-child transmission (PMTCT) of HIV with the participation of primary healthcare specialists, the main representative of which is a general practitioner – family medicine (GP-FD).

**KEY WORDS:** prevention of HIV transmission from mother to child, HIV infection, pregnant woman, newborn

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## INTRODUCTION

The article deals with the relevance of perinatal HIV infection as a solution of its problematic components. In particular, in Ukraine there is an insufficient availability for pregnant women for HIV testing, the excessive duration of the existing algorithm for testing of pregnant women for HIV, the imperfect system of referrals of pregnant women for timely diagnosis, as a result, the late and therefore less effective prophylactic antiretroviral therapy (ART), defects in the effectiveness of standardization of health care for the prevention of mother-to-child transmission (PMTCT) of HIV with the participation of primary healthcare specialists, the main representative of which is a general practitioner – family doctor (GP-FD). The article focuses on the increasing the functions of a family doctor in the organization of obstetric and gynecological services to carry out the prevention of perinatal HIV infection, in particular, testing pregnant women for HIV as early as possible using available methods. The early detection of HIV in pregnant women will lead to earlier starting of antiretroviral therapy (ART), which is much more effective for PMTCT. Such approaches, according to scientists, will bring the achievement of elimination of mother-to-child transmission of HIV according to the WHO Initiative 2014, in which the Global

Community committed the elimination of mother-to-child transmission of HIV by 2030 as one of the priorities of the public health system [1].

The problem of human immunodeficiency virus (HIV) infection remains relevant in the society for more than 30 years, the scale of HIV spread has acquired a global aspect and is a real threat to the social and economic developments of the most countries in the world. The epidemic of HIV is one of the most severe among the countries of the Eastern Europe. According to the definition of the World Health Organization (WHO), the results of HIV testing in pregnant women are the proxy indicator of the pathogen spread among the general population [2].

In 2020, the average national indicator of the HIV infection among pregnant women was 0.67 %, according to the results of primary testing, a decrease in HIV infection level among pregnant women was determined from 0.32 % in 2016 to 0.21 % in 2020. The rate of mother-to-child transmission (MTCT) of HIV, based on early diagnosis of HIV infection in newborns, decreased from 2.6 % in 2016 to 1.3 % in 2020. However, according to the results of the cohort analysis in 2020, which is being conducted rate of MTCT in the cohort of children born from HIV-positive women in 2018 was 3.0 %, which is the criterion for not

fully achievement of the level for the elimination of mother-to-child transmission (EMTCT) of HIV in accordance with the WHO Initiative 2014. According to the international recommendations, the achievement of EMTCT validation is based on ensuring universal access to prophylactic, diagnostic and therapeutic measures to prevent perinatal transmission of HIV [1].

Among the main problems of PMTCT of HIV in Ukraine there are an insufficient level of the initiation of antiretroviral prophylaxis (12 %) on the background of the high rate of early registration of pregnant women for the antenatal care (87 %). This can be due, in particular, to the problems with the primary testing of the pregnant women for HIV and the algorithm of informing of pregnant women with the results and the delay of the decision to start ART. Therefore, the availability and the good organization of algorithm of HIV diagnosis in pregnant women is relevant and need to be improved in Ukraine.

## THE AIM

The aim of the study is to analyze the problems of PMTCT of HIV and to clarify the ways for their solving through the increasing their obstetrical and gynecological services at the primary health care level.

## MATERIALS AND METHODS

Such research methods were used: bibliosemantic, statistical and method of structural and logical analysis. The research materials are the data of the statistical reports for the period 2016-2020.

## REVIEW

The analysis based on the statistics data for the period 2016-2020 indicated a high level of rate of mother-to-child transmission of HIV. Thus, the indicator of the MTCT rate of HIV on the background of a decrease remains high and in 2021, according to the results of a cohort analysis, is amounted 2.6 %, which requires increasing the availability of pregnant women to HIV testing through the use of rapid double tests by the family doctor during the first visit on antenatal care.

The problem of perinatal HIV infection in Ukraine is an actual one because of the high index of MTCT rate. During the last years based of the results of polymerase chain reaction (PCR) the implementation of PMTCT measures lead to decrease of MTCT rate of HIV to 2.6 % (2016), 2.2 % (2017), 2.0 % (2018), and 1.6 % (2019), 1.3 % (2020). However, despite of the high coverage of the pregnant women with HIV testing (more than 97 % since 2003), antiretroviral therapy (more than 95 % since 2007), prolongation of ART after childbirth (98 % of women), use of antiretroviral prevention by children which were born from the HIV-positive women (98 %) and artificial feeding of such newborns (99 %), the final index of MTCT rate (at the age of 18 months of the child) in 2020 is high and

amounts to 3.0 % [3, 4]. In 2021 (tab. 1) 98.73 % of pregnant women were examined for HIV, HIV infection was diagnosed in 0.52 %, and the incidence of HIV infection in newborns was 28.7 % [5].

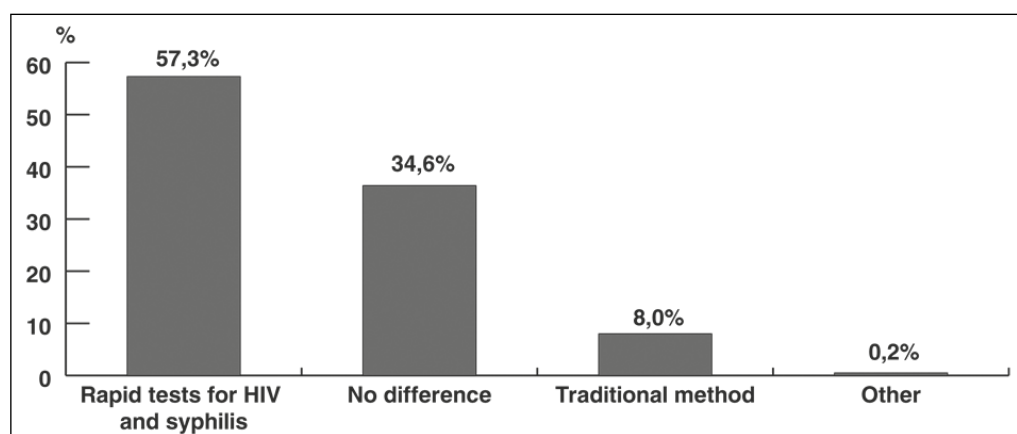
According to the general conclusions of WHO, the awareness of the staff of the antenatal health services about HIV status, which was not determined previously or was hidden by a woman from the medical staff, is a necessary condition for the decreasing of MTCT rate of HIV to the level less than 1 %. In addition, it is an important moment to start treatment and provide health care to HIV-positive pregnant women and their children. The aim of the antenatal screening for HIV is the detection of all HIV-positive pregnant women as early as possible for providing the measures for PMTCT and to minimize the risk of transmission of the virus to the child during pregnancy, childbirth and postpartum period [6, 7], namely, the early diagnosis of HIV infection is provided by the optimal time for this – the first trimester of pregnancy [8].

Today, with a much higher level of effectiveness, WHO recommends rapid testing for HIV with simultaneous rapid testing for syphilis as two perinatal infections (HIV/syphilis) as the first test in the strategy and algorithm of HIV testing during pregnancy monitoring. The use of dual rapid tests for the simultaneous diagnosis of HIV and syphilis provides an opportunity to immediately reduce the difference between the coverage of HIV and syphilis testing among pregnant women in order to eliminate adverse consequences. The use of dual tests allows to test for both infections with a single finger prick. The results are ready quickly, it allows women to start treatment in time.

It was determined that in both high- and low HIV epidemic countries the dual testing for HIV/syphilis allows to save the costs for congenital syphilis prevention and has no negative influence on HIV testing coverage, helps to reduce the storage and transporting costs of the samples. According to the results of many researches the dual HIV/syphilis tests have a sensitivity more than 99 % and a specificity of 100 %, the treponema component has a sensitivity more than 90 % and a specificity more than 96 % [9].

In Ukraine, the analysis of the effectiveness of the dual rapid tests for express testing for HIV and syphilis in female dispensaries and obstetrical hospitals as a pilot project was carried out with our participation.

The study of the feasibility of implementation in Ukraine the use of the dual rapid (express) tests for HIV and syphilis diagnosis in the ambulance obstetrical health care institutions was provided because of the constant different rate between the coverage of testing for HIV and syphilis among pregnant women (in 2020 – 99.1 % and 92.3 %, respectively). However, over the last 10 years 40 000 new cases of syphilis have been registered in the country. The majority of patients were diagnosed late and unspecified forms of syphilis, the frequency of such patients increased from 70 % in 2010 to 85 % in 2020; the 4th generation test systems (Ag+Ab) are used for the screening for HIV in the pregnant women in the country in accordance with the order No 794 of the Ministry of Health of Ukraine dated



**Fig. 1.** The distribution of the participants' answers to the question "By which method would you like to be tested in the future – traditional laboratory method (blood from the vein) or rapid test?"

**Table I.** HIV screening of pregnant women and newborns in Ukraine, 2021 year

Indicator	Number of persons who were examined for HIV									
	The total number		Including twins		Persons with positive HIV-status		Number of persons who had childbirth			
							Ill newborns		Healthy newborns	
	abs. number	per 100 pregnant women	abs. number	per 100 pregnant women	abs. number	per 100 pregnant women	abs. number	per 100 pregnant women with HIV+status	abs. number	per 100 pregnant women with HIV+status
Ukraine	247020	98.73	239099	95.56	1292	0.52	371	28.72	647	50.08

**Table II.** The detection of HIV infection and syphilis based on the testing with instrumental method

Pathogen	Number of negative results	Number of positive results	Detected, %	95% CI
HIV (n=1496)	1493	3	0.2	0.04 – 0.58
Syphilis (n=1488)	1485	3	0.2	0.04 – 0.59

**Table III.** Evaluation of the effectiveness of HIV testing with the use of rapid tests for HIV/syphilis

Accuracy of tests results with the use of rapid tests for HIV/syphilis	Reference result (true HIV status)		Total
	Positive	Negative	
Positive	3 (a – true positive)	0 (b - false positive)	3
Negative	0 (c – false negative)	1493 (d – true negative)	1493
Total	3	1493	1496

Notes: Sensitivity =  $a/(a+c) = 3 / (3 + 0) * 100 = 100\%$  (95% CI 0.292- 1.00)

Specificity =  $d/(b+d) = 1493 / (0 + 1493) * 100 = 100\%$  (95% CI 0.998 – 1.00)

PPV =  $a/(a+b) = 3 / (3 + 0) * 100 = 100\%$  (95% CI 0.292 – 1.00)

NPV =  $d/(c+d) = 1493 / (0 + 1493) * 100 = 100\%$  (95% CI 0.998 – 1.00)

**Table IV.** Evaluation of the effectiveness of syphilis testing with the use of rapid tests for HIV/syphilis

Accuracy of tests results with the use of rapid tests for HIV/syphilis	Reference result (true syphilis status)		Total
	Positive	Positive	
Positive	2 (a – true positive)	1 (b - false positive)	3
Negative	1 (c – false negative)	1484 (d – true negative)	1485
Total	3	1485	1488

Notes: Sensitivity =  $a / (a+c) = 2 / (2 + 1) * 100 = 66.7\%$  (95% CI 0.094 – 0.992)

Specificity =  $d / (b+d) = 1484 / (1 + 1484) * 100 = 99.9\%$  (95% CI 0.996 – 1.00)

PPV =  $a / (a+b) = 2 / (2 + 1) * 100 = 66.7\%$  (95% CI 0.094 – 0.992)

NPV =  $d / (c+d) = 1484 / (1 + 1484) * 100 = 99.9\%$  (95% CI 0.996 – 1.00)

05.04.2019 which makes impossible to standardize the use of dual rapid tests for HIV and syphilis during the first visit of the pregnant women for the pregnancy monitoring according the WHO recommendations.

According to the Project program, the medical specialists had a one-day training how to use rapid tests, explained in detail to pregnant women about the rapid testing and its benefits, and the majority of pregnant women (57 %) after screening testing with rapid tests for HIV and syphilis indicated the comfort of the method. And only 8 % of the women preferred the routine method of laboratory examination (Fig. 1).

The specialists determined that rapid tests are easy to use, as well as a reduction of the time and number of the necessary examinations in the cases with negative results.

The performance indicators of the screening test for HIV and syphilis with the use of the rapid dual tests for HIV/syphilis and the routing testing with instrumental method (IM) were calculated among women who were tested both with IM and rapid tests: HIV – 1496 women, syphilis – 1488 women. The final result is considered with the IM use.

The prevalence rates were: HIV – 0.2 % (95 % CI 0.04 – 0.58) and syphilis 0.2% (95 % CI 0.04 – 0.59 (Table II).

The indicators of the sensitivity, specificity and significance of the positive and negative predictive values (PPV and NPV, respectively) of the screening testing results with rapid tests for HIV/syphilis are presented in tab. III for HIV and tab. IV for syphilis.

Thus, the corresponding indicators of screening testing for HIV with the use of rapid tests for HIV/syphilis were: sensitivity – 100 % (95 % CI 0.292-1.00), specificity – 100 % (95 % CI 0.998 – 1.00), PPV – 100 % (95 % CI 0.292 – 1.00) and NPV – 100 % (95 % CI 0.998 – 1.00).

Thus, the corresponding indicators of screening testing for syphilis with the use of rapid tests for HIV/syphilis were: sensitivity – 66.7 % (95 % CI 0.094 – 0.992), specificity – 99.9 % (95 % CI 0.996 – 1.00), PPV – 66.7 % (95 % CI 0.094 – 0.992), NPV – 99.9 % (95 % CI 0.996 – 1.00) (table IV).

Thus, the obtained results of the study allow to use the rapid tests for HIV/syphilis for the diagnosis of these diseases by the doctor during the first visit of the pregnant women and pregnancy monitoring, in particular, by a family doctor. The use of the rapid tests for HIV/syphilis improves the availability of pregnant women to high-quality examination, which lead to effective screening of pregnant women for these infections and prescribe the treatment in more early terms of pregnancy, this approach decreases the rate of perinatal infection, in particular, HIV-infection.

WHO recommended the screening for all pregnant women for HIV and syphilis during the first antenatal visit which is provided almost in all countries in the world. WHO has published new recommendations to help countries to reach coverage for testing of 8.1 million people with non-diagnosed HIV infection and persons who do not have an access to life-saving treatment. HIV testing is very important for early diagnosis and early treatment. Quality HIV testing services also involves to provide the effective services for HIV-negative patients for prevention facilities

as a primary health care services by a family doctor as a doctor of the first visit of the pregnant woman during pregnancy monitoring. This will help to reduce the number of new HIV-infected individuals, which is amounted 1.7 million persons per years worldwide. In particular, the use of combined express-tests for HIV/syphilis as the first test for HIV during antenatal care can help the countries to eliminate the mother-to-child transmission of these infections. This can help to reduce the defects in the diagnosis and treatment and to stop the second leading cause of the reason of stillbirth in the world [10].

Although the HIV-testing should be voluntary, it is clear that the standardization of HIV-testing as an important part of prenatal care and health care of medical services of HIV-infected women, has a significant meaning for the improvement the assess for health care [3]. HIV-positive pregnant women must have an assess to professional antenatal care during pregnancy and the use of effective medical technologies of PMTCT.

Taking into account the need to standardize the health care for the prevention of mother-to-child transmission of HIV, Medical Care Standards “Prevention of Mother-to-Child HIV Transmission”, which standardizes HIV screening with dual rapid tests, namely, rapid tests for HIV/syphilis, were developed in Ukraine [11]. The standards provide global approaches to PMTCT that HIV-positive pregnant women should have an access to high-quality prenatal medical care during pregnancy monitoring and to the use of effective PMTCT medical technologies. The most important component of the prevention of vertical transmission of HIV is to ensure the involvement of women in health care, that involves the use of medical interventions based on a multidisciplinary approach and the provision of complex complete support that prevents the transmission of HIV from mother to child.

Early diagnosis of HIV infection in pregnant women will help to prevent the transmission of HIV from mother to child. Unified and standardized algorithms of HIV testing services for pregnant women will contribute to expanding access to HIV testing by medical institutions and increasing the coverage of pregnant women with such services. All pregnant women are tested for HIV during their first antenatal care visit (screening). HIV testing with a rapid test as a screening for the simultaneous detection of serological markers of HIV and syphilis are performed.

In the case of the negative result of the second HIV test in pregnant women with high risk for HIV infection, namely, a woman from a serological discordant couple (HIV-negative pregnant woman, HIV-positive partner); persons who inject drugs; a woman who has a new sexual partner with unknown HIV-status; a woman with sexually transmitted infections is tested for the third time to identify the serological markers of HIV in 32-36 weeks of pregnancy or during childbirth by instrumental methods or rapid (express) tests.

Pregnant women with unknown HIV-status or who are HIV-negative from serological discordant couple, if the HIV-positive partner is not virologically suppressed and/or

does not receive ART, the HIV-testing is performed during the third trimester of pregnancy. If HIV is diagnosed, ART is prescribed to pregnant woman for HIV treatment and prevention of the vertical HIV transmission.

## DISCUSSION

Thus, the standardization of PMTCT for HIV according to world best practices will contribute to overcoming the spread of HIV infection among the general population as well. According to the estimated data of the Joint Program of the United Nations Organization on HIV/AIDS (UNAIDS), the total number of people with HIV in the world at the beginning of 2020 reached 38.0 million people, of which – 36.2 million adults and 1.8 million children under 15 years of age. 73 % of women, 85 % of pregnant women with HIV and 53 % of children living with HIV have access to ART. PMTCT interventions have contributed to the prevention of 1.6 million new cases of HIV infection among children since 2000 [16-18].

The region of Eastern Europe and Central Asia (EECA), to which Ukraine belongs, is one of the three regions in the world where the HIV epidemic continues to grow. The increase in cases of HIV infection by sexual transmission and the active involvement of women of childbearing age in the epidemic process are a serious risk for perinatal HIV infection in EECA [18, 19].

According to the WHO definition, the results of HIV testing of pregnant women are a proxy indicator of the spread of the pathogen among the general population. In the conditions of the concentrated stage of the epidemic, the spread of HIV among pregnant women from 1.0 % and above is considered high and indicates a tendency towards the generalization of the epidemic [18, 20].

The PMTCT program has become one of the most successful programs to counter the HIV epidemic in Ukraine due to the coverage of pregnant women with HIV testing at the level 97 %, antiretroviral treatment – more than 95 %, prolongation of ART after childbirth – in 98 % cases, antiretroviral prophylaxis – 98 %, and the organization of artificial feeding of children born from the HIV-positive women – 99 % [21, 22]. The principles of the four-pronged strategy for PMTCT and reducing child mortality, proposed by WHO/UNICEF/Population Fund in 2001, are still relevant today. The widespread implementation of the PMTCT program on a global scale has proven that this is facilitated by: i) primary prevention of HIV infection; ii) the prevention of unwanted pregnancies among women living with HIV; iii) the access to testing, counseling, ART, safe birth practices and appropriate newborn feeding practices and iv) in the case of the birth of a child who inherited the virus, providing care and support to HIV-positive mothers, their children and their families [21, 23].

The screening of all pregnant women for HIV and syphilis at the first prenatal visit, recommended by WHO, is carried out in almost all countries of the world. The use of tests for the simultaneous diagnosis of HIV and syphilis makes possible to immediately close the gap between HIV

and syphilis testing coverage among pregnant women in order to eliminate adverse consequences. Using double tests makes possible to test for both infections with one finger prick. The results are ready quickly, which allows women to start treatment for HIV infection and syphilis in a timely manner [24, 25].

The World Health Organization has published new guidelines to help countries to reach the 8.1 million people living with undiagnosed HIV infection who lack access to life-saving treatment. HIV testing is very important to ensure early diagnosis and early treatment [26, 27]. Quality HIV testing services also involve providing HIV-negative patients with effective prevention services. This will help to reduce the number of new cases of HIV infection, which today is 1.7 million per year. WHO's "Consolidated Guide to HIV Testing Services" provides recommendations for innovative approaches to meet current needs [28, 30], in particular, the use of combined rapid HIV/syphilis tests as the first HIV test within antenatal care can help countries to eliminate mother-to-child transmission of these infections. This could close the gap in diagnosis and treatment and eliminate the second leading cause of stillbirth worldwide [29, 31].

## CONCLUSIONS

The analysis of the problems of PMTCT for HIV demonstrated that in Ukraine there is insufficient availability of pregnant women for HIV testing, the excessive duration of the existing algorithm for testing pregnant women for HIV, the imperfect system of referrals of pregnant women for timely diagnosis, as a result, late and therefore less effective the prophylactic antiretroviral therapy (ART), defects in the effectiveness of standardization of health care for the prevention of mother-to-child transmission (PMTCT) of HIV with the participation of primary healthcare specialists, the main representative of which is a general practitioner – family medicine (GP-FD).

The increasing the family doctor's functions in obstetrics and gynecology services for the prevention of perinatal HIV infection through HIV screening of pregnant women with the use of rapid dual tests for HIV/syphilis during the first visit to the doctor for pregnancy care. This makes a possibility to reduce the time for examination as early as possible and, in case of detection of HIV infection, to use prophylactic ART, which increases the effectiveness of PMTCT and the elimination of cases of perinatal HIV infection in Ukraine.

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**Conflict of interest:**

*The Authors declare no conflict of interest.*

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