

# The importance of HIV antenatal screening programs for pregnant women

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## ABSTRACT

**الأهداف:** معرفة معدل انتشار فيروس الايدز HIV من النوع الأول والثاني لدى النساء الحوامل خلال فترة العشر سنوات.

**الطريقة:** كان العدد الإجمالي للنساء الحوامل اللواتي حضرن للمستشفى الجامعي لجامعة السلطان قابوس 11553 امرأة وذلك خلال الفترة من يناير 1995 حتى ديسمبر 2005. تتراوح أعمار النساء بين 16-45 عام، ومتوسط العمر  $28.6 \pm 7.6$  عام. تم فحص النساء لفيروس الايدز من النوع الأول والثاني باستخدام طريقة الاليزا. وتم تأكيد الإصابة باستخدام فحص الوبستر بلوت (WB). تم تحليل النتائج إحصائياً باستخدام برنامج SPSS نوع 10.

**النتائج:** باستخدام طريقة الاليزا تم اكتشاف الأجسام المضادة لفيروس العوز المناعي المكتسب من النوع الأول لدى 21 امرأة حامل (0.2%)، وأظهر 3 نساء معدل إصابة منخفض لفيروس الايدز من النوع الأول (العدد الإجمالي 24 امرأة، معدل الإصابة 0.2%). ولكن عند استخدام فحص الوبستر بلوت تم تأكيد الإصابة بفيروس العوز المناعي المكتسب لدى 15 امرأة (0.13%) وبمتوسط وقدره 1.5 امرأة حامل للفيروس يتم اكتشافها سنوياً.

**خاتمة:** أن معدل الإصابة بفيروس الايدز لدى النساء الحوامل اللواتي يراجعن المستشفى الجامعي لجامعة السلطان قابوس يعتبر عالياً، مما يحض على أهمية فحص جميع النساء الحوامل اللواتي يراجعن مستشفيات مختلفة و عيادات ما قبل الولادة في عمان، أن هذا الفحص يعتبر ضرورياً لمنع انتقال فيروس الايدز من النوع الأول والثاني للأجنة وللمجتمع والعلاج الطبي المناسب وتوفير الاستشارة الطبية لهن.

**Objectives:** To investigate retrospectively the prevalence of human immunodeficiency virus (HIV)-1 and 2 among pregnant women during a 10-year period.

**Methods:** The total number of pregnant women attending the Sultan Qaboos University Hospital (SQUH), Muscat, Oman between January 1995 and December 2005 was 11553 women. Their age range

was 16-45 years (average of  $28.6 \pm 7.6$  years). The women were tested for HIV-1 and 2 using the standard enzyme-linked immunosorbent assay (ELISA). Positive samples were further tested by Western Blot. The data were statistically analyzed using the Statistical Package for Social Sciences Version 10.0.

**Results:** By ELISA testing, 21 women were positive for HIV-1 (prevalence rate: 0.2%) and 3 women were weakly positive for HIV-1 (24 women; 0.2% prevalence rate). However, 15 women were confirmed HIV-1 positive using the Western Blot method (prevalence rate: 0.13%) with an average of 1.5 positive women per year. None of the women were found positive for HIV-2.

**Conclusions:** This relatively high prevalence of HIV-1 among pregnant women attending SQUH, highlights the need for screening all pregnant women attending different hospitals and antenatal clinics in Oman. This is essential for preventing the transmission of HIV-1 and 2 to the infants and to the community, and for the appropriate medical treatment and counseling of affected women.

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Mother to child transmission is a major route of human immunodeficiency virus (HIV) infection among children globally,<sup>1</sup> and if not treated, these children are most likely to die before they reach the age of 10 years. Ninety percent of HIV infection among children is due to vertical transmission of HIV from the mother to her child.<sup>2</sup> Mother-to-child transmission is preventable and could be eliminated, if infected expectant mothers could be identified and treated early, their chances of giving birth to an infected baby would be greatly reduced. Numerous clinical studies over the past decade have documented that it is possible to reduce the mother-to-child transmission risk to less than 2%.<sup>3,4</sup> Since the early 1990, studies have indicated that antiretroviral therapy can reduce mother-to-child transmission effectively.<sup>3,4</sup> Furthermore, if antiretroviral therapy is used, combined with cesarean section delivery and avoidance of breastfeeding, the chances of passing on HIV infection to babies can be reduced to one-fourth of the expected transmission rate.<sup>5,6</sup> Oman is a country that is situated in the Southeastern corner of the Arabian Peninsula with a total population of 2,508,837 (according to the year 2005 statistics).<sup>7</sup> The Omani nationals comprise 1,842,684 with over 911,000 females, the majority of which are in their sexual active age group. It is well known that sexual contact is the most common mode of HIV transmission among adults. Women are at a vulnerable position in relation to contracting HIV infection. World wide, women and girls are increasingly at risk of HIV/AIDS infection. Approximately 64% of people in developing countries who contracted HIV recently are women and girls.<sup>1</sup> In Oman, the main routes of HIV transmission are through sexual contact.<sup>7</sup> As of December 2006, women accounted for nearly 27% of the population who contracted HIV infection in Oman since 1984.<sup>7</sup> Sultan Qaboos University Hospital (SQUH) has initiated prenatal screening, for HIV-1 and HIV-2, of pregnant women, Omani and non-Omani, who visited the hospital since the year 1995. Data are now available of over 11,000 pregnant women, who delivered their babies at SQUH. No statistical analysis has been performed on these women, and therefore this retrospective study was aimed to analyze statistically the available data in order to evaluate the importance of the HIV antenatal screening program at SQUH and to recommend appropriate recommendations to SQUH, Oman and other neighboring countries.

**Methods.** An enzyme-linked immunosorbent assay (ELISA) was used for the simultaneous detection of HIV-1 and HIV-2 and p24 antibodies (AxSYM HIV Ag/Ab Combo, Abbott Diagnostics, Germany) in the

Serology Division of the Department of Microbiology and Immunology, SQUH, Muscat, Oman. The principle of the AxSYM HIV Ag/Ab Combo is based on utilizing recombinant HIV (*Escherichia coli* [*E. coli*]) antigens and HIV p24 monoclonal (mouse) antibodies coated on micro-particles to capture antibodies against HIV-1/HIV-2 and HIV p24 antigen. Captured antibodies/antigens react with biotin-labeled recombinant antigens, peptides, and p24 monoclonal antibodies. The biotin-labeled complexes are detected using an anti-biotin-alkaline phosphatase conjugate. The presence or absence of antibodies to HIV-1/HIV-2 and /or HIV p24 antigen in the sample is determined by comparing the rate of formation of fluorescent product to the cutoff rate, which is previously calculated using the AxSYM HIV Ag/Ab combo index calibrator. All positive samples were re-tested for confirmation using the Western Blot (immunoblotting).

Western Blot testing (New LAV Blot I, Bio-Rad, Boulevard Raymond Poincare, France) is based on indirect ELISA technique on nitrocellulose strip containing all the HIV-1 constituent proteins and an internal anti-IgG control. Human immunodeficiency virus-1 proteins are separated according to their molecular weights by polyacrylamide gel electrophoresis in dissociating and reducing medium, and subsequently electrically transferred into a nitrocellulose membrane sheet. Qualified technical personnel performed the test according to the manual instruction.

The data on the test results were retrieved through the SQU, Hospital Information System. The data were analyzed using SPSS version 10.0. This study was approved by the Research and Ethics Committee of the College of Medicine and Health Sciences, Sultan Qaboos University, Muscat, Oman in the year 2007.

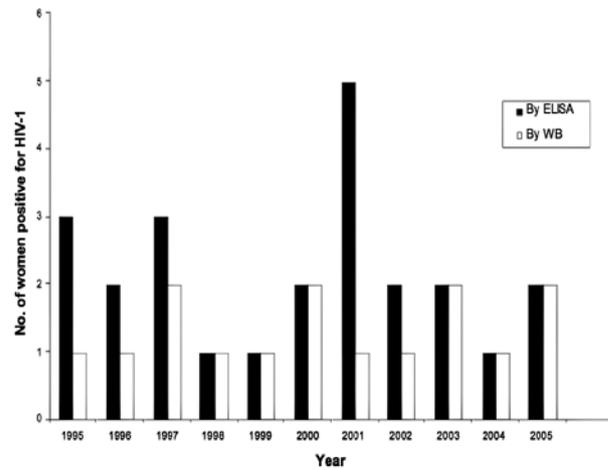
**Results.** The total number of pregnant women attending SQUH between 1995 and 2005 was 11553 women. Their age range was between 16-45 years (average of  $28.6 \pm 7.6$  years). All women were tested for HIV-1 and 2 using the standard ELISA. Positive samples were re-tested using the Western Blot technique to rule out the false positive. Twenty-one women were positive with HIV-1, and 3 women were weakly positive with HIV-1 (Table 1). Fifteen women were confirmed HIV-1 positive using the Western Blot technique (15/24; 62.5%) (Figure 1). The prevalence rate of HIV-1 based on Western Blot testing was 0.13% and on average 1.5 women were confirmed positive per year (Figure 1). None of the women were found positive for HIV-2 during the 10 years period of investigation.

**Table 1** - Distribution of pregnant women according to their human immunodeficiency virus (HIV) ELISA-screening report.

Characteristics	HIV-1		HIV-2	
	No. of women	ELISA positive (%)	No. of women	ELISA positive (%)
Positive	21	(0.2)	0	(0)
Weak positive	3	(0.0)	0	(0)
Negative	11529	(99.8)	11553	(100)
<b>Total</b>	<b>11553</b>	<b>(100)</b>	<b>11553</b>	<b>(100)</b>

ELISA - enzyme linked immunosorbent assay

**Discussion.** Antenatal screening is the most direct and effective way of identifying HIV-infected women and preventing mother-to-child infection.<sup>8-15</sup> While the Centres for Disease Control and Prevention (CDC) recommended voluntary antenatal HIV testing for pregnant women, others argued that mandatory testing is more effective at reducing mother-to-child HIV transmission.<sup>16</sup> It is important that HIV-infected pregnant women (and their health-care providers) know their status to protect their own health and reduce the risk for transmitting HIV to their infants. Diagnosis allows a woman to receive appropriate medical intervention to improve the chances that her infant will be born free from infection. In addition, it may prevent transmission of HIV to her sexual partner if not yet infected. In the present retrospective study, 24 women were found HIV-1 positive using the ELISA testing and 15 women were confirmed positive using the Western Blot technique. We observed an average of 1.5 women being detected positive for HIV-1 per year with a prevalence rate of 0.13%, which is almost 3-times the prevalence rate of HIV-1 in the whole of the Omani population (<0.05%).<sup>7</sup> None of the women found to be positive for the human immunodeficiency virus-2 which is known as less pathogenic and more prevalent in West Africa, although has been detected in many parts of the world. The mode of transmission of HIV-2 is similar to HIV-1 except for heterosexual transmission and prenatal transmission which are very limited.<sup>1</sup> We noticed a relatively high percentage (37.5%) of false positive samples by the ELISA method emphasizing the importance of Western Blot technique for confirming HIV positive samples. All the confirmed positive women were Omanis except for one expatriate. Most of these women (14 patients) received appropriate medical treatment and counseling for themselves and their families at the SQUH. We have available data on 9 children and no data on the others. Out of these 9 children, 3 were positive for HIV-1 as their mothers were tested only when presenting during labor (namely, first presentation) and none was on antiretroviral therapy during pregnancy. However, all the other 6 children were



**Figure 1** - Occurrence of human immunodeficiency virus (HIV)-1 in pregnant women attending Sultan Qaboos University Hospital over a 10-year-period. ELISA - Enzyme linked immunosorbent assay (n=24), WB - Western Blot (n=15)

born negative for HIV-1 as all their 6 mothers were on ART during pregnancy. This indicates the importance of prenatal screening for pregnant women not only at SQUH, but at all hospitals and prenatal clinics in the whole of Oman. The relatively high prevalence of HIV-1 among Omani pregnant women detected in one hospital highlights the need for conducting antenatal HIV screening programs for the whole country. The same picture may be true in other neighboring countries, and therefore, we would recommend that studies be conducted and prenatal screening programs should be considered. This will obviously result in identifying affected women and hence with appropriate counseling and treatment reduction of HIV/AIDS prevalence. Oman has experienced rapid modernization and acculturation in the past few decades. One of the major benefits of recent affluence in Oman is the improvement in living standards and the establishment of a modern health care delivery system. It has been estimated that 96% of the population of Oman has an access to health care services.<sup>17</sup> With the improvements in health care, the country has experienced a significant decline in maternal and child mortality.<sup>18</sup> In a recent health system ranking, the World Health Organization (WHO) ranked Oman as the most “efficient” health care system in the world in terms of outcomes.<sup>19</sup> In demographic terms, the current population pattern in Oman fits with a second phase ‘demographic transition’ characterized by declining death rates coupled with high birth rates.<sup>20</sup>

A recent census suggests a wide-based age pyramid, with 42% of the population under the age of 15. With this large, young population base, a 3.4% population growth, and 38 births per 1,000 of the population are

anticipated.<sup>21</sup> On the other hand, surveys conducted in Oman suggested that the country is not immune to the wrath of infectious diseases.<sup>22</sup> Economic development has resulted in the decline in some infectious disease, but globalization reignited the emergence of new challenges including HIV/AIDS. The toll takes not only affects the person who succumbed to the disease, but also his or her entire social network. In this context, the only viable channel to curb the rising tide of infestations is to institute preventive measures such as prenatal screening.

We do not know whether women in Oman are receptive to HIV testing. Such information is valuable especially for women who might be at risk of HIV infection. Public health efforts to protect women and their offspring from HIV infection and to design appropriate health policy and screening services for their vulnerable population, requires understanding of women's knowledge of HIV, their perceptions of risk, risk behaviors and management as well as their attitudes towards HIV screening. We are currently investigating this aspect among pregnant women attending different hospitals and prenatal clinics in Oman. The early knowledge of maternal HIV status is important for decisions regarding obstetrical management. Achieving these goals requires increased access to and use of prenatal care. To illustrate the importance of prenatal care, it was reported that during 1997 to 1998, the HIV transmission rate among women in New York State was 17.5% (30/171) among those with no prenatal care, 16.2% (23/142) among those with 1-2 prenatal visits, and 8% (90/1,124) among those with >3 prenatal visits, indicating the importance of prenatal care in providing services that prevent prenatal transmission.<sup>23-25</sup> Human immunodeficiency virus-infected women should receive HIV-related medical care, including immune-function monitoring, recommended therapy, and prophylaxis for and treatment of opportunistic infections and other HIV-related conditions.<sup>26</sup> Human immunodeficiency virus-infected women should receive appropriate care, including regular counseling, information on how to prevent sexual and drug-related transmission of HIV, and treatment of gynecologic conditions.<sup>27</sup> Human immunodeficiency virus-infected pregnant women should be referred to appropriate hospitals or health centers for continuous medical care after delivery. Those women need to be aware of the importance of follow-up for their children and those children whose HIV status is not known would require confirmation of their HIV status and may need prophylactic therapy to prevent *Pneumocystis Carinii* pneumonia. Infected

children require follow-up care to determine the need for prophylactic therapy and antiretroviral treatment and to monitor disorders in growth and development that often occur before age 24 months. Uninfected children who are exposed to antiretroviral therapy should be assessed for potential short- and long-term side effects. Identification of an HIV-infected mother indicates that her family needs or will need medical and social services as her disease progresses. Thus, health-care providers should ensure that referrals to services address the needs of the entire family. Due to advances in antiretroviral and medical interventions, pregnant women infected with HIV who know their status prenatally can reduce their risk for transmitting HIV to their infants to <2%.<sup>3,4</sup> Reducing exposure of the infant to maternal blood and secretions during the intrapartum period can prevent not only prenatal HIV transmission but also other infectious agents.<sup>1,27</sup> Appropriate medical intervention can be sought for example, cesarean delivery performed before onset of labor and membrane rupture lowers the risk for HIV transmission compared with vaginal delivery.

Although this study has its own limitations, in terms of not having a control group of non-pregnant women along with the pregnant women group. It is hoped that this cross-sectional study, looking retrospectively and analyzing data over 10 years, will reduce barriers to voluntary testing for all pregnant women and make the voluntary counseling and testing process simple and routine in prenatal settings. It is important that infected pregnant women (and their health-care providers) should know their status to protect their own health and reduce the risk for transmitting HIV to their infants and the consequences of such infections. This is not only important for Oman alone, but should alert other nations to consider initiating antenatal screening programs for HIV.

In conclusion, the relatively high prevalence of HIV-1 among pregnant women attending SQUH, highlights the need for the screening of all pregnant women attending different hospitals and antenatal-clinics in Oman. Similarly in other neighboring countries, antenatal screening-programs should be encouraged for all hospitals and prenatal clinics. This is essential for preventing the transmission of HIV-1 to the infants and to the community and for the appropriate counseling, and medical treatment of affected women.

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