ORIGINAL ARTICLE

Universal antenatal human immunodeficiency virus (HIV) testing programme is cost-effective despite a low HIV prevalence in Hong Kong

CME

PM Lee 李培文
KH Wong 黃家慶

Objective To evaluate the cost-effectiveness of universal antenatal human immunodeficiency virus (HIV) testing in Hong Kong.

Design Cost-effectiveness analysis from the health care provider's perspective.

Setting Public antenatal clinics in Hong Kong.

Participants All pregnant women who gave birth in Hong Kong during the inclusive period 1 September 2001 and 31 December 2004.

Main outcome measures The primary endpoints were (i) the cost per HIV infection avoided and (ii) the cost per life-year gained.

Results From 2001 to 2004, a total of 160 878 deliveries were recorded in Hong Kong; and 75% of the corresponding women had HIV testing before delivery. In all, 28 women tested HIV-positive and gave birth to 15 babies, one of which was HIV-positive. The mother of the infected baby presented late in labour, without her HIV status being diagnosed and thus missed the opportunity for prompt intervention. Assuming a natural transmission rate of 25%, it was estimated that six out of seven anticipated HIV infections among the newborns had been avoided. The cost for implementation of the programme for the first 3 years was HKD12 227 988. Hence, the average costs per HIV infection averted and per discounted life-year gained were HKD2 037 998 and HKD79 099, respectively. Sensitivity analysis showed that both the coverage and the loss-to-follow-up rate were the major determinants of the cost-effectiveness of the universal antenatal testing programme in Hong Kong.

Conclusion The universal antenatal testing programme in Hong Kong is largely efficient. In view of the low prevalence of HIV infection, high rates of HIV testing and uptake of antiretroviral prophylaxis are crucial to the success of the programme.

Introduction

In Hong Kong, nearly all new human immunodeficiency virus (HIV) infections in children are acquired through mother-to-child transmission (MTCT). Without intervention, an estimated 15 to 30% of these infants would become HIV infected.[1]

It has been found that if HIV-positive women could be identified early in their pregnancy and so long as they followed appropriate treatment regimens, delivered by caesarean section and avoided breast feeding,[2] the risk of vertical transmission of HIV to their unborn children could be reduced by approximately 67% from 26% to 8%.[1] Based on these findings, the universal antenatal HIV testing (UAT) programme has been started in Hong Kong since September 2001. Three years thereafter, only one baby was documented HIV-positive, from the 28 HIV-positive pregnancies identified through the programme.[3] Assuming that natural vertical transmission rate was 25%,[1] it appeared that six out of seven anticipated HIV infections had been avoided.

This study set out to document the costs of the MTCT intervention with a view to providing health planners and policy makers real-life factual information from an economic perspective. Cost-effectiveness analysis (CEA) was used in this evaluation. The primary endpoints examined were: (i) the cost per HIV infection avoided and (ii) the cost per life-year gained. Local data were used whenever available, whereas overseas reference parameters and values were factored in as necessary.

Key words
Cost-benefit analysis; Disease transmission, vertical; HIV infections; Mass screening; Quality-adjusted life years

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Red Ribbon Centre, Public Health Services Branch, Centre for Health Protection, Department of Health, Hong Kong
PM Lee, MB, ChB, MSc
KH Wong, MB, BS, FRCP

Correspondence to: Dr PM Lee
E-mail: pmlee@dhspp.net

雖然本地愛滋病發病率低，在香港實施產前愛滋病病毒抗體普及測試仍有成本效益

目的 評估香港實施產前愛滋病病毒抗體普及測試的成效。

設計 從醫療服務提供者的角度作成本效益的分析。

安排 香港的公立產前診所。

參與者 2001年9月1日至2004年12月31日期間所有在香港生產的孕婦。

主要結果測量 主要終點目標包括(1)防止一宗愛滋病病毒感染的成本，及(2)增加一年存活期的成本。

結果 2001至2004年間，香港共錄得160 878個嬰兒出生紀錄，當中75%的孕婦曾接受產前愛滋病病毒抗體測試。28人測試呈陽性；出生的15名嬰兒中有一名帶有愛滋病病毒。該嬰兒的母親在分娩後期才求診，無法診斷出帶有愛滋病病毒，因此失去適時治療的機會。假設自然的感染率為25%，估計7名有可能被感染的新生嬰兒中，有6名可以因為接受測試而避免被母親感染。實施此計劃的首3年成本為港幣12 227 988元。因此每防止一個感染個案的成本為港幣2 037 998元，而每增加一年存活期的成本為港幣79 099元。敏感性分析顯示，在香港實施普及產前檢查是否有成本效益，主要取決於檢查覆蓋率和無法跟進的個案比率。

結論 在香港實施產前愛滋病病毒抗體普及測試大有成效。觀乎愛滋病病毒感染的流行性低，愛滋病病毒測試的高參與率和服食抗病毒治療，對於這個普及測試計劃是否成功有重大影響。

Universal antenatal testing programme in Hong Kong

Every pregnant woman who attends public antenatal services (accounting for 70% of all deliveries in Hong Kong[3]) was offered voluntary HIV antibody testing, using an opt-out approach. The programme was supported by the provision of information and counselling in all public antenatal clinics. For HIV-positive pregnant women, medical and obstetrical care was offered, according to recommendations by the Scientific Committee on AIDS in 2001.[4]

As shown in Table 1, the total number of eligible women (defined as pregnant women attending the public antenatal services between September 2001 and December 2004) who had routine HIV testing was 136 052, of which 50 068 were first seen in Maternal Child Health Centres and 85 984 in Hospital Authority obstetric units. Overall, around 97% of all eligible women were tested for the HIV antibody.

During the same period, a total of 160 878 deliveries were recorded in Hong Kong (in both the public and private sectors). Thus, overall 75% of these women had HIV-testing results available before delivery (Table 1). As the acceptance rate of HIV testing among the eligible women was 97%; the 22% discrepancy was regarded as very likely due to late presentations of some women (particularly non-residents), resulting in omission of routine antenatal testing (including for HIV) prior to delivery.

A total of 28 women tested HIV-positive in the public sector. Over 90% of these mothers received interventions (either antiretroviral therapy [ART] or abortion) to combat MTCT. Fifteen babies were born, but only one was documented to be HIV-positive. The mother of this infected baby presented late in labour without having had her HIV status diagnosed, and thus missed the window of opportunity for prompt intervention.

Methods

Overview of the model

The predicted incremental costs of universal screening were estimated and compared to incremental benefits. The authors adopted a health care provider perspective by including costs and benefits to the health care sector. The authors assumed that the intervention could be regarded as cost-effective if the incremental costs were less than or equal to the monetary value of incremental benefits. The model was evaluated for a 3-year-and-4-month cohort (1 September 2001 to 31 December 2004) of pregnant women and included all future costs and benefits. Both the future costs and benefits were discounted at rates of 3.6%, the value used by the Hong Kong Census and Statistical Department. The uncertainty and impacts of the variation of key variables on the estimates were assessed by a sensitivity analysis. All values of the cost variables were reported in Hong Kong dollars and reflected 2004/2005 prices. The average exchange rates for one Hong Kong dollar against the British pound, Australian dollar, US dollar, and Canadian dollar during that time period were 0.07048, 0.1695, 0.1287, and 0.1540, respectively (http://pacific.commerce.ubc.ca/xr/).

Direct intervention costs

The direct intervention costs were divided into two components: (a) costs associated with HIV information delivery, HIV screening and antibody test services for pregnant women who attended the public antenatal services, and (b) costs associated with MTCT averting interventions.

HIV information delivery and health talks

The implementation of the UAT programme required the development of new education resource materials (mainly video, leaflets, and posters). Delivery of HIV information was conducted in groups and was incorporated in the existing antenatal health talk series for all the expectant mothers (note that individual risk assessment by the health professions was not essential before HIV testing). For women who were confirmed to be HIV positive, more elaborate post-test counselling was offered by professional counsellors.[5]

TABLE 1. Summary statistics of universal antenatal human immunodeficiency virus (HIV) testing (UAT) programme from September 2001 to December 2004

	2001 (Sep-Dec)	2002	2003	2004	Overall
No. of HIV tests performed in public antenatal services (ie acceptance rate)					
Total No. of eligible women for routine HIV screening	13 423	43 130	37 533	41 966	136 052
Total No. of HIV tests performed	12 965	41 932	36 366	41 070	132 333
Eligible women who had HIV test done	96.6%	97.2%	96.9%	97.9%	97.3%
Opt-out rate in public service	3.4%	2.8%	3.1%	2.1%	2.7%
No. of deliveries with HIV test result available before delivery					
Hospital Authority hospitals	2065 (16.3%)	30 534 (82.5%)	32 139 (91.0%)	32 147 (86.0%)	96 885 (79.2%)
Private hospitals	592 (14.8%)	5391 (49.1%)	8256 (71.9%)	9531 (79.5%)	23 770 (61.8%)
Overall	2657 (15.9%)	35 925 (74.8%)	40 395 (86.3%)	41 678 (84.4%)	120 655 (75.0%)
No. of HIV-positive pregnancies identified (point prevalence rate)	7 (0.05%)	9 (0.02%)	6 (0.015%)	6 (0.014%)	28 (0.02%)
Outcome of pregnancies (No.)					
Termination of pregnancy	3	3	3	2	11
Delivered					
Caesarean section	3	5	3	3	14
Vaginal delivery	1	0	0	0	1
Loss to follow-up	0	1†	0	1†	2
Total	7	9	6	6	28
ART* prescription in known delivered pregnancies	3 (75%)	5 (100%)	3 (100%)	3 (100%)	14 (93.3%)
No. of babies born by the infected mothers	4	5	3	3	15
No. of ART prescription in neonatal period	3 (75%)	5 (100%)	3 (100%)	2‡ (66.7%)	14 (93.3%)
HIV status of babies born					
Negative	3	5	3	2	13
Positive	1	0	0	0	1
Unknown	0	0	0	1‡	1

* **ART denotes antiretroviral treatment**
† **2 infected mothers were lost to follow-up before delivery**
‡ **1 baby and her infected mother were lost to follow-up after delivery**

Mother-to-child transmission intervention: antiretroviral therapy regimen and its cost

The treatment regimen consists of three phases. In the first phase, the HIV-positive pregnant woman was started on either zidovudine (AZT) monotherapy (300 mg twice a day) or AZT and lamivudine (3TC) combination therapy (300 and 150 mg respectively, twice a day) on an out-patient basis commenced at 14 weeks of gestation and continued until the onset of labour. In some of the pregnant patients, highly active ART (eg AZT 300 mg twice a day + 3TC 150 mg twice a day + indinavir 800 mg 3 times a day) was prescribed for better viral suppression. In the second phase, intravenous AZT was given during labour as a loading dose (2 mg/kg), followed by continuous infusion of 1 mg/kg per hour until delivery. In the final phase, the newborn infant was treated orally with AZT syrup (2 mg/kg) every 6 hours, beginning 8 to 12 hours after birth and continued for 6 weeks.

The drug-acquisition costs for ART per treated case were calculated using information from the Department of Health pharmaceutical service.[6] Acquisition costs for ART were based on mid-range estimates at the point of initiation of prenatal treatment, ie 25 weeks' gestation (range, 10-34 weeks), as well as the mid-range estimates of maternal weight (55 kg), length of labour (6 hours); and the average infant weight over the corresponding 6-week treatment period (5 kg).

Additional treatment costs for HIV-infected women and newborns due to early diagnosis

Respective additional treatment costs for an HIV-infected woman and her newborn due to early diagnosis and treatment were estimated to be HKD36 180 and HKD100 500. These calculations were based on the assumptions that without the UAT programme, all

TABLE 2. Values for variables included in the cost-effectiveness model

Variable*	Value/unit cost (HKD)	Source
Epidemiological parameters		
Accept screening (%)	97	Special Preventive Programme, Department of Health[3]
Women with HIV status available at delivery (%)	75	
Prevalence of HIV (%)	0.02 (yearly prevalence, 0.01-0.05)	
Universal HIV antibody testing and counselling service		
HIV antibody test (include staff and reagent cost)	100	Government Virus Unit, Department of Health
Investment in educational materials and training of staff	500 000	Report on the implementation of the UAT programme in public services[5]
Health talks for expectant mothers	570 000	
Intervention to reduce risk of vertical transmission		
Termination of pregnancy	15 850	Hong Kong Gazette 2003[9]
Caesarean section	34 600	
ART prophylaxis		
Antepartum		
AZT	14.7/100 mg	Drug Formulary 2005, Department of Health[6]
3TC	32.1/150 mg	
IDV	16.3/400 mg	
NFV	10.93/250 mg	
Intrapartum and postpartum AZT (syrup)	4.66/mg	Interview with pharmaceutical company
Unit cost for out-patient and hospital service		
Out-patient consultation (per session)	1910	Hong Kong Gazette 2003[10] and Government Virus Unit
CD4/CD8 T lymphocyte subset test	1010	
Virus load determination	1100	
Hospital admission (per day)	3300	
Capita income		
Median per capita income	186 267	Census and Statistics Department[11]

* **ART denotes antiretroviral therapy, AZT zidovudine, IDV indinavir, HIV human immunodeficiency virus, NFV nelfinavir, 3TC lamivudine, and UAT universal antenatal testing programme**

infected women would have their HIV status diagnosed 18 months (range, 12-24 months) after delivery[7] and all infected newborns would be diagnosed within 50 months of birth (range, 32-78 months).[8] It was also assumed that each HIV-infected woman and child would need an out-patient visit, CD4/CD8 T lymphocyte subset tests as well as virus load determination every 2 months. It was also assumed that no ART would be given within this period.

Further analysis of net cost: potential savings of lifetime medical cost for HIV-infected infants averted by the universal antenatal testing programme

To estimate net costs for each life-year gained, all potential savings were deducted from the gross costs. Therefore, the cost savings from an avoided case of vertically transmitted HIV infection (ie the lifetime costs of treatment for a child born with HIV) were deducted from the intervention costs.

An estimate of the total lifetime medical costs for an HIV-infected child diagnosed at the symptomatic phase was obtained by multiplying phase-specific annual costs by the estimated average duration of each phase, and summing the corresponding costs for all three phases (asymptomatic, symptomatic, and AIDS phase). Because of the small number of cases in Hong Kong, phase duration estimates were based on data from the international literature. The cost of paediatric HIV infection, for children born to mothers whose HIV status was unknown at the child's birth (ie an unscreened population) has been studied.[8] The mean total survival of the children with ART initiated at onset of symptoms was 122 months (range, 74-218 months); the mean duration

TABLE 3. Incremental costs and savings estimated, based on the 28 human immunodeficiency virus (HIV)–positive mothers identified from 2001 to 2004

	No.	Cost (HKD)
HIV information delivery, screening, and antibody test		
(a) No. of HIV antibody tests performed	132 333	13 233 300
(b) Training health care professionals and producing health education materials		1 700 000
Subtotal (a+b)		14 933 300
Interventions to counter mother-to-child transmission*		
(c) No. of abortions	11	174 350
(d) No. of caesarean sections	14	484 400
ART† prophylaxis		
(e) No. of women receiving ART during pregnancy	14	343 915
(f) No. of women receiving ART during labour and delivery	14	25 116
(g) No. of newborns receiving neonatal ART prophylaxis	13	101 777
Subtotal (c+d+e+f+g)		1 129 558
Costs arising from earlier diagnosis of HIV status		
No. of HIV-positive mothers/children under the care of the public sectors‡	17/1	
(h) Incremental treatment costs of HIV-pregnant women due to early diagnosis and treatment		615 060
(i) Incremental treatment costs of HIV-infected newborns due to early diagnosis and treatment		100 500
Subtotal cost (h+i)		715 560
All additional costs (a+b+c+d+e+f+g+h+i)		16 778 418
Lifetime medical cost of HIV-infected children		
No. of HIV-positive infants avoided§	6	
(j) Saving of lifetime costs of treating HIV-infected children (discounted annual cost of treatment x 6 cases averted)		4 550 430
Total incremental costs=all additional costs minus all savings		**12 227 988**

* **2 were lost to follow-up and 1 presenting very late**
† **ART denotes antiretroviral therapy**
‡ **Of the 28 HIV positive mothers, 11 did not continue in the programme, presumably they returned to China or were lost to follow-up**
§ **Assuming a perinatal HIV transmission rate of 25%**

of the asymptomatic, symptomatic, and AIDS phases were taken to be 50 (range, 32-78), 24, and 48 (range, 18-116) months, respectively.[8]

The annual charges for health care services needed to manage an HIV-infected child included outpatient visits, hospital stays, laboratory investigations, and the cost of HIV-related prescription drugs. It was assumed that each HIV-infected child requires an outpatient visit, CD4/CD8 T lymphocyte subset tests, as well as virus load determination every 3 months. Antiretroviral therapy commences when the child starts to have symptoms (ie the time when the HIV status of the child is discovered) and continued till death. Hospital admission was assumed to ensue twice per year (7 days for each episode) after the development of AIDS; primary prophylaxis on opportunistic infection (mainly *Pneumocystis carinii* pneumonia) would be routinely offered during that phase or when there was moderate-to-severe immunosuppression. Thus, based on the above assumptions, the discounted annual cost for an HIV-infected child was estimated to be HKD758 405.

Identification of incremental benefits

The incremental benefits of the programme were determined by the total life-years gained, reflected by the increase in life expectancy for infants who had successfully avoided HIV infection. To predict the likely number of cases of HIV infection avoided, the observed rate of transmission with the intervention was compared to the estimated rate without intervention. The net life-years gained also included the gain in the life expectancy of HIV-positive mothers and babies (who still contract HIV despite optimal interventions) due to earlier diagnosis and appropriate (ie undelayed) treatment.

Several assumptions have to be made in the calculation of total life-years gained. Assuming the life expectancy of HIV-negative infants to be 79 years and that of HIV-positive subjects to be 10 years, nearly 70 life-years were gained for each baby whose HIV infection was averted.[7] If a 3.6 percent rate was used to discount the future benefit, then 22.72 discounted life-years were obtained. A gain of 1 year and 1.27 years respectively,

TABLE 4. Results (cost in HKD) of a change to the values of the key variables

Variable*	Cost per HIV infection avoided (% change from actual value)	Cost per life-year gained (% change from actual value)
HIV prevalence of antenatal population		
0.01%	7 388 303 (+102%)	251 688 (+102%)
0.02%	3 654 978 (0%)	124 510 (0%)
0.05%	1 414 983 (-61%)	48 202 (-61%)
% of women with HIV status available during delivery		
60%	5 078 406 (+31%)	146 725 (+21%)
75%	3 885 126 (0%)	121 523 (0%)
90%	3 091 311 (-20%)	102 325 (-16%)
MTCT rate[1]		
18%	5 898 052 (+90%)	172 967 (+63%)
25%	3 110 305 (0%)	106 033 (0%)
33%	1 858 006 (-40%)	68 329 (-36%)
Antiretroviral therapy effectiveness rate (to reduce MTCT rate to)[1]		
3.9%	2 284 226 (-27%)	82 487 (-22%)
8.3%	3 110 305 (0%)	106 033 (0%)
12.8%	4 572 646 (+47%)	141 845 (+34%)
Discount rates		
0%	3 081 980 (-0.9%)	40 760 (-61%)
3.6%	3 110 305 (0%)	106 033 (0%)
5%	3 121 316 (+0.4%)	108 519 (+2.3%)
Assume all lost-to-follow-up cases were HIV positive†	4 834 401 (+137%)	160 718 (+103%)

* **HIV denotes human immunodeficiency virus, and MTCT mother-to-child transmission**

† **A total of 3 cases were lost to follow-up, 2 before and 1 after delivery**

were assumed to be the health benefit for each HIV-positive mother and infant from starting ART earlier.[7] This analysis also assumed that antiretroviral drug treatment causes no adverse effects to the health of infants that eventually turn out to be unaffected.[8]

Data sources

The values for variables included in the model are listed in Table 2.[3,5,6,9-11]

Results

Incremental cost

The additional costs of the UAT programme for the first 3 years were HKD13 233 300 for HIV antibody testing, HKD1 700 000 for training health care professionals, producing health education materials and conducting health talks, HKD1 129 558 for the treatment directed at preventing perinatal infection (perinatal ART prophylaxis for the women and the infants; the costs for additional caesarean sections and terminations of pregnancy), and HKD715 560 for the medical treatment for the infected mothers and newborns due to earlier diagnosis of HIV status through the UAT programme. These costs were offset by saving of HKD4 550 430 from the lifetime HIV care of infected newborns that were averted. Therefore, the total incremental cost of the UAT programme for the first 3 years' implementation was HKD12 227 988. The results and the breakdown of the costs are shown in Table 3.

Incremental benefit

As for the incremental benefit (assuming an HIV vertical transmission rate of 25% in the absence of UAT[1]), it was estimated that seven newborns of the 28 positive pregnancies would have been HIV-infected without the UAT programme. Whereas, after implementing universal screening and its interventions, only one baby born to the 28 HIV-positive pregnant mothers was infected, though six such infants would have been anticipated. Thus UAT with appropriate treatment when necessary, appeared to have avoided six HIV-infected babies, consistent with a net gain of 136.32 (22.72 x 6) discounted life-years. In addition, 18.27 ((1 x 17) + 1.27) discounted life-years were gained due to earlier treatment of public sector infected mothers and the newborn, yielding a total of 154.59 discounted life-years (Table 3). For a decision maker willing to pay up to twice the median per capita

income (ie HKD372 534[11]) to gain one life-year, the incremental saving (benefit) of the programme was calculated to be HKD57 590 031.

Cost-effectiveness result of the 3-year-and-4-month universal antenatal testing programme cohort

As per the above calculations, the incremental benefit was around 5 times greater than the incremental cost of implementing the UAT programme. The calculated endpoints of the average cost per HIV infection avoided and average cost per discounted life-years gained amounted to HKD2 037 998 and HKD79 099, respectively.

Sensitivity analysis

The results of the sensitivity analysis are shown in Table 4. It was found that cost-effectiveness of the programme was sensitive to changes in the HIV prevalence of the antenatal population and the extent to which it covered the population, because both the cost per HIV infection avoided and the cost per discounted life-years gained are decreasing functions of both variables (Figs 1 and 2). As the prevalence of HIV infection among the antenatal population in Hong Kong was low, adequate cover of the relevant population being offered testing and uptake of interventions (when required) were thus crucial for achieving well-justified cost-effectiveness of the programme. In addition, the loss-to-follow-up rates of HIV-infected mothers and their infants, must need to be kept to a minimum, as a large loss-to-follow-up could also have a major impact on the cost-effectiveness of the UAT programme.

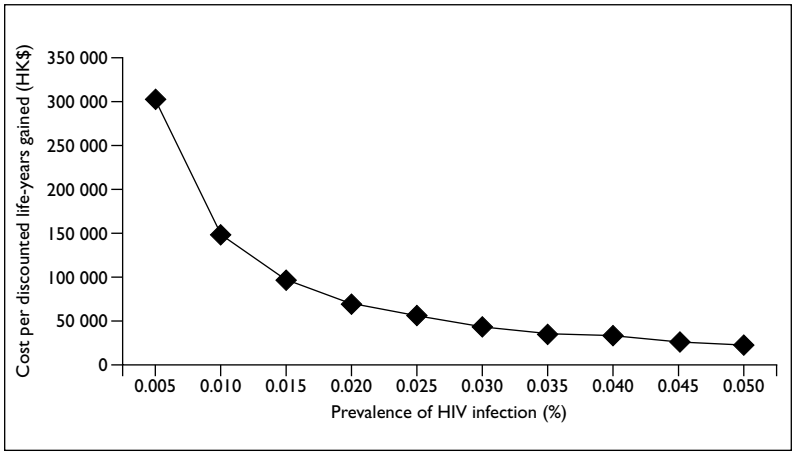

FIG 1. Cost per discounted life-years gained for all human immunodeficiency virus (HIV) prevalence in antenatal population in Hong Kong

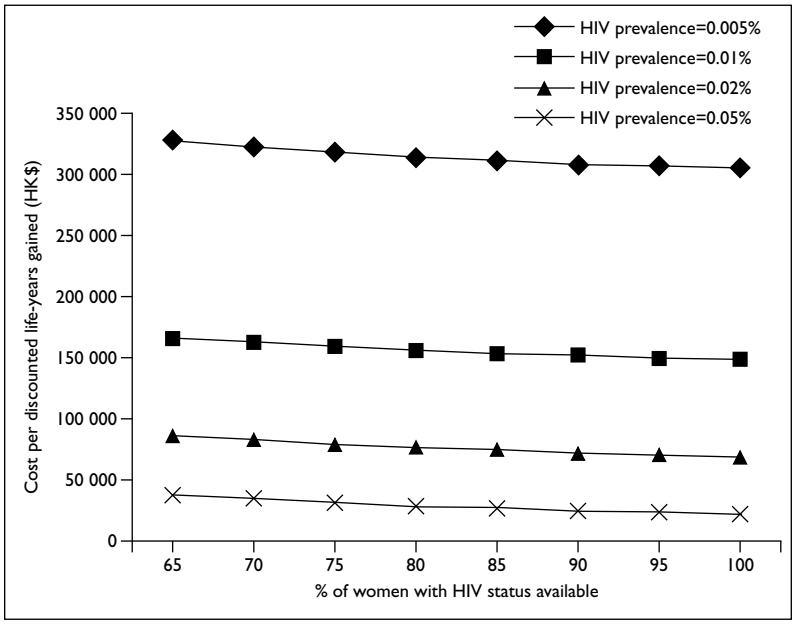

FIG 2. Cost per discounted life-years gained for different percentage of women with human immunodeficiency virus (HIV) status available during delivery

Discussion

From the CEA, we found that despite a low HIV prevalence, the incremental benefit was much greater than the incremental cost of implementing the UAT programme in Hong Kong. Similar cost-effectiveness analyses have been undertaken in western countries, where similar antenatal testing and MTCT programmes are in place. A study in the United Kingdom found that 6.39 discounted life-years were gained at a net cost of GBP14 833 (HKD210 457), yielding a cost per discounted life-year gained of GBP2321 (HKD32 931).[12] The authors assumed that a discounted life-year gained was worth GBP10 000 (HKD141 884) and concluded that universal screening was cost-effective in preventing perinatal HIV transmission. Another study in the CEA from the United States revealed similar findings.[13]

Comparisons can also be drawn to other health care programmes in Hong Kong and other countries. In a review of the cost-effectiveness of a cardiovascular programme in Hong Kong,[14] it was found that the costs per fatal/non-fatal cardiac event and stroke prevented were HKD1 146 413 and HKD2 961 566 respectively; and the net cost per quality-adjusted life-year gained was HKD65 280. An analysis of the decisions made by the Australian Pharmaceutical Licensing Authorities indicated that policy makers most often endorsed the use of a drug if the cost per life-year gained was less than AUD48 000 (HKD283 261).[15] One Canadian article considered the cut-off point at which the cost for each life-year gained becomes acceptable was CAD20 000 (HKD130 008).[16] A study in the United States considered that a health programme was cost-effective if each discounted life-year gained was valued at USD50 000 (HKD388 390) or less.[17] Clearly,

the cost per discounted life-year gained for our UAT programme (estimated to be HKD79 099) would be considered cost-effective.

The CEA on universal screening conducted in Australia in 2004 demonstrated that the intervention would be cost-effective if HIV prevalence in the antenatal population was greater than or equal to 0.0044%.[7] In Hong Kong, the point prevalence of HIV in the antenatal population was around 0.02%. Based on this figure, it could be inferred that the UAT programme in Hong Kong was cost-effective. However, from the sensitivity analysis, we found that apart from HIV prevalence, the cost-effectiveness estimates are greatly affected by the extent of HIV testing cover of the population, and subsequent uptake of interventions by infected mothers and their babies. While HIV prevalence is not amenable to change, the extent of cover offered by the programme should be enhanced to improve cost-effectiveness in a low prevalence setting.

Given the well-proven efficacy of antiretroviral and obstetric interventions in reducing MTCT, the missed opportunity for prevention of perinatal infections in Hong Kong is a cause for concern and poses challenges to all involved. It is recognised that in recent years, a substantial proportion of those delivering in public hospitals were non-eligible, as they were not local residents; most such mothers were from Mainland China and other parts of Asia. The latter often have no prior antenatal care and present to hospital close to or at the time of delivery. Hence, they did not have an HIV test result available before delivery. Prevention of MTCT for these patients requires that they have sufficiently early HIV testing, so as to enable timely action according to the antibody result whenever necessary. A rapidly available HIV test result appears crucial for this group of mothers who present late, to increase the proportion having a known HIV status before delivery. Essential prepartum, intrapartum, and neonatal interventions can then be given in time, if indicated. Early revelation of an HIV status to the mother may also enhance her compliance with necessary interventions and follow-up for her baby.

Regarding limitations of this study, information on opt-out rates in the private sector was not available, though there were attempts to collect such data. This drawback therefore limited the scope of this evaluation. Our CEA made no attempt to address the human costs of HIV infection such as the emotional, psychosocial, and other burdens of infection accruing to the patient, the patient's family, and the caregivers. This was because psychological factors cannot be valued easily and thus would be difficult to incorporate into the model. Moreover, the indirect costs, such as those associated with orphaned children and years of productivity lost due to illness and premature death, were also not addressed.

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