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# Cost-effectiveness of influenza vaccination for elderly people living in the community

## Key Messages

1. Influenza vaccination of elderly people living in the community was cost-effective from a societal perspective but did not cut publicly funded medical costs or total medical costs.
2. For the oldest group ( $\geq 75$  years) living in the community, influenza vaccination can cut publicly funded medical costs if the total vaccination cost per head is HK\$39.6 or less.
3. Influenza vaccination is cost-effective if the value of increasing an elderly person's lifespan for a year at most is measured as HK\$68 047 or more.

## Introduction

Influenza is one of the leading causes of respiratory infection. It is a highly contagious viral infection that affects 10 to 20% of the population every year.<sup>1</sup> Influenza generates both medical expenses, from resource use, and societal costs, due to lost productivity and mortality.

Older people are particularly vulnerable to influenza infection and its complications can result in serious illness and death. Some countries recommend an annual influenza vaccination for older and high-risk groups because it is the most effective means of preventing influenza and reducing the impact of epidemics.<sup>2</sup>

Since 1998, the Department of Health in Hong Kong has been providing free annual influenza vaccination to older people living in residential care homes.<sup>3</sup> In addition, mainly since the outbreak of severe acute respiratory syndrome (SARS) in 2003, the Department of Health and non-governmental organisations have also provided free or low-cost annual influenza vaccinations to older people.

Studies from other countries have shown that influenza vaccination in older people is cost-effective and can be cost saving for the health care provider.<sup>4</sup> These studies are not directly applicable to Hong Kong with its different influenza seasonal pattern, health care cost structure, and relatively healthy older people.<sup>5</sup> The only study on the cost-effectiveness of influenza vaccination in Hong Kong published to date concluded that influenza vaccination was not cost-effective in any age-group.<sup>6</sup> That study was based on a limited survey that found no additional risk of hospitalisation from the complications of influenza in older people and no influenza-related mortality in older people in Hong Kong. Subsequent analyses of influenza-related hospitalisation and mortality suggest that neither of these assumptions is appropriate.<sup>7</sup> Thus, there is a need to conduct a local evaluation of the cost-effectiveness of influenza vaccination among older people in the Hong Kong community, taking into account the latest information on the impact of influenza in Hong Kong.

## Aim

We evaluated the cost-effectiveness of influenza vaccination in Hong Kong for people aged 65 years and over living in the community. We also considered the following subsidiary questions:

1. Would a publicly funded influenza vaccination programme be cost saving?
2. What is the maximum cost per head of influenza vaccination at which a publicly funded influenza vaccination programme in older people would become cost saving?
3. What is the value of a life at which a publicly funded influenza vaccination programme in older people would break even?
4. Are there differences in cost-effectiveness or cost saving of medical costs in those aged 65 to 74 years and those 75 years and over?

## Methods

This study was conducted from August 2004 to July 2005. We evaluated the

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**Table 1. Vaccination cost, uptake, and effectiveness**

	Age-group (years)	
	65-74	≥75
Vaccination cost		
Influenza vaccination		HK\$25
Staff costs		HK\$25
Administration		HK\$6.5
Refund system for opportunistic programme only		HK\$6.5
Lost productivity	HK\$3.6	N/A
Travel cost for comprehensive programme only	HK\$5.6	HK\$4.6
Vaccine uptake		
Comprehensive programme		90%
Opportunistic programme	62%	76%
Vaccine effectiveness in preventing		
Self-care cases		5%
Doctor consultations		5%
Hospitalisations*		22-27%
Mortality†		47%

\* 22% for respiratory diseases, 24% for cardiac diseases, and 27% for pneumonia and influenza

† 47% for all-cause mortality

cost-effectiveness of an influenza vaccination programme by comparing the dollar value of the benefits obtained with the cost of a vaccination programme over 1 year, as influenza vaccinations are repeated annually. We considered (1) a comprehensive vaccination programme, where vaccination was centrally provided in the autumn, and (2) an opportunistic programme, where older people visiting a doctor for a reason other than cold, 'flu', or fever between October and December were offered an influenza vaccination. These programmes have different costs and uptakes.

Given concerns over avian influenza and SARS we assumed a high uptake rate of 90% for a centrally provided vaccination, but travel costs for the older people concerned. An opportunistic programme generates no additional travel costs for the older people vaccinated, but there are additional costs involved in refunding the private general practitioners who administered the vaccine on an opportunistic basis to 90% of those who made an appropriate doctor visit in the relevant months.

The effectiveness of influenza vaccination as a means of preventing influenza was estimated from the most recent meta-analysis.<sup>8</sup> Table 1 summarises the information used to cost an influenza vaccination programme and to estimate its benefits.

Excess mortality, admissions to hospital, visits to a general practitioner, and number of cases where self-care was used for influenza-related illness were estimated from published studies and local survey data.<sup>7</sup> Unit costs were obtained from routine data and local surveys. Table 2 summarises the information used to cost influenza-related illness and shows the number of deaths, hospitalisations, doctor consultations, and self-care episodes estimated to be

**Table 2. Annual mortality and morbidity associated with influenza in older people and unit costs**

	Age-group (years)	
	65-74	≥75
Deaths		
Value of life		HK\$10 million
Annual number due to 'flu'	272	628
Hospital use		
Cost per bed-day		HK\$3132
Annual admissions due to 'flu'	759	1321
Length of stay*	Various	Various
Doctor visits		
Unit cost (public)		HK\$251
Unit cost (private)		HK\$164
Travel cost	HK\$5.6	HK\$4.6
No. of visits due to 'flu'	14 340	6464
Self-care		
Western medicine cost	HK\$134	HK\$61
Chinese medicine cost	HK\$79	HK\$41
No. using self-care for 'flu'	34 901	19 656
Lost productivity		
Value of work-time lost per worker	HK\$912	N/A

\* The length of stay varies depending on the type of disease

associated with influenza annually. The risk of influenza-related mortality or hospitalisation is higher in the older age-group.

We took three perspectives on costs and benefits (1) societal (2) personal or individual and (3) government or publicly funded health care. Societal costs and benefits included mortality, lost productivity, public and private use of medical resources, and personal expenses, such as travel costs.

We carried out a probabilistic sensitivity analysis to identify the maximum vaccination cost at which influenza vaccination would be cost saving. We carried out our analysis for all older people in Hong Kong who live in the community, separated into two age-groups. Of the 729 200 elderly people in Hong Kong, we estimated that 447 190 aged 65 to 74 years and 237 222 aged 75 years and above lived in the community.<sup>9</sup> Costs relate to the year 2000 and are in Hong Kong dollars (HK\$).

## Results

### Cost of influenza

We estimated the total annual cost of influenza in older people living in the community as HK\$9068 million, of which HK\$60.7 million is publicly funded medical costs (Table 3). This is equivalent to HK\$13 250 per head, and HK\$88.6 per head in public health care costs.

### Cost of vaccination

In a comprehensive programme reaching 90% of older people in the community, the total vaccination cost would be HK\$40 million (Table 4). This is equivalent to a cost per person vaccinated of HK\$64, including HK\$57 in health care costs, HK\$2 in lost productivity and HK\$5 in personal

**Table 3. Cost of influenza in older people living in the community**

	Perspective			Total
	Personal	Public	Other societal	Societal
Deaths (million)			HK\$9000	HK\$9000
Hospitalisation (million)	HK\$0.1	HK\$60.3	HK\$0.2	HK\$60.7
Out-patient (million)	HK\$3.3	HK\$0.3	HK\$1.2	HK\$4.9
Self-care (million)	HK\$1.7		HK\$1.4	HK\$3.1
Total (million)	HK\$5.1	HK\$60.7	HK\$9002	HK\$9068
Cost per head	HK\$7.5	HK\$88.6	HK\$13 154.1	HK\$13 250

**Table 4. Monetary benefits and costs of influenza vaccination for all people aged 65 years and over living in the community: from personal, governmental, and societal perspectives**

Perspective (HK\$)	Comprehensive programme (90% uptake)				Opportunistic programme (62% and 76% uptake, respectively of those aged 65-74 and ≥75 years)			
	Personal	Government	Indirect costs	Societal	Personal	Government	Indirect costs	Societal
Benefits								
Deaths				3 810 000 000				3 030 000 000
Hospitalisations	32 358	13 129 999	43 025	13 205 382	25 486	10 360 305	29 640	10 415 431
Out-patient	149 030	14 471	55 798	219 299	109 865	10 625	38 438	158 928
Self-care	75 437	-	62 470	137 907	53 706		43 035	96 741
Total benefits	256 825	13 144 470	161 293	3 823 562 588	189 057	10 370 930	111 113	3 040 671 100
Benefits per person vaccinated	0.4	21.3	0.3	6207.4	0.4	22.7	0.2	6645.6
Costs	3 235 938	34 802 371	1 450 080	39 488 389		28 825 450		28 825 450
Cost per person vaccinated	5.3	56.5	2.4	64.1		63.0		63.0
Net benefits	-2 979 113	-21 657 901		3 784 074 199	189 057	-18 454 520		3 011 845 650
Per person net benefits	-4.9	-35.2		6143.3	0.4	-40.3		6582.6

costs. In an opportunistic programme in which 62% of those aged 65 to 74 years and 76% of those aged 75 years and over are vaccinated, the total vaccination cost would be HK\$29 million or HK\$63 per person vaccinated and this involves health care costs only.

#### **Monetary benefits from influenza vaccination**

A comprehensive vaccination programme would yield benefits of HK\$3824 million, or HK\$6207 per person vaccinated (Table 4). Most of this is from avoided mortality. The savings in public health care costs are HK\$13 million or HK\$21 per person vaccinated. An opportunistic programme yields savings in public health care of HK\$10 million or HK\$23 per person vaccinated.

#### **Cost-effectiveness of influenza vaccination**

The net benefits for both types of programme are negative from a governmental perspective but positive from a societal perspective. Vaccination would, on average, cut medical costs (from the government's perspective) in the 75 years and over age-group if the vaccination cost per person was HK\$40 or less. For the 65 to 74 years age-group, vaccination would not reduce public health care costs even if the vaccination cost per person were as low as HK\$15.

#### **Breakeven value of life**

For vaccination to be cost-effective, the value placed on saving a life would have to be at least HK\$16 947 for those aged 75 years and older and at least HK\$186 243 for those aged 65 to 74 years. If we put the age-groups together, the value of saving the life of anyone aged 65 years or older living in the

community would have to be at least HK\$68 047.

## **Discussion**

Vaccinating people living in the community against influenza is cost-effective from a societal perspective. Most of the cost reductions from a vaccination programme come from mortality reductions. Vaccination does not save health care costs at the estimated cost of vaccination used in the analysis. These findings are consistent with some overseas studies.<sup>10</sup> The results are not surprising because hospitalisation rates for influenza-related diseases in older people in Hong Kong appear to be lower than those observed elsewhere, making potential benefits from vaccination also lower. Local people also have lower mortality rates from cardiovascular disease and lower lifetime rates of smoking, which could contribute to them being less vulnerable to the cardiorespiratory complications of influenza.<sup>11</sup>

We used a value of life of HK\$10 million in this study. The analysis shows us that vaccination is still cost-effective from a societal perspective at values of life much lower than this.

## **Conclusion**

Vaccinating elderly people living in the community against influenza was found to be cost-effective from a societal perspective but not from a governmental perspective at the values of costs and benefits used in this analysis. Nonetheless, influenza vaccination in older people (≥75

years) in the community would be cost saving from the governmental (public health care) perspective if the cost of vaccinating each person, including the cost of the vaccine and its administration, was HK\$39.6 or less. Furthermore, vaccination would be cost-effective from a societal perspective if the value of a life of a person aged over 65 years were put at HK\$68 047 or more.

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