

Comparison of the influenza vaccination coverage among high-risk people between the online registration system and walk-in service system in Bangkok, Thailand

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ABSTRACT

Until recently, the Thai national program of seasonal influenza vaccination for high-risk people has been using a walk-in service system. However, in 2020, an online registration system was introduced in Bangkok to improve vaccine coverage. This study aimed to compare the coverage of influenza vaccination between the walk-in service and online registration systems. The study participants included 374,710 Thai individuals who obtained an influenza vaccination from the national program in the Bangkok health region in 2018 (n = 162,214) and in 2020 (n = 212,496). The registration systems that were examined were the walk-in service system in 2018 and the online registration system in 2020. The characteristics of vaccine recipients and the vaccine coverage in each risk group and health facility level were compared between the two systems. Coverage comparison in Bangkok between the years 2018 and 2020 showed an increase in coverage, particularly among individuals who had an influenza vaccination at health facilities of the primary level and in the elderly and obesity groups. The coverage among children was lowest among all high-risk groups. To improve coverage in Thailand, the online registration system should be introduced in all regions. Additionally, information about influenza vaccination for children should be disseminated to parents using handbooks or by word-of-mouth from healthcare workers.

Keywords: influenza vaccination, online registration system, Thailand

Abbreviations:

AIDS: acquired immunodeficiency syndrome

NHSO: National Health Security Office

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INTRODUCTION

According to an estimation by the World Health Organization, seasonal influenza causes 3,000,000–5,000,000 severe illness cases and 290,000–650,000 deaths every year in the world.¹

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Immunocompromised individuals, such as patients with chronic diseases, pregnant women, and the elderly (especially those over 65 years of age) have a higher risk of death due to influenza infection.^{2,3} In addition, influenza infection is a major cause of hospitalization among children aged 5 years and younger.^{4,5} Influenza vaccination has been proven to be the most effective strategy in preventing infection and reducing morbidity and mortality, especially in high-risk groups.^{6,7} Moreover, influenza vaccination of healthcare workers indirectly reduces the morbidity and mortality of high-risk individuals who visit health facilities to receive healthcare services.^{8,9} Many countries have seasonal influenza vaccination programs, which are cost-effective in preventing high-risk individuals and healthcare workers from getting an influenza infection.¹⁰

In Thailand, 76 provinces and 1 special administrative area (Bangkok Metropolitan) are categorized into 13 health regions. In 2019, there were 378,881 reported influenza cases (571 per 100,000 population) and 27 deaths. Bangkok, the capital and most populous city of Thailand, had a morbidity rate of 1,583 per 100,000 population—the highest in the country.¹¹ In 2008, the National Health Security Office (NHSO) started the national program of seasonal influenza vaccination as one of many activities to promote health promotion and prevent disease.¹² Seasonal influenza vaccinations are provided to high-risk individuals from May to September since the seasonality of influenza epidemics is from July to November¹³; high-risk individuals include pregnant women, children, the elderly, and individuals with chronic diseases, cerebral palsy, thalassemia, acquired immunodeficiency syndrome (AIDS), and obesity. Thai citizens in high-risk groups can receive a free vaccination service at health facilities in the National Health Security System.

In 2012, the influenza vaccination coverage in Thailand was only 6.3%, and the wastage rate of the influenza vaccine was 9.6%. In the Bangkok health region, the wastage rate was 17%.¹² Up until 2018, the influenza vaccination system was only provided as a walk-in service. Before 2018, individuals had to visit health facilities for vaccinations, which were provided on a first-come-first-served basis. In May 2019, the Bangkok health region created an online registration system as a pilot project to increase influenza vaccination coverage. The online registration system allowed individuals to reserve vaccinations and receive vaccination services at hospitals, health service centers, and private clinics in the National Health Security System. In 2020, the walk-in service system was replaced with the online registration system in the Bangkok health region. However, the other 12 health regions continued to use the walk-in service system. Data obtained since the online registration system was launched in the Bangkok health region have not been analyzed for further application and expansion to other health services throughout Thailand. Thus, the purpose of this study was to compare the coverage of influenza vaccination in high-risk groups between the online registration and walk-in service systems in Thailand.

MATERIALS AND METHODS

Study design

This retrospective study included data from Thai individuals who obtained an influenza vaccination from the national program in the Bangkok health region in 2018 and 2020. The national program provides annual vaccinations from May to September. The registration systems used for the vaccination service were the walk-in service system in 2018 and the online registration system in 2020. All data of vaccinated individuals were submitted by health facilities to the NHSO database in accordance with the health information standard structure of NHSO. This study was approved by the Ethics Committee for Human Research of the Mahamakut Buddhist University, Thailand (No. 364/2566).

The national program of seasonal influenza vaccination

The national program of seasonal influenza vaccination in Thailand has been held by the NHSO since 2008.¹² This program aims to reduce infection risk, severe illness, and death due to influenza outbreaks among seven high-risk groups, which are determined by the National Vaccine Committee. The seven high-risk groups are pregnant women who are in the second trimester or later; children aged 6 months to 2 years; the elderly (65 years or older); individuals who have chronic diseases, such as chronic obstructive pulmonary disease, asthma, heart disease, cerebrovascular disease, kidney failure, diabetes, and who are undergoing chemotherapy for cancer; individuals with cerebral palsy; individuals with thalassemia or AIDS; and individuals with obesity (defined as having a body weight of more than 100 kg or a body mass index more than 35 kg/m²). Thai citizens in the high-risk groups can receive a free vaccination at the health facilities in the National Health Security System such as public hospitals, private hospitals, public health centers, and private clinics. The vaccination period is decided regionally, ranging between May and September.

The walk-in service system

The walk-in service system allows high-risk individuals to receive walk-in influenza vaccinations in conveniently located health facilities during the program period. However, this relies on the availability of influenza vaccines in these health facilities.

The number of influenza vaccines that a health facility receives from the NHSO is estimated based on the number of at-risk people in the area. The health facilities provide vaccinations on a first-come-first-served basis and must send the information of all vaccine recipients to the NHSO. This includes identification number, name, birthday, age, sex, categories of high-risk groups, vaccination date, site of vaccination, and national health insurance type.

In the Bangkok health region, all health facilities submitted the information to the Bangkok Promotion & Prevention Database System program of the NHSO Region 13 Bangkok until 2019. Furthermore, each vaccine recipient was categorized into one of the seven high-risk groups and registered at health facilities nearest to their residence before the vaccine campaign started. After the recipient had the influenza vaccine, the health facility registered the high-risk category to NHSO. However, when the registered category was different from 'child' but the recipient was 6 months to 2 years, 'child' was added as the second category of high-risk group to NHSO. When the recipient was 65 years or older but the registered category was other than "elderly", "elderly" was added as the second category.

The online registration system

The online registration system allows high-risk individuals to reserve the vaccination date and choose the vaccination site before and during the program period through the NHSO website which supports both personal computers and smartphones, the NHSO call center, or by visiting health facilities. People can also postpone their vaccination date using the same system. In 2020, all health facilities in the Bangkok health region submitted the information to the NHSO Region 13 Bangkok's Registration system for the influenza vaccination program.

Data of influenza vaccine recipients

There were 162,214 individuals who received influenza vaccinations in the Bangkok health regions in 2018 and 217,407 in 2020. The data of the 379,621 vaccine recipients were provided by the NHSO after the removal of personal information such as identification number, name, and birthday. After exclusion of incomplete data (n = 4,911), the data of 374,710 individuals who had vaccinations in Bangkok in 2018 (n = 162,214) and in 2020 (n = 212,496) were analyzed

in this study. The final data for this study included sex, age (younger than 3 years, 3–18 years, 19–40 years, 41–65 years, and 65 years or older), categories of high-risk groups, health facilities, and types of national health insurance. Health facilities were categorized into primary, secondary, and tertiary according to their amenities.

Influenza vaccination coverage

At the end of every year, the NHSO estimates the target population from the current and past years to forecast demand for influenza vaccine supplies in each health facility for the upcoming year. In Thailand, individuals in high-risk groups are registered to a health facility in their respective residence area. The estimated target population includes individuals in the seven high-risk groups registered to health facilities in the health regions. In this study, the influenza vaccine coverage was calculated from the number of vaccine recipients divided by the estimated target population for the same year.

Statistical analyses

Descriptive analysis was performed to summarize the characteristics of vaccine recipients and to estimate the vaccine coverage in each high-risk group and health facility level. Variables were compared between the walk-in system in 2018 and the online system in 2020. Chi-square test was performed to compare the characteristics of vaccine recipients, the distribution of high-risk groups, and the vaccine coverage between the two systems. A $p < 0.05$ was considered statistically significant.

RESULTS

Characteristic of influenza vaccine recipients

The total number of influenza vaccine recipients in the Bangkok health region that used the walk-in service system in 2018 and the online registration systems in 2020 was 162,214 and 212,496, respectively. After exclusion of individuals with missing data, a total of 374,710 influenza vaccine recipients (162,214 in 2018 and 212,496 in 2020) were analyzed. Most vaccine recipients were female (64.6% in 2018 and 63.8% in 2020), in the age group of 65 years or older (59.3% in 2018 and 63.0% in 2020), had the universal coverage scheme in the National Health Insurance Program (67.9% in 2018 and 66.4% in 2020), and had vaccinations at the primary level (53.7% in 2018 and 61.6% in 2020; Table 1). The major high-risk group of influenza vaccine recipients was the elderly (59.3% in 2018 and 63.0% in 2020), followed by individuals with chronic diseases (55.2% in 2018 and 45.6% in 2020). The total percentage of all high-risk groups was 118.9% in 2018 and 114.1% in 2020, because ‘child’ or ‘elderly’ was added by the NHSO when children (6 months to 2 years old) or the elderly (≥ 65 years old) were registered as having other high-risk. In the online system in 2020, there were more vaccine recipients who were males (36.2% vs 35.4%), older than 65 years (63.0% vs 59.3%), had health insurance other than the universal coverage scheme, Social Security Scheme, and Civil Servant Medical Benefit Scheme (6.2% vs 1.9%), and had vaccine at health facilities of the primary level (61.6% vs 53.7%) compared to those in the walk-in system in 2018.

Influenza vaccination service in the high-risk groups at the primary, and the secondary and tertiary levels of health facilities

Table 1 also shows the comparison of influenza vaccination services in the high-risk groups according to the health facility levels. The major high-risk group of influenza vaccine recipients

Table 1 The characteristics of vaccine recipients in the Thai national influenza vaccination program in the Bangkok health region in 2018 and 2020

Variables	Walk-in in 2018 (N=162,214)		Online in 2020 (N=212,496)		p-value
	n	%	n	%	
Sex					<0.001
Male	57,468	35.4	77,009	36.2	
Female	104,746	64.6	135,487	63.8	
Age groups (years old)					<0.001
<3	3,444	2.1	3,539	1.7	
3-18	4,673	2.9	3,840	1.8	
19-40	9,903	6.1	12,319	5.8	
41-64	48,064	29.6	58,893	27.7	
≥65	96,130	59.3	133,905	63.0	
National Health Insurance Programs					<0.001
UCS	110,083	67.9	141,046	66.4	
SSS	18,203	11.2	24,463	11.5	
CSMBS	30,801	19.0	33,911	16.0	
Other	3,127	1.9	13,076	6.2	
Level of health facilities					<0.001
Primary	87,173	53.7	130,984	61.6	
Secondary/tertiary	75,041	46.3	81,512	38.4	
High-risk group according to the health facility levels					
All levels	162,214		212,496		
Pregnancy	1,980	1.2	3,164	1.5	<0.001
Child	3,444	2.1	3,539	1.7	
Elderly	96,130	59.3	133,905	63.0	
Chronic diseases	89,540	55.2	96,864	45.6	
Cerebral palsy	317	0.2	848	0.4	
Thalassemia/AIDS	841	0.5	1,473	0.7	
Obesity	654	0.4	2,693	1.3	
Primary level	87,173		130,984		
Pregnancy	375	0.4	990	0.8	<0.001
Child	957	1.1	2,239	1.7	
Elderly	54,752	62.8	86,717	66.2	
Chronic diseases	50,257	57.7	61,143	46.7	
Cerebral palsy	223	0.3	505	0.4	
Thalassemia/AIDS	157	0.2	561	0.4	
Obesity	436	0.5	1,775	1.4	
Secondary and tertiary levels	75,041		81,512		
Pregnancy	1,605	2.1	2,174	2.7	<0.001
Child	2,487	3.3	1,300	1.6	
Elderly	41,378	55.1	47,188	57.9	
Chronic diseases	39,283	52.3	35,721	43.8	
Cerebral palsy	94	0.1	343	0.4	
Thalassemia/AIDS	684	0.9	912	1.1	
Obesity	218	0.3	918	1.1	

UCS: Universal Coverage Scheme

SSS: Social Security Scheme

CSMBS: Civil Servant Medical Benefit Scheme

AIDS: acquired immunodeficiency syndrome

was the elderly at the primary level (62.8% in 2018 and 66.2% in 2020) and at the secondary and tertiary level (55.1% in 2018 and 57.9% in 2020) followed by individuals with chronic diseases (57.7% in 2018 and 46.7% in 2020 at the primary level; 52.3% in 2018 and 43.8% in 2020 at the secondary and tertiary levels). In the 2020 online system, the percentage of the elderly was higher at the primary level (66.2%) and at the secondary and tertiary level (57.9%) compared to that in the 2018 walk-in system (62.8% and 55.1%, respectively). At health facilities of the secondary and tertiary level, the percentage of recipients with pregnancy (2.1% in 2018 and 2.7% in 2020, respectively) and thalassemia/AIDS (0.9% in 2018 and 1.1% in 2020, respectively) was higher than those at health facilities of the primary level (pregnancy, 0.4% in 2018 and 0.8% in 2020, respectively; thalassemia/AIDS, 0.2% in 2018 and 0.4% in 2020, respectively).

The influenza vaccination coverage

The influenza vaccination coverage was estimated using the number of vaccine recipients and the target population according to high-risk groups, the levels of health facilities, and years. The total target population increased from 905,730 individuals in 2018 to 929,071 individuals in 2020. The vaccine coverage at all health facility levels in the Bangkok health region increased from 17.9% in 2018 to 22.9% in 2020 (Table 2). The coverage at the primary level increased from 21.3% to 31.4%, which was greater than that of the secondary and tertiary levels (from 15.1% to 15.9%). The coverage at all levels, at the primary level, and at the secondary and tertiary levels was significantly higher in 2020 compared to that in 2018.

The highest coverage at all levels was found in individuals with chronic disease, both in 2018 (39.6%) and 2020 (33.9%), followed by the elderly (19.1% in 2018 and 30.5% in 2020) and obesity groups (13.2% in 2018 and 33.3% in 2020). The coverage of the groups of pregnant women, children, individuals with cerebral palsy, and individuals with thalassemia/AIDS was lower than 10% in 2018 and in 2020. The coverage increased significantly from 2018 to 2020 in the groups of children (3.1% to 3.3%, $p = 0.004$), the elderly (19.1% to 30.5%, $p < 0.001$), individuals with cerebral palsy (3.2% to 5.5%, $p < 0.001$), and individuals with thalassemia/AIDS (3.9% to 5.5%, $p < 0.001$), and obesity (13.2% to 33.3%, $p < 0.001$). However, the coverage in individuals with chronic diseases decreased (39.6% to 33.9%, $p < 0.001$) and did not change in pregnant women (7.2% to 6.8%, $p = 0.067$).

At health facilities of the primary level, the highest coverage in 2018 was in the group of individuals with chronic diseases (47.7%) followed by the elderly (26.1%) and obesity (15.8%). The coverage increased from 2018 to 2020 in the groups of pregnant women (3.3% to 4.2%, $p < 0.001$), children (1.5% to 3.9%, $p < 0.001$), the elderly (26.1% to 50.8%, $p < 0.001$), individuals with cerebral palsy (4.0% to 6.2%, $p < 0.001$), individuals with thalassemia/AIDS (1.4% to 3.8%, $p < 0.001$), and individuals with obesity (15.8% to 42.9%, $p < 0.001$). However, the coverage among people with chronic diseases decreased from 47.7% in 2018 to 44.1% in 2020. In 2020, the highest coverage was in the elderly (50.8%) followed by chronic diseases (44.1%) and obesity (42.9%).

At health facilities of the secondary and tertiary level, the highest coverage in 2018 was in the group of individuals with chronic diseases (32.6%), followed by the elderly (14.1%) and individuals with obesity (10.0%). The coverage increased from 2018 to 2020 in the elderly group (14.1% to 17.6%, $p < 0.001$), individuals with cerebral palsy (2.3% to 4.8%, $p < 0.001$), individuals with thalassemia/AIDS (6.7% to 7.8%, $p < 0.001$), and individuals with obesity (10.0% to 23.3%, $p < 0.001$). However, the coverage between 2018 and 2020 among children (5.0% to 2.6%, respectively) and people with chronic diseases (32.6% to 24.2%, respectively) decreased. In 2020, the highest coverage was in the group of individuals with chronic diseases (24.2%), followed by individuals with obesity (23.3%) and the elderly (17.6%).

Table 2 Comparison of the influenza vaccination coverage in each high-risk group according to the health facility levels in the Bangkok health region in 2018 and 2020

	Walk-in in 2018			Online in 2020			<i>p</i> -value
	Service	Target	Coverage (%)	Service	Target	Coverage (%)	
All levels							
Total	162,214	905,730	17.9	212,496	929,071	22.9	<0.001
Pregnancy	1,980	27,679	7.2	3,164	46,524	6.8	0.067
Child	3,444	112,333	3.1	3,539	107,878	3.3	0.004
Elderly	96,130	503,684	19.1	133,905	438,654	30.5	<0.001
Chronic diseases	89,540	225,931	39.6	96,864	285,999	33.9	<0.001
Cerebral palsy	317	9,810	3.2	848	15,352	5.5	<0.001
Thalassemia/AIDS	841	21,356	3.9	1,473	26,589	5.5	<0.001
Obesity	654	4,937	13.2	2,693	8,075	33.3	<0.001
Primary level							
Total	87,173	408,437	21.3	130,984	417,254	31.4	<0.001
Pregnancy	375	11,294	3.3	990	23,727	4.2	<0.001
Child	957	62,411	1.5	2,239	57,179	3.9	<0.001
Elderly	54,752	209,725	26.1	86,717	170,603	50.8	<0.001
Chronic diseases	50,257	105,466	47.7	61,143	138,522	44.1	<0.001
Cerebral palsy	223	5,638	4.0	505	8,134	6.2	<0.001
Thalassemia/AIDS	157	11,147	1.4	561	14,948	3.8	<0.001
Obesity	436	2,756	15.8	1,775	4,141	42.9	<0.001
Secondary and tertiary level							
Total	75,041	497,293	15.1	81,512	511,817	15.9	<0.001
Pregnancy	1,605	16,385	9.8	2,174	22,797	9.5	0.391
Child	2,487	49,922	5.0	1,300	50,699	2.6	<0.001
Elderly	41,378	293,959	14.1	47,188	268,051	17.6	<0.001
Chronic diseases	39,283	120,465	32.6	35,721	147,477	24.2	<0.001
Cerebral palsy	94	4,172	2.3	343	7,218	4.8	<0.001
Thalassemia/AIDS	684	10,209	6.7	912	11,641	7.8	0.001
Obesity	218	2,181	10.0	918	3,934	23.3	<0.001

AIDS: acquired immunodeficiency syndrome

DISCUSSION

This is the first study that analyzes the differences between the vaccination coverages of the online registration and walk-in service systems in the Thai national program of seasonal influenza vaccination. The coverage of seasonal influenza vaccination in the Bangkok health region improved after the system was changed from walk-in to online in all health facility levels. This was especially clear at health facilities of the primary level and in high-risk groups of individuals with obesity and the elderly. The increase in coverage at the primary level may be due to the high number of primary level health facilities distributed in districts of Bangkok. These health care facilities focus more on health promotion and disease prevention than the secondary and

tertiary level facilities. Therefore, the improvement of vaccine coverage was greater in primary health facilities compared to secondary and tertiary level facilities.

The increase in coverage among individuals with obesity and the elderly may be due to increased accessibility to the vaccination service where the online system helps individuals who do not visit health facilities regularly. Individuals with chronic disease, cerebral palsy, and thalassemia/AIDS require regular visits to health facilities due to the nature of their diseases. Therefore, the benefit of the online registration system might be minimal for these individuals. The change in system did not improve coverage among the chronic disease group at any level. The target people of the chronic disease group at all health facility levels increased by 60,068 (26.6%) between 2018 and 2020. However, only 7,324 vaccine recipients (8.2%) increased in this group. The number of chronic disease cases in the Bangkok health region has been increasing because the population in Bangkok is rapidly aging.¹⁴

The coverage in people with thalassemia/AIDS was low in both systems and all levels of health facilities. This may be because most people in this group are people with AIDS. This group should include all people with HIV. However, the guidelines of the Thai national program of seasonal influenza vaccination determines that only people with AIDS are eligible for the vaccine services but not people with HIV who have not developed AIDS. The influenza vaccine coverage among HIV patients varies among countries, but a study in Brazil showed that the low level of CD4 cells and detectable levels of HIV virus were associated with non-vaccination against influenza.¹⁵ People with AIDS may have poor compliance with anti-retroviral treatment and less likely to follow recommendations of vaccinations.

Children aged 6 months to 2 years had the lowest vaccination coverage among all high-risk groups in both systems. Seasonal influenza vaccination has been included in the Expanded Program on Immunization for children since 2018, but the vaccination is provided by the national program of seasonal influenza vaccination. Influenza vaccination is a seasonal vaccination, which is different from the other vaccines in the routine vaccination program of the Expanded Program on Immunization that are provided according to the age of children. The vaccination coverage in the routine immunization program for children under 3 years of age is very high (88.4%–99.8%).¹⁶ Furthermore, the mother-and-child handbook in Thailand includes information about the seasonal influenza vaccination for pregnant women, but not for children. Therefore, to increase the influenza vaccination coverage in children aged 6 months to 2 years, information about seasonal influenza vaccination for children should be included in the mother-and-child handbook. Furthermore, healthcare providers should recommend the time of the seasonal influenza vaccination whenever children and their parents visit health facilities for routine vaccination of the children.

A previous study conducted in Nakhon Phanom Province in northeastern Thailand reported that the influenza vaccination coverage was significantly lower when the distance from home to the nearest health facility was farther. In addition, 28% of unvaccinated individuals did not know that the vaccine was available for them.¹⁷ A study conducted in Australia including university students and staff showed that having an online appointment system for influenza vaccination increased the vaccination coverage since it provided information to target people.¹⁸ Therefore, changing the system from the walk-in service to the online registration system may be one of the methods for improving the vaccination coverage, providing more information, and reducing wasteful visits to health facilities.

There are some limitations to this study. First, this study did not include the data of all influenza vaccine recipients in the study sites. Some health facilities might have problems with exporting the data of vaccine recipients. As a result, the overall data might be underreported.¹⁹ However, the data analyzed in the study were obtained from 266 health facilities in 2018 and

311 health facilities in 2020 in the Bangkok health region, adding power to the study. Second, the service reporting system in the Bangkok health region, assigns each recipient to only one of the high-risk groups, although 18.9% of recipients in 2018 and 14.1% in 2020 had two high-risk categories. However, more recipients might have two high-risk categories or more, because the morbidity of chronic disease or obesity are higher as people get older. The prevalence of obesity among people with chronic diseases, such as diabetes mellitus or heart diseases, might be high. Therefore, the coverage in each group might be underestimated in Bangkok. Third, this study did not include health facilities in the private sector that were not in the National Health Security System. Furthermore, the COVID-19 pandemic might have affected the coverage of influenza vaccination in 2020, although there was no restriction by the government during the influenza vaccine campaign (from May to September) that year.

In conclusion, this study compared the influenza vaccination coverages in high-risk groups between the online registration and walk-in service systems. The coverage among the Bangkok health region was greater in the online registration system compared to the walk-in service system, especially in the elderly and obese individuals, and at the primary health facilities. However, children aged 6 months to 2 years had the lowest vaccination coverage in all regions and systems. Therefore, the online registration system should be expanded to all regions in Thailand and the influenza vaccination for children should be included in the mother-and-child handbook. Moreover, healthcare providers should advise about the seasonal influenza vaccination period whenever children and their parents visit health facilities for routine vaccination.

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CONFLICT OF INTEREST

All authors declare that there are no competing interests.

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