



July 2016

## Summary Report - The 2015/2016 Influenza Season

### Main Findings:

#### Laboratory Surveillance:

- In the 2015/2016 winter season, the surveillance network numbered 26 clinics distributed throughout Israel. The sentinel clinic network operated from the last week of September 2015 (Week 40) until the second half of April 2016 (Week 15).
- A total of 1,919 specimens were collected from the sentinel clinic network. Approximately 44% of the specimens were positive for influenza; 9.2% of the specimens were positive for RSV.
- Most influenza-positive specimens were positive for type B influenza (56.5%), and 43.5% of the specimens were found to be positive for type A influenza, of which 98% were found to be positive for influenza A(H1N1)pdm09.
- The influenza virus isolation rate for specimens from the sentinel clinics reached a peak of approximately 72% in Week 3 of 2016.
- 94.7% of the specimens from the sentinel clinics that were positive for influenza type B and that underwent molecular characterization were from the Victoria lineage, and therefore did not correspond to the vaccine strain, which contained an influenza B strain from the Yamagata lineage. The type A influenza components of the vaccine were found to correspond to the influenza strains that were widespread in the population this season.

#### Clinical Surveillance:

- In the 2015/16 winter season, influenza-like morbidity in the community was seen relatively early as compared to the multi-annual average, with higher rates than for the previous two influenza seasons. Influenza activity in the 2015/16 winter season is defined as medium, according to the thresholds calculated using the algorithm developed in the framework of the European influenza surveillance project.
- Similarly to the two previous winter seasons, in the 2015/16 winter season influenza-like morbidity rates in the community were highest for infants, children and youths up to the age of 18, and were low for the elderly aged 65 and over.
- The rate of visits to "Maccabi Healthcare Services" physicians with a diagnosis of pneumonia was high for infants, children and youths aged 2-18 years. In the 2015/16 winter season, the visit rate for infants under the age of two years reached a peak of 75 visits per 10,000 infants.



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- Pediatric emergency room visits due to pneumonia were mostly below the multi-annual average during the 2015/16 winter season.
- Adult emergency room visits due to pneumonia exceeded the multi-annual average during most of the 2015/16 winter season.
- Throughout the entire 2015/16 winter season, the average hospital bed occupancy rate in internal medicine departments of general hospitals exceeded 100%.
- In pediatric departments, the average hospital bed occupancy rate exceeded 100% from Week 47 of 2015 (second half of November 2015) until Week 2 of 2016 (second half of January 2016).
- In the 2015/16 winter season, the percentage of deaths due to pneumonia varied around the seasonally expected level.



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### Immunization against Influenza:

- In the 2015/16 winter season, two types of vaccine were in use in Israel: an inactivated trivalent vaccine (against 3 strains of influenza) and an inactivated quadrivalent vaccine (against 4 strains of influenza).
- The inactivated trivalent vaccine is recommended for the overall population from age 6 months; infants from age 6 months to age two years may only receive inactivated vaccine, while the population aged two years to 49 years may receive either a live attenuated vaccine or an inactivated vaccine (there is no preference for a live attenuated vaccine over an inactivated vaccine for children aged 2-17 years). From age 50 and over, only an inactivated vaccine is recommended. The inactivated quadrivalent vaccine is intended for ages 3 years and over.
- In the 2015/16 winter season, some 1,740,000 people were immunized against seasonal influenza (approximately 20.9% of the total population of Israel). Immunization coverage in the elderly group, of persons aged 65 years and over, reached approximately 66%. Immunization coverage for infants and children aged 6-59 months reached approximately 24%.



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- **Background:**

The influenza surveillance system in Israel is administered by the Israel Center for Disease Control (ICDC) in the Ministry of Health, and comprises two branches: laboratory surveillance and clinical surveillance. The laboratory surveillance is based on nasal and pharyngeal swab specimens collected from patients presenting to one of the sentinel clinics with influenza-like illness, and tested for the presence of influenza virus at the Central Virology Laboratory of the Ministry of Health. The clinical surveillance is primarily based upon information regarding patient visits to clinics in the community and to hospital emergency rooms due to influenza-like illness, upper respiratory tract infections and pneumonia.

All the information collected from the various information sources is analyzed by the staff of the Infectious Diseases Unit of the ICDC, summarized in weekly reports during the influenza season and distributed to the management of the Ministry and to specific groups of physicians. The reports may be viewed on the Ministry of Health website in Hebrew and in English<sup>1</sup>.

The objectives of the influenza surveillance system are to present an up-to-date picture of morbidity due to influenza and its complications, to describe the burden on the health system and to describe the active influenza strains. The surveillance is usually conducted from October until April of the following year<sup>2</sup>.

### **1. Laboratory Surveillance**

Starting from the winter of 1996/97, the ICDC has been operating a network of sentinel clinics in the community to identify the influenza viruses that are active during the influenza season. In the 2015/2016 winter season, the surveillance network numbered 26 clinics distributed throughout Israel, from Dimona in the South to Akko in the North (Appendix 1 shows the distribution of the sentinel clinics). The medical staff in these clinics are instructed to take nasal and pharyngeal swabs from patients who are in the first or second day of their illness and meet the definition of influenza-like illness (temperature of 37.8°C or higher accompanied by one or more of the following signs: cough, sore throat, muscle pain, runny nose, chills, etc.). The nasal and pharyngeal swabs are stored under refrigeration, and are transported once per week to the Central Virology Laboratory of the Ministry of Health (Public Health Services), where they are tested for the presence of influenza virus and of RSV (Respiratory Syncytial Virus). In the laboratory, the influenza viruses are characterized at the level of type, subtype and strain; antigenic and genetic changes are identified. The degree of correspondence of the influenza viruses to the seasonal vaccine is also assessed.



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### 1.1 Virological Surveillance via the Sentinel Clinic Network: Winter 2015/2016

The sentinel clinic network operated from the last week of September 2015 (Epidemiological Week 40) until the second half of April 2016 (Week 15). Table 1 shows the overall number of specimens received in the laboratory for each of the weeks of the surveillance period, by age groups of under 18, and 18 and over. The findings of the Central Virology Laboratory's testing of the specimens collected during the above period is shown in Tables 2 and 3. 56.5% of the specimens were found to be positive for influenza B, and approximately 43.5% of the specimens were found to be positive for influenza A. Some 98% of the influenza-A positive specimens were A/H1N1 2009 (Table 3). Eleven specimens during the current season were found to be positive for influenza B+A/H1N1 2009.



**Table 1: Number of Specimens by Epidemiological Week and Age Group, Winter 2015/2016<sup>1,3</sup>:**

Week	Year	Total No. of Specimens*	Number of Specimens from Children (under the age of 18)	Number of Specimens from Adults (18 years and over)
40	2015	13	8	5
41	2015	18	12	6
42	2015	28	14	14
43	2015	32	25	7
44	2015	30	19	11
45	2015	53	34	19
46	2015	66	37	29
47	2015	67	40	27
48	2015	51	25	26
49	2015	51	37	14
50	2015	72	45	27
51	2015	88	55	33
52	2015	83	43	40
53	2015	156	86	70
1	2016	144	92	51
2	2016	146	66	79
3	2016	152	66	86
4	2016	123	61	62
5	2016	162	70	92
6	2016	128	39	89
7	2016	76	34	42
8	2016	64	32	32
9	2016	42	17	25
10	2016	29	13	16
11	2016	14	6	8
12	2016	14	7	7
13	2016	11	3	8
14	2016	4	2	2
15	2016	2	2	0
<b>Total</b>		<b>1,919</b>	<b>990</b>	<b>927</b>

\*For 2 specimens, age/date of birth is missing.



**Table 2: Distribution of Influenza and RSV Isolations from Nasal and Pharyngeal Specimens Collected in the Sentinel Clinics, Winter 2015/16<sup>1,3</sup>: Numbers and Percentages**

<b>Total Number of Specimens Sent</b>	<b>N=1,919</b>	<b>%</b>
Influenza-positive specimens*	853	44.5
RSV-positive specimens*	178	9.2
Specimens negative for influenza and for RSV	888	46.3

\*4 specimens during the current season were found to be positive both for influenza and for RSV.

**Table 3: Distribution of Influenza Isolations from Nasal and Pharyngeal Specimens By Type, Winter 2015/16<sup>1,3</sup>: Numbers and Percentages**

<b>Type of Influenza Virus</b>	<b>N</b>	<b>%</b>
<b>Type A influenza</b>	<b>377</b>	<b>43.6</b>
A/H1N1 2009	371	98.4
A/H3	6	1.6
A/H1	0	0
<b>Type B influenza</b>	<b>487</b>	<b>56.4</b>
<b>Total number of isolations positive for influenza</b>	<b>864</b>	<b>100</b>

Figure 1 shows the results of testing by the Central Virology Laboratory of specimens collected at the sentinel clinics during the winter season, by week. RSV morbidity preceded influenza morbidity, as it does every season. The percentage of RSV-positive isolations began to rise in the second week



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of November 2015 (Week 46). The percentage of isolations continued to increase until the first week of December 2015, when it reached a peak of 38% of all specimens. From the third week of December 2015, the percentage of RSV isolations declined in the sentinel clinics. The percentage of influenza-positive isolations began to rise in the second week of December 2015 (Week 50), and starting from Week 51 of 2015, the percentage of influenza isolations was higher than the percentage of RSV isolations. In Week 3 of 2016 (the second half of January 2016), the percentage of influenza isolations reached a peak of some 72%, after which the percentage of isolations began to decline. Specimens positive for influenza were found throughout almost the entire surveillance period, until Week 14 of 2016 (the second week of April 2016).

**Figure 1: Nasal and Pharyngeal Specimens Positive for Influenza and for RSV Collected at the Sentinel Clinic Network, By Week of Specimen, Winter 2015/16<sup>1,3</sup>: Percentages**

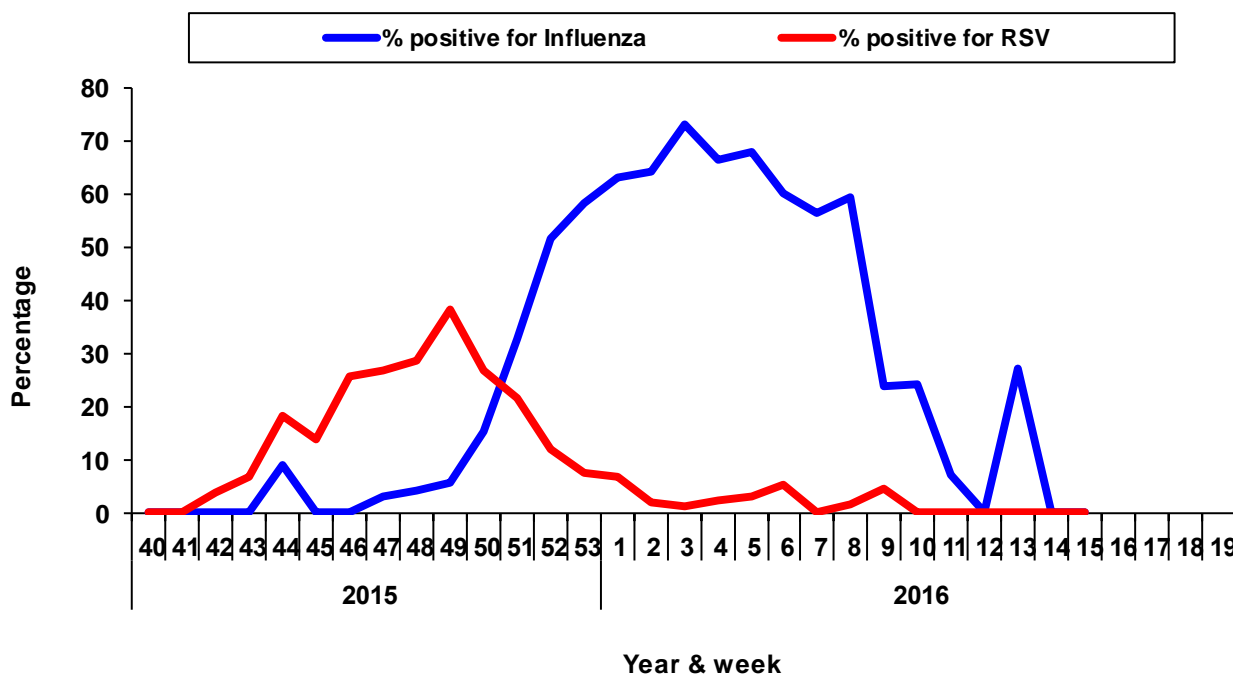


Figure 2 shows the influenza sub-types isolated from specimens in the sentinel network. A similar pattern of activity was also identified in hospitalized patients with respiratory illness diagnosed at the Central Virology Laboratory. The percentage of specimens positive for RSV declined to a few percent only, starting from Week 2 of 2016 (the second half of January 2016), and the percentage of specimens positive for influenza declined to a few percent only starting from Week 11 of 2016 (second half of March 2016)<sup>3</sup>.

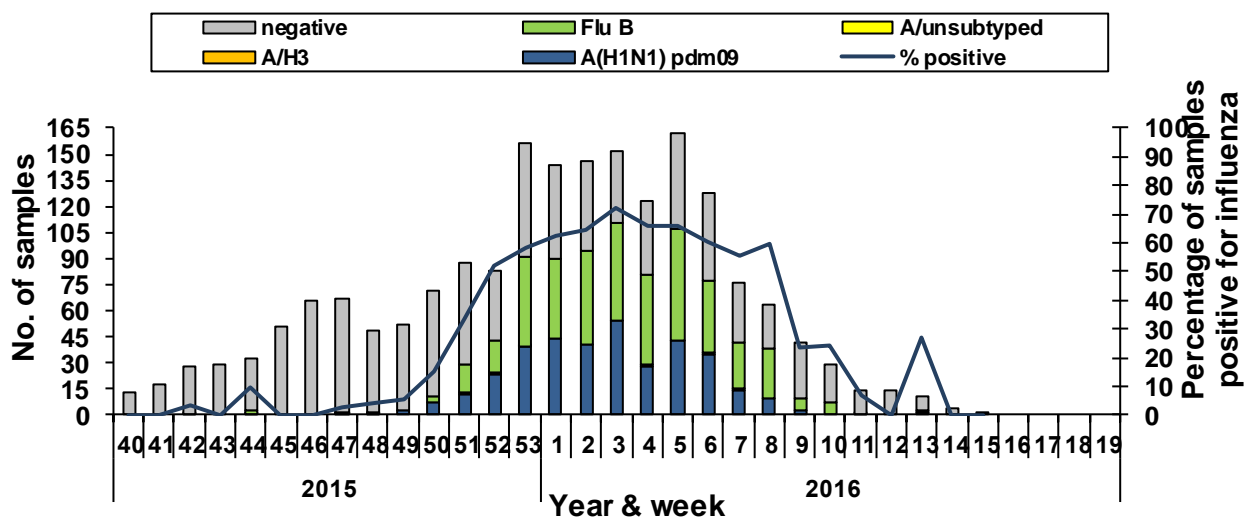




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**Figure 2: Nasal and Pharyngeal Specimens Collected at the Sentinel Clinic Network, By Laboratory Finding and Week of Specimen, Winter 2015/16<sup>1,3</sup>: Numbers and percentage positive for influenza**



## 2. Clinical Surveillance

The clinical surveillance is based on a number of information sources:

- Data regarding persons insured by the two largest HMOs in Israel ("Maccabi Healthcare Services"<sup>4</sup> and "Clalit" Health Services<sup>5</sup>) who presented to community physicians and were clinically diagnosed as having influenza or influenza-like illness, acute upper respiratory tract infection or pneumonia. Detailed non-identifiable information about these patients is conveyed to the ICDC daily, and stored in a dedicated database.
- Daily data regarding the number of patients who presented to the emergency rooms of "Clalit" Health Services' 8 general hospitals and were diagnosed with pneumonia.
- Daily data regarding hospital bed occupancy in the general hospitals.
- Data regarding deaths in the community and in hospitals.
- Weekly data regarding overall deaths in Israel due to all causes and due to pneumonia that were reported to the Division of Epidemiology in the Ministry of Health.



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## 2.1 Surveillance of Influenza-Like Morbidity in the Community

Figure 3 shows weekly influenza-like morbidity rates, based upon patient visits to "Maccabi Healthcare Services" physicians in the community during the period May 2013 to May 2016. This period includes the last three winter seasons. The average is also plotted, demonstrating seasonal influenza activity in Israel from multi-annual data (2008-2014, excluding the 2009/10 winter season, which deviated from the norm due to the appearance of a new strain of A/H1N1 influenza, which caused a pandemic). This season, we have again displayed a baseline level in the figure, which is intended to indicate the beginning of the influenza season and the intensities of influenza activity. The baseline level and the intensities were calculated using an algorithm that was developed in the framework of the European influenza surveillance project (EuroFlu), based on past data accumulated at the ICDC regarding visits to "Maccabi Healthcare Services" clinics due to influenza-like illness. Morbidity rates exceeded the baseline level for the first time in Week 51 of 2015 (the second half of December 2015), and remained above it until Week 9 of 2016 (the beginning of March 2016). Influenza activity in the 2015/16 winter season is defined as medium (by peak morbidity) when utilizing the thresholds calculated using the algorithm developed in the framework of the European influenza surveillance project.

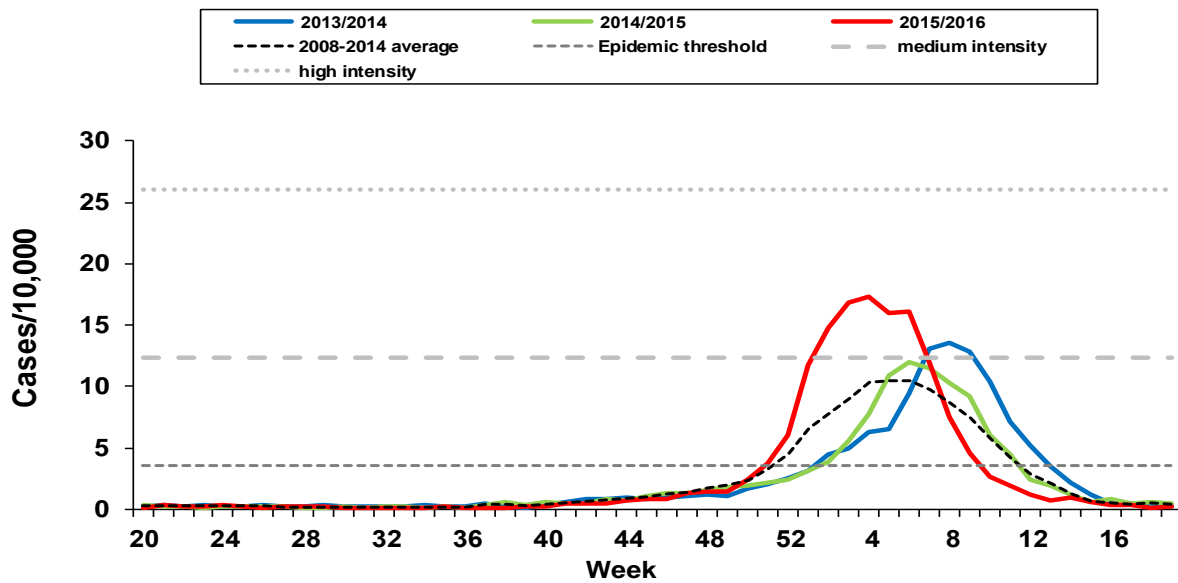
During the 2015/2016 winter season, morbidity was observed early, both with respect to the commencement of the season and with respect to the peak of the season, compared to the multi-annual average, and rates were higher than in the two preceding winter seasons. The highest morbidity rates observed were for infants, children and youths up to the age of 18 years, similarly to the previous two years (Figure 4).



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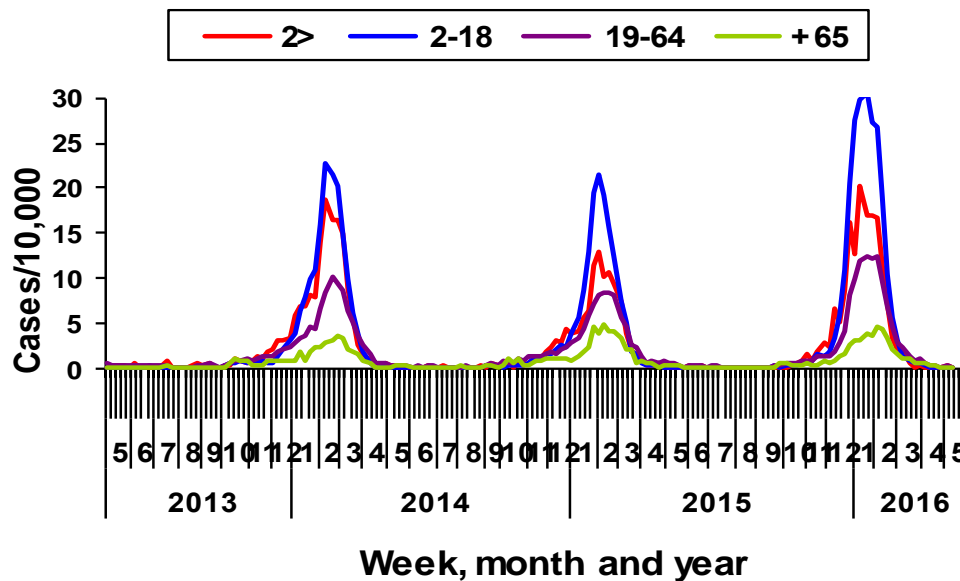
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Figure 3: Visits per Week to "Maccabi Healthcare Services" Clinics that ended with a Diagnosis of Influenza-Like Illness\*<sup>1,4</sup>: Rates per 10,000



\* The multi-annual average does not include the 2009/10 winter season.

Figure 4: Visits per Week to "Maccabi Healthcare Services" Clinics that ended with a Diagnosis of Influenza-Like Illness, by Age Group<sup>1,4</sup>: Rates per 10,000





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## 2.2 Surveillance of Pneumonia Morbidity in the Community

Figure 5 shows weekly visit rates to "Maccabi Healthcare Services" physicians that ended with a diagnosis of pneumonia during the period May 2013 to May 2016, as compared to the multi-annual average, excluding the 2009/10 winter season. In Weeks 43-49 of 2015 (end of the second half of October 2015 until the beginning of December 2015), clinic visit rates were above the multi-annual average. In Weeks 50-13 of the 2015/2016 season (the first half of December 2015 until the end of March 2016), the visit rate varied around the multi-annual average, and in Weeks 14-17 of 2016 (the beginning of April 2016 until the end of April 2016), the rates reverted to being higher than the multi-annual average (Figure 5).

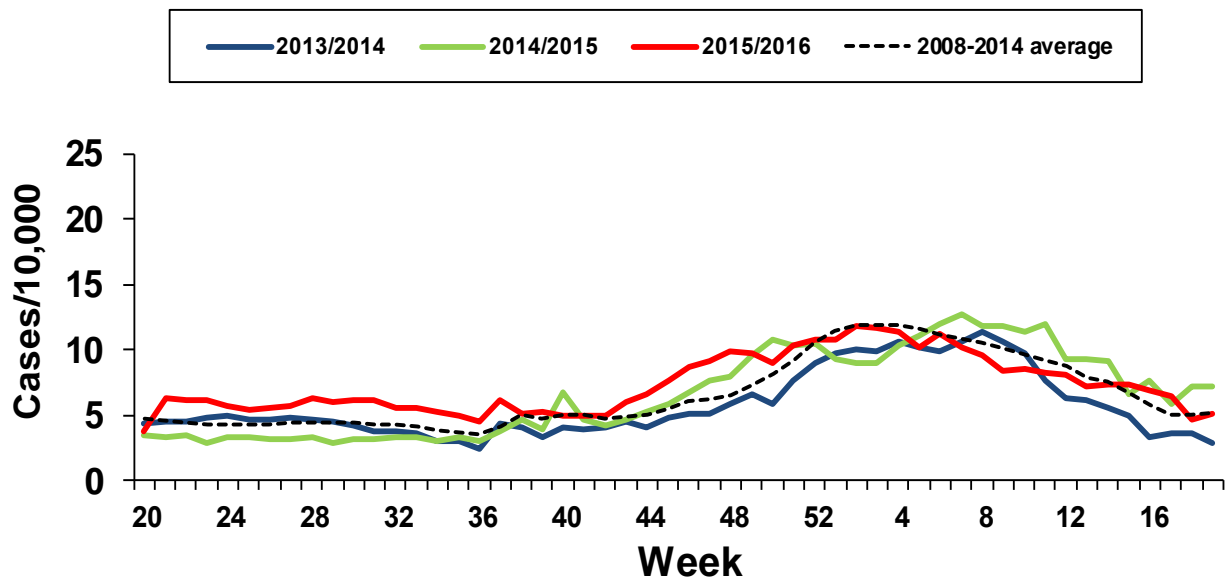
The visit rate due to pneumonia was particularly high in the group of infants under the age of two years, reaching 75 visits per 10,000 in the 2015/16 winter season. For the 19-64 year old age group, visit rates due to pneumonia were lower than the rates for the remaining age groups (Figure 6).



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Figure 5: Visits per Week to "Maccabi Healthcare Services" Clinics that ended with a Diagnosis of Pneumonia<sup>1,4\*</sup>: Rates per 10,000



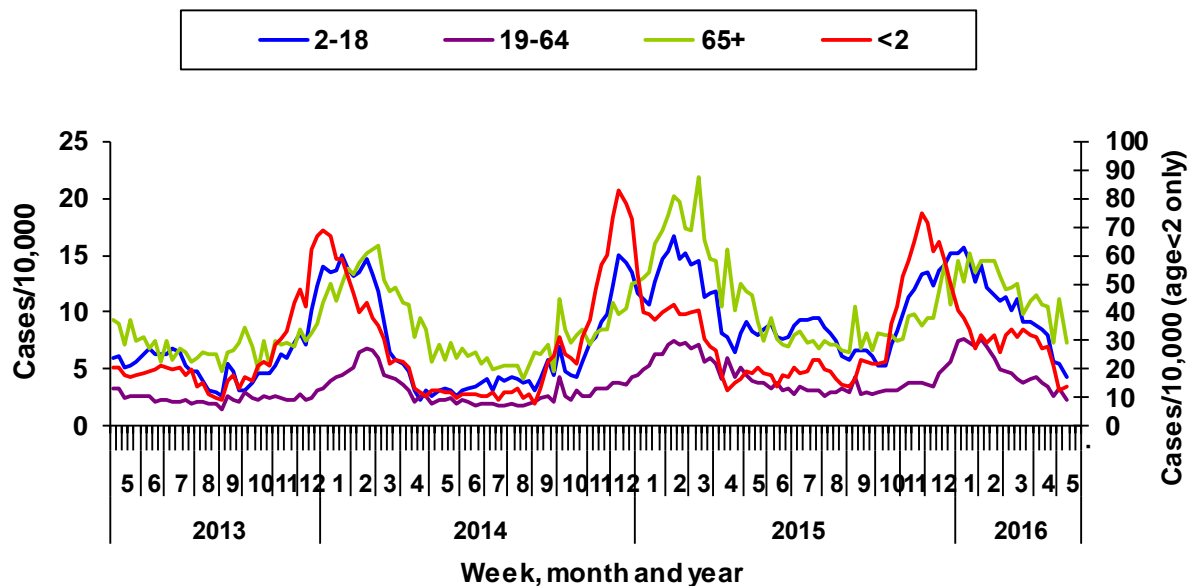
\* The multi-annual average does not include the 2009/10 winter season.



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**Figure 6: Visits per Week to "Maccabi Healthcare Services" Clinics that ended with a Diagnosis of Pneumonia, by Age Group<sup>1,4</sup>:** Rates per 10,000 (the y-axis for infants up to the age of two years is on the right hand side of the Figure, and the y-axis on the left hand side of the Figure is for all the remaining age groups)



**2.3 Surveillance of Emergency Room Visits that ended with a Diagnosis of Pneumonia**

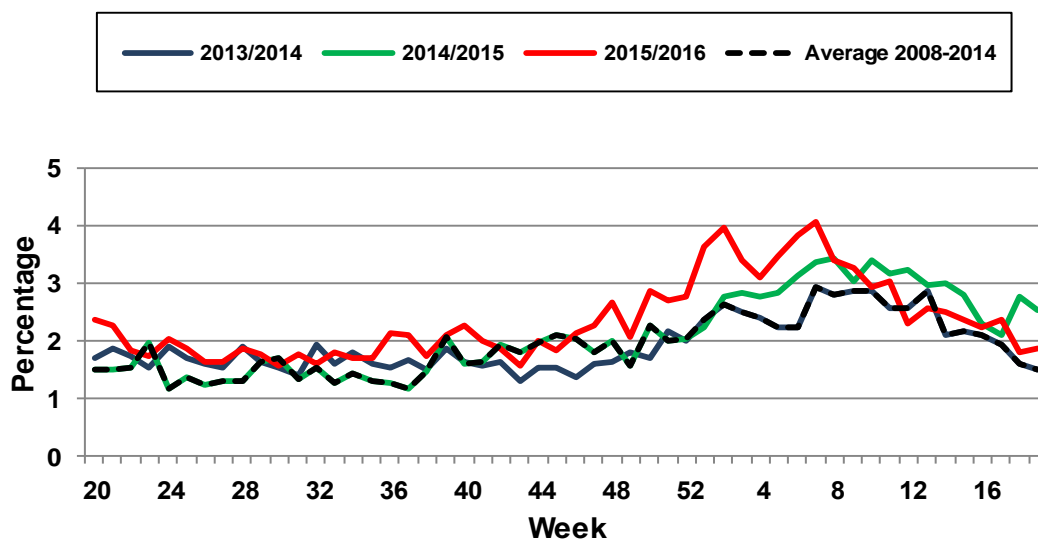
Influenza morbidity is generally accompanied by increased emergency room visits due to pneumonia. Figures 7 and 8 show visits that ended with a diagnosis of pneumonia, as a percentage of all visits that ended with any diagnosis, to adult and pediatric emergency rooms of "Clalit" Health Services' 8 general hospitals. From Week 20 of 2015 until Week 49 of 2015 (the beginning of December 2015), the percentage of visits to adult emergency rooms in which pneumonia was diagnosed varied around the multi-annual average. From Week 50 of 2015 (the beginning of December 2015) until Week 9 of 2016 (the beginning of March 2016), the percentage of visits was above the multi-annual average (Figure 7)<sup>5</sup>. For visits to pediatric emergency rooms due to pneumonia, this percentage was lower, for most of the season, than the multi-annual average (Weeks 2-16 of the year 2016) (Figure 8)<sup>5</sup>.



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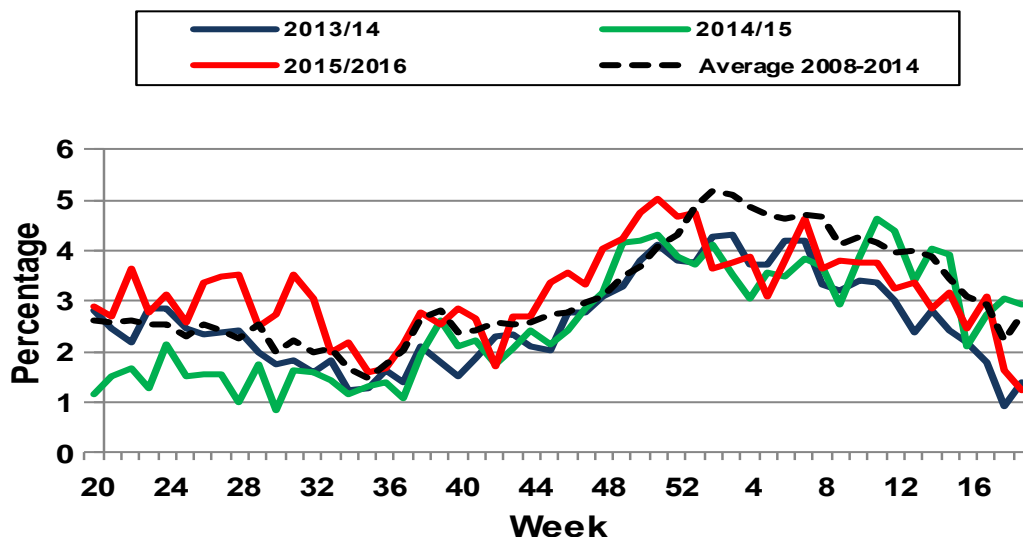
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**Figure 7: Visits to (Adult) Emergency Rooms in "Clalit" Health Services' Hospitals that ended in a Diagnosis of Pneumonia, May 2013 - April 2016, and the Multi-Annual Average\*<sup>1,5</sup> (expressed as a percentage of all visits that ended with any diagnosis)**



\* The multi-annual average does not include the 2009/10 winter season.

**Figure 8: Visits to (Pediatric) Emergency Rooms in "Clalit" Health Services' Hospitals that ended in a Diagnosis of Pneumonia, May 2013 - April 2016, and the Multi-Annual Average\*<sup>1,5</sup> (expressed as a percentage of all visits that ended with any diagnosis)**



\* The average does not include the 2009/10 winter season.



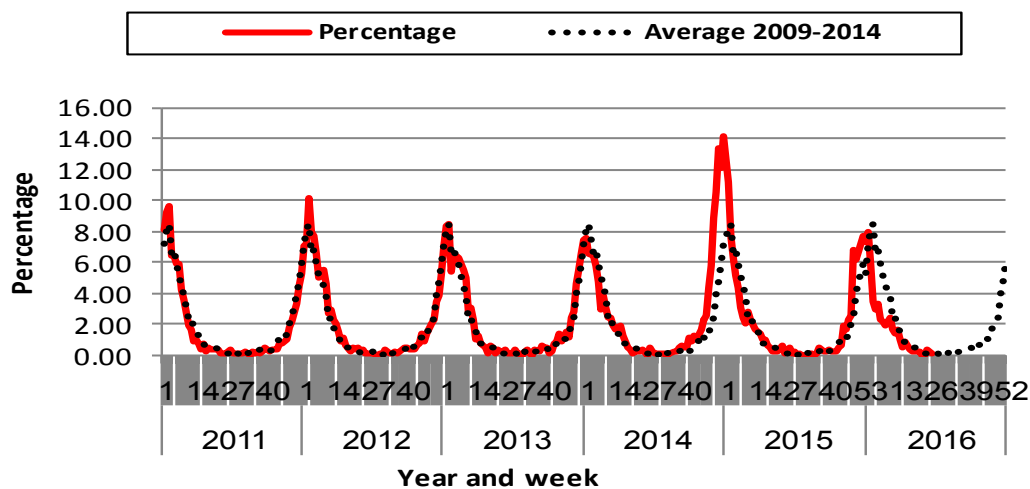
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**2.4 Surveillance of (Pediatric) Emergency Room Visits that ended with a Diagnosis of Bronchiolitis**

Figure No. 9 shows the percentage of visits of infants under the age of two years due to bronchiolitis to pediatric emergency rooms in the years 2011-2016. It can be seen that the wave of morbidity commenced this year as expected, in Week 47 of 2015, and the percentage of visits peaked in Week 1 of 2016 (the beginning of January 2016).

**Figure 9: Visits to (Pediatric) Emergency Rooms in "Clalit" Health Services' Hospitals that ended in a Diagnosis of Bronchiolitis, January 2011 - May 2016, and the Multi-Annual Average<sup>1,5</sup>** (expressed as a percentage of all visits that ended with any diagnosis)



**2.4 Surveillance of Weekly Hospital Bed Occupancy Rates in General Hospitals**

Throughout the entire 2015/2016 winter season, the average hospital bed occupancy rate in internal medicine departments of general hospitals exceeded 100%, and reached a peak of 114% in Week 7 of 2016 (the second half of February 2016). In pediatric departments, the average occupancy rate was lower than in internal medicine departments. From Week 47 of 2015 until Week 2 of 2016 (with the exception of Week 50 of 2015), the occupancy rate exceeded 100%, peaking at 102% in Week 2 of 2016 (the second week of January 2016). In pediatric departments, the peak occupancy rate this year was low relative to the peaks from the previous two influenza seasons. In departments of internal medicine, the peak occupancy rate in the departments this season was similar to the peak recorded last season, but low compared to the peak from the 2013/2014 winter season.

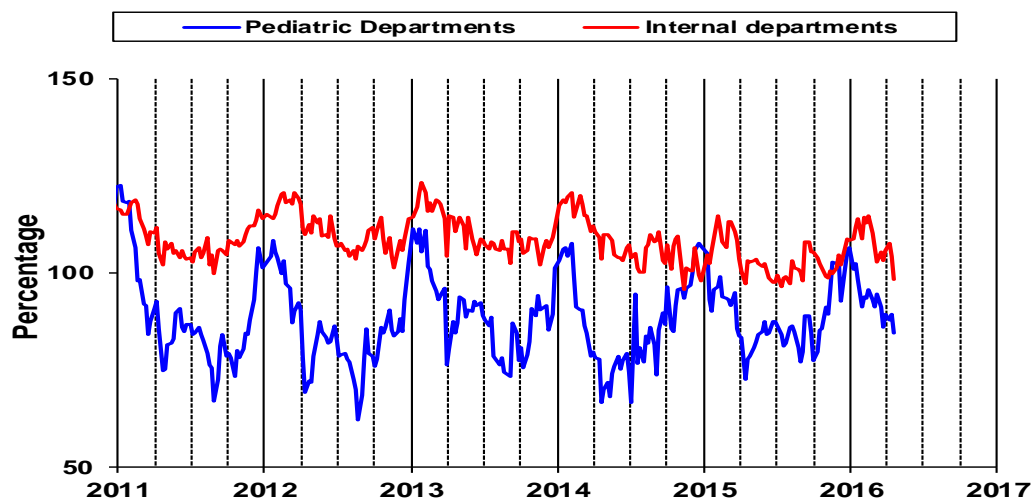




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**Figure 10: Weekly Hospital Bed Occupancy Rates in Internal Medicine and Pediatric Departments, General Hospitals, 2011-2016<sup>1</sup>: Average Percentage**



## 2.5 Surveillance of Mortality

In order to assess the severity of influenza during the winter seasons, two measures of mortality were utilized: mortality due to all causes (Figure 11), and mortality due to pneumonia as a percentage of all cases of death in Israel (Figure 12).

The number of deaths in the 2015/2016 winter season was higher than the multi-annual average from Week 50 of 2015 (the first half of December 2015) until Week 9 of 2016 (the beginning of March 2016).

During the current season, the percentage of deaths due to pneumonia was within the seasonally expected range.



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Figure 11: Number of Deaths per Week, as Compared to the Multi-Annual Average, 2012-2016<sup>6</sup>: Absolute Numbers

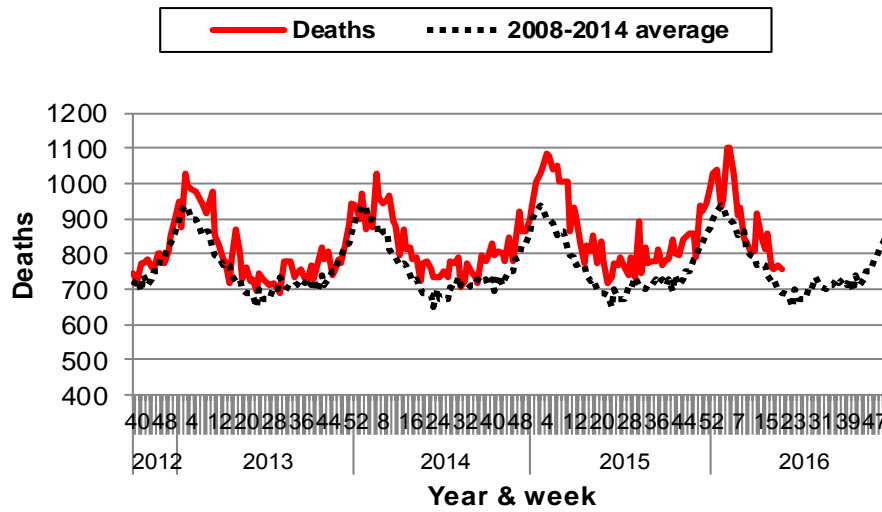
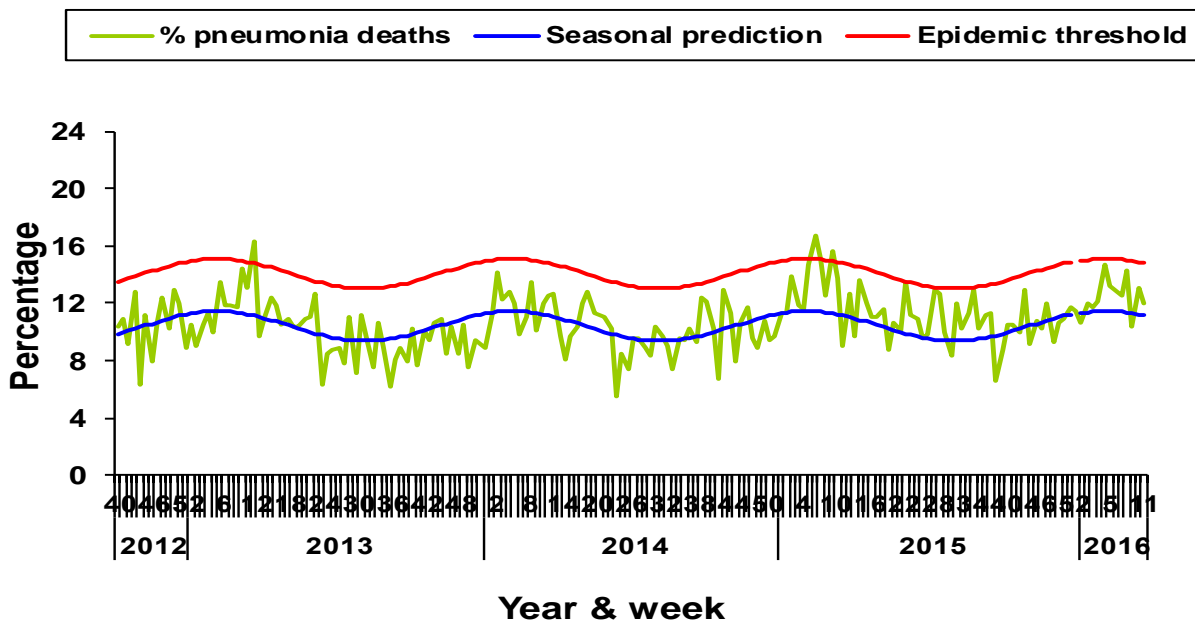


Figure 12: Deaths per Week due to Pneumonia, as Compared to Level Expected from Multi-Annual Data, 2012-2016<sup>7</sup>: Percentage of Total Cases of Death





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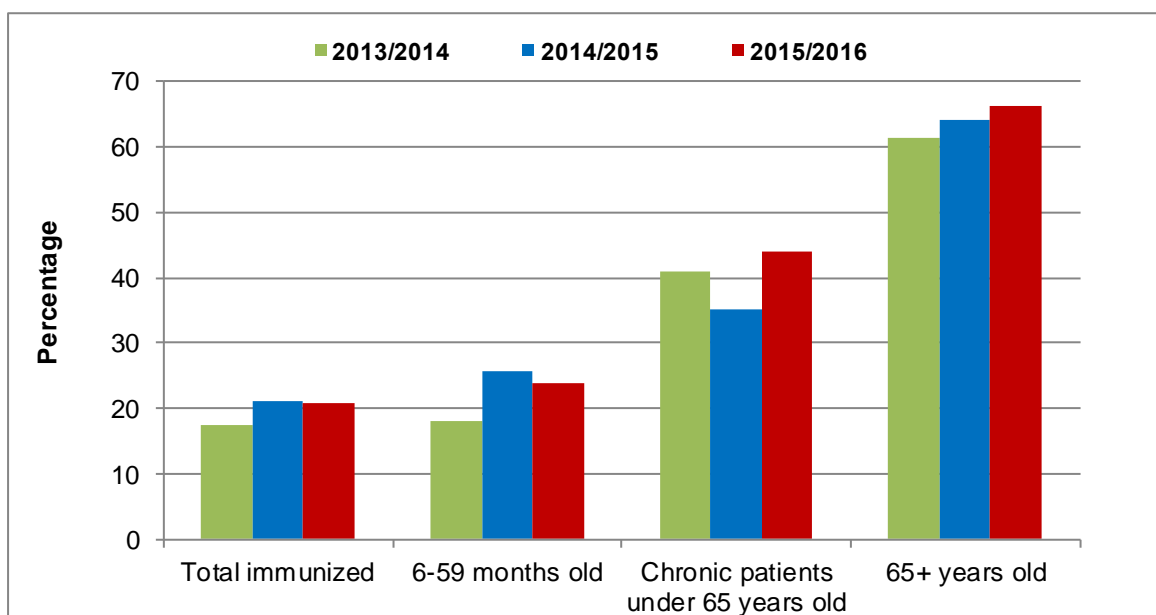
### **3. Immunization Against Influenza and the degree to which the Vaccine Corresponds to Influenza Viruses Active during the Season**

Since 2011, there has been a recommendation for the entire population over the age of 6 months to be vaccinated against influenza. 94.7% of the specimens from the sentinel clinics that were found to be positive for influenza type B and that underwent molecular characterization were from the Victoria lineage, and therefore did not correspond to the vaccine strain, which contained an influenza B strain from the Yamagata lineage. The type A influenza components of the vaccine were found to correspond to the influenza strains that were prevalent in the population this season. In the Vaccination Guide of the Division of Epidemiology of the Ministry of Health<sup>8</sup>, details can be found of the vaccine's target groups (persons at risk of suffering complications of influenza and medical staff).

In the 2015/2016 winter season, some 1,740,000 people were immunized against seasonal influenza (approximately 21% of the total population of Israel). Immunization coverage in the elderly group, of persons aged 65 years and over, reached approximately 66%. Immunization coverage for infants and children aged 6-59 months reached approximately 24%.

The percentage of persons immunized in all HMOs was similar to the percentages recorded of people immunized in the preceding winter seasons (Figure 13).

**Figure 13: Immunization Percentages for the Past Three Influenza Seasons, by Age Group<sup>9</sup>:**



#### 4. International Comparison

**USA:** The increase in the percentage of clinic visits due to ILI in the 2015/16 winter season commenced in the second half of December 2015, crossed the national baseline level, and remained above it until Week 14 of 2016 (the first half of April 2016). The current season commenced relatively late, and the peak levels were low as compared to the 2014/15 influenza season.

A/H1N1 2009 was the most dominant subtype this season, and 99.9% of all influenza A/H1N1 2009 specimens that were antigenically characterized were found to correspond to the season's influenza vaccine.

As of Week 20, ending 14-May-16, a total of 68,465 specimens had been collected. 26,306 (38.4%) were found to be positive for influenza, of which 18,643 (70.9%) were positive for influenza A: 14,778 (79.3%) were found to be positive for influenza A(H1N1)pdm09, 3,524 (18.9%) were found to be positive for influenza H3 and 341 specimens (1.8%) had not yet been subtyped. 7,663 additional specimens were found to be positive for influenza B (29.1%).



**Europe:** During the 2015/16 winter season, A(H1N1)pdm09 was the most dominant, and beginning from Week 9 of 2016 (the beginning of March 2016), influenza B became dominant among the sentinel sources.

Additionally, excess mortality was reported among adults aged 15-64 years, starting from the end of 2015 until Week 14 of 2016 (the beginning of April 2016), in the framework of the EuroMOMO project.

Most of the strains were found to antigenically correspond to the strains that compose the vaccine that contains 4 influenza strains, but not to that which contains 3 strains.

Both in Europe and in the USA, the influenza viruses were found to be highly sensitive to Oseltamivir and to Zanamivir, and highly resistant to Adamantanes<sup>10,11</sup>.

#### Sources of Information:

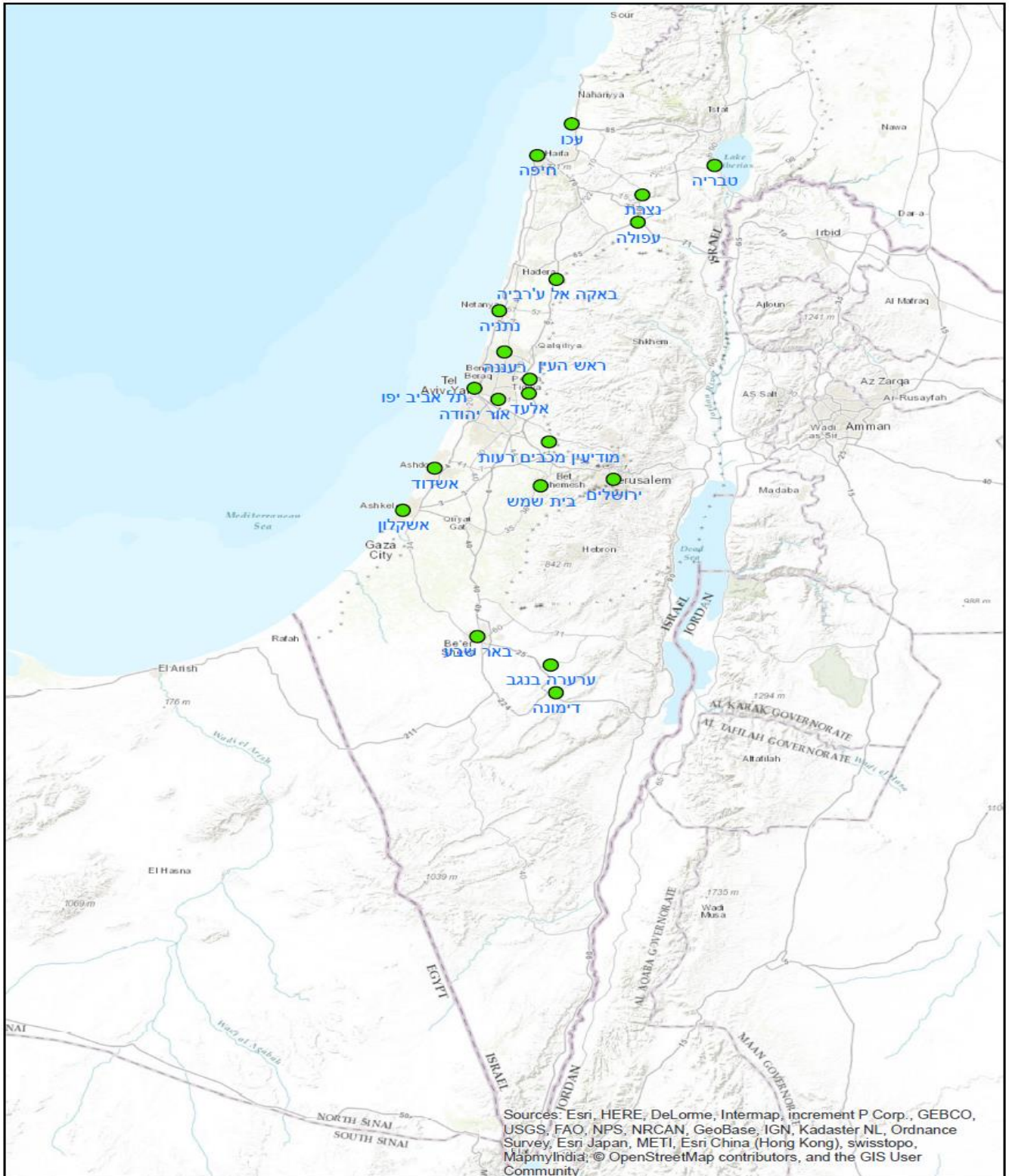
1. Israel Center for Disease Control. Influenza Surveillance in the 2014-2015 Winter Season in Israel and Internationally.  
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חטיבת הבריאות  
המרכז הלאומי לבקרת מחלות  
ICDC - Israel Center for Disease Control

**משרד  
הבריאות**  
לחיים בריאים יותר

**Appendix 1: National Distribution of the Sentinel Clinic Network**



Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community