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Predicting AH1N1 2009 influenza epidemic in Southeast Europe

Aim To use the data on the AH1N1 2009 influenza epidemic in the Southern hemisphere countries to predict the course and size of the upcoming influenza epidemic in South-Eastern Europe (SEE) countries and other regions of the World with temperate climate.

Method We used a comparative epidemiological method to evaluate accessible electronic data on laboratory-confirmed deaths from AH1N1 2009 influenza in the seasons 2009/2010 and 2010/2011. The studied SEE countries were Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Hungary, Kosovo, Macedonia, Montenegro, Romania, Serbia, and Slovenia, while Southern hemisphere countries were Argentina, Australia, Chile, New Zealand, Paraguay, Uruguay, and South Africa.

Results In influenza season 2009/2010, Southern hemisphere countries with temperate climate reported 1187 laboratory-confirmed influenza AH1N1 2009 deaths (mortality rate 0.84/100 000; 95% confidence interval [CI], 0.50-1.24). SEE countries with similar climatic conditions reported 659 deaths and similar mortality rates (0.86/100 000, 95% CI, 0.83-1.10). In the whole Europe without the Commonwealth of Independent States countries (CIS, former Soviet Union), there were 3213 deaths (0.60/100 000; 95% CI, 0.65-0.93). In 2010/2011, Southern hemisphere countries reported 94 laboratory-confirmed deaths (mortality rate 0.07/100 000; 95% CI, 0.02-0.28) or only 7.9% of the previous season. SEE countries by the end of the 11th epidemiological week of 2010/2011 season reported 489 laboratory-confirmed deaths, with a mortality rate of 0.64/100 000 (95% CI, 0.26-0.96) or 74.2% of the previous season, which was significantly higher than in the Southern hemisphere countries ($\chi^2_1 = 609.1$, $P < 0.001$). In Europe without CIS countries, there were 1836 deaths, with a mortality rate of 0.34/100 000 ($\chi^2 = 153.3$, $P < 0.001$ vs SEE countries).

Conclusion In the 2009/2010 season, SEE countries and Southern hemisphere countries had similar influenza AH1N1 2009 mortality rates. In the 2010/2011 season, the forecast of 10% increase in total mortality in SEE countries and Europe compared with the 2009/2010 season was significantly exceeded, while the expected impact of type-specific vaccines against influenza AH1N1 2009 was not achieved. Consumption of epidemic potential has greater importance for the prognosis of the course and size of influenza epidemic than the degree of vaccine immunity.

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In order to plan anti-epidemic measures for infectious diseases, including influenza, it is important to predict the course of each outbreak. This is mostly done by using historical data of previous outbreaks (1). Modern means of communication, which allow simultaneous monitoring of influenza in different parts of the world, are used to collect data from the countries where an influenza epidemic has just finished to predict its course in the countries where it is yet to begin. With the outbreak of influenza AH1N1 2009, the World Health Organization (WHO) introduced laboratory monitoring of patients and deaths by detecting influenza-specific RNA by real-time reverse transcriptase-polymerase chain reaction, available in all developed countries and many developing countries (2,3). The world now has much more reliable and comparable data based on a correct diagnosis of influenza virus types than the former practice of registration of patients with influenza-like illness and the number of deaths from influenza-like illness (2-6). Laboratory confirmation of deaths facilitates the comparison of epidemic course between countries and provides more accurate forecasts. We compared the available data from the 2010/2011 influenza season with the predictions for the same season, and we specifically compared SEE countries, which used different approaches to monitor the epidemic and perform the vaccination.

METHOD

We used electronically available mortality data on influenza AH1N1 2009, collected and processed by governmental institutions, international organizations, and other relevant sources that regularly register morbidity and mortality (7-67). Mortality rate indicators (laboratory-confirmed deaths from AH1N1 2009) were calculated using the UN population estimate for each country (68). SEE countries include Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Hungary, Kosovo, Macedonia, Montenegro, Romania, Serbia, and Slovenia, that altogether have 76.4 million inhabitants (7-14,68). Europe includes 40 countries, without 13 Commonwealth of Independent States (CIS) countries, and has 534.1 million inhabitants. Northern hemisphere includes 69 countries without China and the countries of Central Asia, and has 1823.4 million inhabitants. Equatorial area includes 51 countries and has 1776.8 million inhabitants. North America includes United States of America (USA) and Canada and has 340 million inhabitants. The Western hemisphere ('The New World') includes 35 countries of the North, Central, and South America, and has 904.0 million inhabitants. The Eastern hemisphere ('The Old World') includes 92 countries, with 2838.0 inhab-

itants. The Southern hemisphere includes Argentina, Australia, Chile, New Zealand, Paraguay, Uruguay, and South Africa and has 141.7 million inhabitants.

We compared the countries and regions of the world during the 2 most recent influenza seasons: 2009/2010 and 2010/2011. As the epidemic broke out in Mexico at the end of April 2009, the data for the 2009/10 season are from May 2009 until the end of April 2010 (69). The 2010/11 influenza season started in May 2010 and ended with the 11th epidemic week of 2011 (March 20, 2011).

Chi-square test was used to test the differences between data for the two seasons, using Statistica 7 software package (StatSoft, Tulsa, OK, USA).

RESULTS AND DISCUSSION

In Tables 1-4, the number of laboratory-confirmed influenza deaths is summarized and compared between the countries of Europe, North America, Northern hemisphere, Western hemisphere, Eastern hemisphere, equatorial area, and the world. Out of 214 world countries, with 6724.3 million inhabitants, 127 countries (3743.4 million inhabitants) adequately monitored and regularly reported on the number of laboratory-confirmed deaths.

The outbreak of influenza AH1N1 2009 in Mexico in April 2009 was announced as the first catastrophic pandemic – the 'young people killer' influenza virus – of the third millennium. With the surrounding media frenzy, the influenza scare traveled quickly around the world (13-20), and frightened governments were forced to take action by activating the pandemic plans prepared after the pandemic avian influenza in 2005 (70-77). However, the first findings from Mexico, together with the course of the epidemic in the Southern hemisphere countries where local winter was starting, indicated that there was no exceptional, out-of-season outbreak of dangerous 'killer virus.' Instead, it was the usual epidemic of highly contagious influenza virus AH1N1 2009, accompanied by the usual low mortality and lethality as is the case for the ordinary seasonal influenza (15-20,48-50). Indeed, the mortality in the 2009/2010 season was much lower than had been predicted by the WHO and the USA Center for Disease Control (77-79). Based on the number of laboratory-confirmed deaths from influenza in Southern hemisphere countries, the expected mortality in Northern hemisphere countries, where winter was starting, was 0.84/100 000 population. It was estimated that the

epidemic would be a single-wave, lasting 10-16 weeks, with the onset 2 months earlier than usual (80). It was expected that SEE countries would have lower mortality

rates than the Southern hemisphere countries, due to the availability of the type-specific vaccine against influenza virus AH1N1 09 (80-82).

TABLE 1. Laboratory-confirmed deaths from influenza AH1N1 09 per month in 2009/2010 season*

Country	Population (million)	Season 2009/2010												total
		2009						2010						
		V	VI	VII	VIII	IX	X	XI	XII	I	II	III	IV	
Albania	3.2								6	6	0	0	0	12
Bosnia and Herzegovina	4.0							1	8	2	8	0	0	19
Bulgaria	7.6					1	1	3	30	5	0	0	0	40
Croatia	4.5						1	9	14	5	0	3	0	32
Greece	11.2				1	2	0	9	58	36	34	6	3	149
Hungary	10.0			1	0	1	2	3	45	55	17	6	4	134
Kosovo	2.1							2	12	0	0	0	0	14
Macedonia	2.1							1	15	8	2	0	0	26
Montenegro	0.7								5	3	0	0	0	8
Romania	21.5							2	56	53	11	0	0	122
Serbia	7.5						1	16	38	26	2	0	1	84
Slovenia	2.0							2	11	6	0	0	0	19
Total South-Eastern Europe	76.4			1	1	4	5	48	298	205	74	15	8	659
Europe				0.2	0.2	0.6	0.7	7.3	45.2	31.5	11.2	2.3	1.2	100%
Europe without CIS countries	534.1	0	1	44	56	58	146	598	1179	637	217	228	49	3213
		0	0.03	1.4	1.7	1.8	4.5	18.6	36.7	19.8	6.7	7.1	1.5	100%
Argentina	40.5		26	433	7	73	58	17	4		9			627
Australia	21.7		7	68	80	24	7	4	1					191
Chile	17		12	84	34	2	4	12	2	3	2			155
New Zealand	4.2			16	11								8	35
Paraguay	6.8			22	19	11							1	53
South Africa	48			2	25	32	32		2					93
Uruguay	3.5		1	24	5	3								33
Total Southern hemisphere (7 countries)	141.7	0	46	649	181	145	101	33	9	3	11	0	9	1187
		0	3.9	54.7	15.2	12.2	8.5	2.8	0.8	0.2	0.9	0	0.8	100%
Equatorial area (51 countries)†	1776.8	1	12	371	1011	922	675	400	711	451	328	420	146	5448
			0.2	6.8	18.6	16.9	12.4	7.3	13.1	8.3	6.0	7.7	2.7	100%
Northern hemisphere (69 countries)†	1823.4	114	161	401	382	1543	1947	3031	3599	1696	514	1119	147	14654
		0.8	1.1	2.5	2.6	10.5	13.3	20.7	24.6	11.6	3.5	7.6	1.0	100%
The world (127 countries)‡	3743.4	115	219	1421	1574	2610	2723	3464	4319	2150	853	1539	301	21288
		0.5	1.0	6.7	7.4	12.3	12.8	16.3	20.3	10.1	4.0	7.2	1.4	100%
Total Western hemisphere (35 countries)†	904.0	115	205	1182	1055	2134	2107	1572	954	506	432	393	173	10828
		1.1	1.9	10.9	9.7	19.7	19.5	14.5	8.8	4.7	4.0	3.6	1.6	100%
Total Eastern hemisphere (92 countries)†	2838.0	0	14	239	519	476	616	1892	3365	1644	421	1146	128	10460
		0	0.1	2.3	5.0	4.6	5.9	18.1	32.2	15.7	4.0	11.0	1.2	100%
The world (214 countries)§	6724.3	115	219	1438	1590	2640	2741	3624	4902	2267	853	1542	302	22233
		0.5	1.0	6.5	7.2	11.9	12.3	16.3	22.0	10.2	3.8	6.9	1.3	100%
Total Northern America (2 countries)	340.0	17	135	322	212	1385	1495	1031	489	174	113	89	29	5491
		0.3	2.5	5.9	3.9	25.2	27.2	18.8	8.9	3.2	2.1	1.6	0.5	100%

*Shaded fields indicate enhanced seasonal influenza activity; CIS – Commonwealth of Independent States. Source: references 7-67.

†Countries with total mortality rates in both seasons <0.10/100000 were excluded from calculation.

‡Reliable data on influenza-related deaths were available for 127 countries.

§Calculations for all 214 countries, regardless of the number of reported deaths.

TABLE 2. Laboratory-confirmed deaths from influenza AH1N1 09 per months in 2010/2011 season*

Country	Population (million)	Season 2010/2011												total	
		2010						2011							
		V	VI	VII	VIII	IX	X	XI	XII	I	II	III			
Albania	3.2											1			1
Bosnia and Herzegovina	4.0											10	6	2	18
Bulgaria	7.6									1		30	70	27	128
Croatia	4.5									1		9	15	1	26
Greece	11.2											15	110	37	162
Hungary	10.0											4	31	36	71
Kosovo	2.1												2		2
Macedonia	2.1											5	4	8	17
Montenegro	0.7											5	1	1	7
Romania	21.5										3	3	12	14	32
Serbia	7.5											5	11	8	24
Slovenia	2.0											1			1
Total South-Eastern Europe	76.4	0	0	0	0	0	0	0	0	5	88	262	134		489
										1.0	18.0	53.6	27.4		100%
Europe without CIS countries	534.1	7	2	0	0	1	0	5	42	617	815	347			1836
		0.4	0.1					0.3	2.3	33.6	44.4	18.9			100%
Argentina	40.5				22										22
Australia	21.7		1	2	3	13	4								23
Chile	17			5	4	6	5								20
New Zealand	4.2			2	14	4									20
Paraguay	6.8											9			9
South Africa	48														0
Uruguay	3.5														0
Total Southern hemisphere (7 countries)	141.7	0	1	9	43	23	9	0	0	0	9	0			94
			1.1	9.6	45.7	24.5	9.6				9.6				100%
Equatorial area (51 countries)†	1776.8	61	80	230	294	573	106	110	121	13	177	88			1853
		3.3	4.3	8.1	15.9	30.9	5.7	5.9	6.5	0.7	9.5	4.7			100%
Northern hemisphere (69 countries)†	1823.4	34	56	27	0	1	5	51	118	801	1040	700			2833
		1.2	2.0	1.0			0.2	1.8	4.2	28.3	36.7	24.7			100%
The world (127 countries)‡	3743.4	95	137	266	337	597	120	161	239	814	1226	800			4780
		2.0	2.9	5.5	7.1	12.5	2.5	3.4	5.0	17.0	25.6	16.7			100%
Total Western hemisphere (35 countries)†	904.0	64	78	87	9	26	6	95	24	47	136	184			756
		8.5	10.3	11.5	1.2	3.4	0.8	12.6	3.2	6.2	18.0	24.3			100%
Total Eastern hemisphere (92 countries)†	2838.0	31	59	179	328	571	114	66	215	767	1090	604			4024
		0.8	1.5	4.4	8.2	14.2	2.8	1.6	5.3	19.1	27.1	15.0			100%
The world (214 countries)§	6724.3	95	137	267	315	597	119	168	235	863	1351	798			4945
		1.9	2.8	5.4	6.4	12.1	2.4	3.4	4.8	17.5	27.3	16.1			100%
Total Northern America (2 countries)	340.0	0	0	0	0	0	2	8	16	43	99	99			267
		0	0	0	0	0	0.7	3.0	6.0	16.1	37.1	37.1			100%

*Shaded fields indicate enhanced seasonal flu activity; CIS countries, Commonwealth of Independent States. Source: references 7-67.

†Countries with total mortality rates in both seasons <0.10/100 000 were excluded from calculation.

‡Reliable data on influenza-related deaths were available for 127 countries.

§Calculations for all 214 countries, regardless of the number of reported deaths.

After such experiences from 2009/2010 influenza season, a similar sequence of events was expected in 2010/2011 season. By that time, the South hemisphere countries had had trivalent type-specific vaccines for AH1N1 2009 influenza virus (83). The influenza season ended with a total of 96 registered laboratory-confirmed deaths (Tables 1-4). The highest mortality rate was in New Zealand (17), while Argentina, Australia, and Chile had a very low mortality rate and South Africa and Uruguay had no laboratory-confirmed deaths (15-20). The data on vaccination coverage were not available for all countries, but were reliable for New Zealand and Argentina, where about a quarter of the total population was vaccinated: 1.1 million in New Zealand and 10 million in Argentina (83-85). Despite the similar vaccination coverage, the mortality in Argentina (0.05/100 000) was significantly lower than in New Zealand (0.48/100 000). Also, the mortality in New Zealand did not differ from that in 2009/2010, despite vaccination (0.83/100 000; $\chi^2_1 = 3.56, P > 0.10$) (15,17).

In the 2010/2011 season, Southern hemisphere countries recorded only 7.9% (95% confidence interval [CI], 3.74-33.03) of laboratory-confirmed influenza deaths, less than in the previous season; $\chi^2_1 = 930.9, P < 0.001$).

As the influenza season in the Southern hemisphere precedes the one in the Northern hemisphere, it was expected that Northern hemisphere countries would also have a similar lower mortality rate. By the end of the 11th epidemic week (March 20, 2011, the end of influenza season), in North American countries 267 laboratory-confirmed deaths were recorded, with a mortality rate of 0.08/100 000 or only 4.7% of the 2009/10 season. According to the Centers for Disease Control weekly reports on the total number of laboratory-confirmed deaths from different types of influenza viruses, deaths from influenza virus AH1N1 2009 made up at most a third of the cumulative number of all types of influenza viruses in the USA (48). Mexico did not report any deaths caused by influenza AH1N1 2009 virus

TABLE 3. Comparison of AH1N1 09 mortality during influenza seasons in South-Eastern Europe and in southern hemisphere, where the AH1N1 09 flu originated in 2009*

Country	Population (million)	Season 2009/2010		Season 2010/2011		Both seasons		Ratio 2010/2011 vs 2009/2010	
		number of deaths	mortality per 100 000	number of deaths	mortality per 100 000	number of deaths	mortality per 100 000	ratio	%
Albania	3.2	12	0.38	1 [†]	0.03	13	0.41	1/12	8.3
Bosnia and Herzegovina	4.0	19	0.48	18	0.45	37	0.93	18/19	94.7
Bulgaria	7.6	40	0.53	128 [†]	1.68	168	2.21	128/40	320.0
Croatia	4.5	32	0.71	26	0.58	58	1.29	26/32	81.3
Greece	11.2	149	1.33	162	1.45	311	2.78	162/149	108.7
Hungary	10.0	134	1.34	71 [†]	0.71	205	2.05	71/134	53.0
Kosovo	2.1	14	0.67	2 [†]	0.09	16	0.76	2/14	14.3
Macedonia	2.1	26	1.24	17	0.81	43	2.05	17/26	65.4
Montenegro	0.7	8	1.14	7	1.00	15	2.14	7/8	87.5
Romania	21.5	122 [†]	0.57	32 [†]	0.15	154	0.72	32/122	26.2
Serbia	7.5	84 [†]	1.12	24 [†]	0.32	108	1.44	24/84	28.6
Slovenia	2.0	19 [†]	0.95	1 [†]	0.05	20	1.00	1/19	5.3
Total South-Eastern Europe	76.4	659	0.86 (0.65-1.1)	489	0.64 (0.26-0.96) [†]	1148	1.50 (1.01-1.96) [‡]	489/659	74.2 [‡]
Argentina	40.5	627	1.55	22 [†]	0.05	649	1.60	22/627	3.5
Australia	21.7	191	0.88	23 [†]	0.11	214	0.99	23/191	12.0
Chile	17	155	0.91	20 [†]	0.12	175	1.03	20/155	12.9
New Zealand	4.2	35	0.83	20	0.48	55	1.31	20/35	57.1
Paraguay	6.8	53	0.78	9 [†]	0.13	62	0.91	9/53	17.0
South Africa	48	93	0.19	0	0	93	0.19	0/93	0
Uruguay	3.5	33	0.94	0	0	33	0.94	0/33	0
Total southern hemisphere	141.7	1187	0.84 (0.5-1.2)	94	0.07 (-0.02-0.28) [†]	1281	0.91 (0.6-1.4)	94/1187	7.9

*Numbers in brackets are 95% confidence intervals.

[†] $P < 0.001$ vs previous year (χ^2 test).

[‡] $P < 0.001$ vs Southern hemisphere (χ^2 test).

and reported a low morbidity, just confirming the presence of influenza AH1N1 2009 virus in circulation. Canada reported 13 laboratory-confirmed deaths (48-50). The total number of laboratory-confirmed deaths in the Northern hemisphere was 2823 or only 19.3% of the previous season. For all the world countries, the laboratory-confirmed influenza mortality reached 22.2% of that in the previous season.

In Europe without the CIS, all countries recorded lower laboratory-confirmed mortality in 2010/2011 than in 2009/2010 (0.34 vs 0.60). The percentage of laboratory-confirmed deaths ($n=1836$) was 57.1% of that for the 2009/10 season ($n=3213$). The lower mortality rate in Europe than in Southern hemisphere countries in the season 2009/2010 (0.60 vs 0.84, $\chi^2_1 = 95.5$, $P < 0.001$) indirectly points to a smaller consumption of epidemic potential in that season in Europe.

In 2009/10 influenza season, SEE countries had an average mortality rate similar to Southern hemisphere countries (Table 1). In 2010/2011 season, the percentage of laboratory-confirmed deaths was 74.2% of that in the previous season. In Croatia, the mortality in the 2010/2011 sea-

son until March 14, 2011 was similar to that in 2009/2010 (0.71/100 000 vs 0.58/100 000; $\chi^2_1 = 0.43$, $P = 0.20$). This was despite the fact that in 2009/2010 season fewer than 20 000 persons (0.4% of the population) were vaccinated, due to delayed administration of influenza vaccine H1N1A 09, compared with more than 550 000 (more than 12% of population) in the second season (Figure 1).

In 2010/2011, an even higher mortality rate than in Croatia was recorded in Greece, which also had a higher mortality in the 2009/2010 season (Tables 1 and 2). In 2010/2011, only 3.5% of Greek population was vaccinated (9). In contrast, the UK, in which more than 70% of the risk-group population was vaccinated, also had a high laboratory-confirmed mortality in 2010/2011 (22).

Poland is the only European country that refused the purchase of type-specific vaccine against influenza AH1N1 2009 in the 2009/2010 season. If the last available vaccination coverage for Poland from 2008 is used to estimate the current vaccination coverage (10% of the population older than 65 years), it is clear that the type-specific vaccine cannot be the reason for significantly lower overall laboratory-confirmed influenza mortality in Poland (0.78/100 000)

TABLE 4. Total mortality rates of laboratory-confirmed deaths from Influenza AH1N1 09 for world's regions in both seasons

Country	Population (million)	2009/2010 season		2010/2011 season		Both seasons		2010/2011 vs 2009/2010 season	
		No. deaths	mortality per 100 000	No. deaths	mortality per 100 000	No. deaths	mortality per 100 000	number	%
Northern America (2 countries)	340.0	5491	1.62	267	0.08 [†]	5758	1.69	267/5491	4.9
South-Eastern Europe (12 countries)	76.4	659	0.86	489	0.64 [†]	1148	1.50	489/659	74.2
Western hemisphere (35 countries)*	904.0	10 828	1.20	756	0.08 [†]	11 584	1.28	756/10 828	7.0
Northern hemisphere (69 countries)*	1823.4	14 654	0.80	2823	0.15	17 477	0.96	2823/14 654	19.3
Europe without CIS countries (40 countries)	534.1	3213	0.60	1836	0.34	5049	0.94	1836/3213	57.1
Southern hemisphere (7 countries)*	141.7	1187	0.84	94	0.07	1281	0.91	94/1187	7.9
The world (127 countries)**	3743.4	21 289	0.57	4780	0.13 [†]	26 069	0.70	4780/21 289	22.5
Eastern hemisphere (92 countries)*	2838.0	10 460	0.37	4024	0.14 [†]	14 484	0.51	4024/10 460	38.4
Equatorial area (51 countries)*	1776.8	5448	0.31	1853	0.10 [†]	7301	0.41	1853/5448	34.0
The world (214 countries) [§]	6724.3	22 233	0.33	4945	0.07	27 078	0.40	4945/22 233	22.2

*Countries with total mortality rates $< 0.10/100\,000$ for both seasons were excluded from calculation. Sources: references 7-67.

[†] $P < 0.001$ vs previous season.

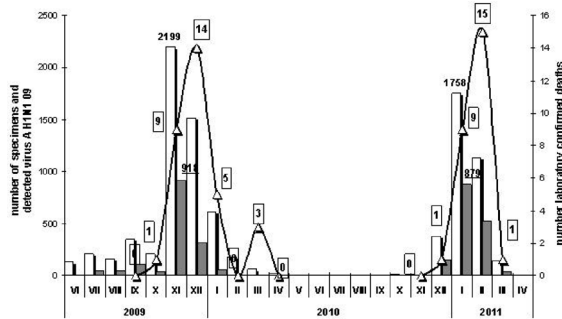
[‡]Reliable data on influenza-related deaths were available for 127 countries.

[§]Calculations for all 214 countries, regardless of the number of reported deaths.

than in the UK (1.55/100000) in both seasons ($\chi^2_1 = 112.2$, $P < 0.001$) (38,81).

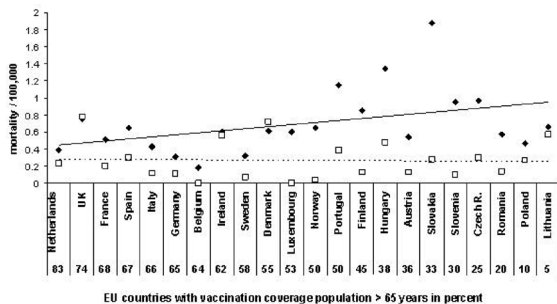
As the current data on vaccine coverage are not available for 22 EU countries, the data for the seasonal influenza in 2008 could be used (Figure 2). Since our practice in the field shows that the desired vaccination coverage is not achieved rapidly and that the habit of vaccination is not rapidly lost, similar vaccination coverage could be expected for the 2010/11 season. In 2009/2010 season, when type-specific vaccines against influenza AH1N1 2009 were not timely available in EU countries, laboratory-confirmed deaths mortality rate in the >65 age group

Figure 1.



Influenza AH1N1 2009 in Croatia, number of specimens processed (open columns), number of detected influenza virus AH1N1 2009 cases (gray columns) and number of laboratory confirmed deaths (triangles and framed number). Sources: Croatian Public Health Institute (8) and WHO Flunet, <http://apps.who.int/globalatlas/dataQuery/default.asp>.

Figure 2.



Mortality rates of laboratory confirmed deaths of influenza AH1N1 2009 in 2009/10 season (closed rhombs and full line) and 2010/11 season (open squares and broken line) in relation to estimated vaccination coverage in EU countries. Asterisks and numbers indicate the data for the UK, the country with high vaccination coverage, and Poland (low vaccination coverage), where Poland had significantly lower mortality than the UK in both seasons ($P < 0.001$) despite lower vaccination coverage. Sources: references 2,3,5-14,21-39,81.

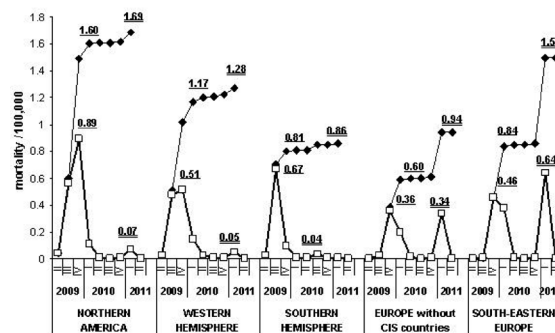
linearly increased as the vaccination coverage decreased (Figure 2). In 2010/2011 season, when the vaccines were available, greater vaccine coverage was not followed by a lower mortality rate (13,14,21-39,81).

The comparison of laboratory-confirmed AH1N1 2009 mortality rates among countries, even without sero-epidemiological field investigation, and detailed analysis by time, age, disability, geographic distribution, and with no valid data on the volume of applied non-pharmaceutical and pharmaceutical measures (vaccines and antivirals for preventive purposes) demonstrated that anti-epidemic protection measures by type-specific vaccines against AH1N1 2009 influenza virus in 2010/11 in SEE, Europe, and all Northern hemisphere countries did not result in a lower expected mortality rate than in Southern hemisphere countries.

Countries of the Western hemisphere, which had a higher rate of laboratory-confirmed influenza AH1N1 2009 deaths, ie, greater active infectious immunity by natural contact with influenza virus during the 2009/10 season, and thus greater estimated consumption of epidemic potential, had a significantly smaller number of laboratory-confirmed deaths in the 2010/11 season (Figure 3) than in 2009/2010, compared with the Eastern hemisphere (Table 2, Figure 3).

With the growing evidence on the questionable efficacy of influenza vaccines (86-89) and despite the lack of reliable sero-epidemiological studies, the pattern of laboratory-confirmed AH1N1 2009 mortality indicated that Western hemisphere countries achieved a higher degree of acquired active, infectious immunity than other world regions

Figure 3.



Cumulative (closed rhombs) and quarterly (open squares) mortality rates of laboratory confirmed deaths of influenza AH1N1 2009 in different global areas. Numbers present the mortality rates for 2009/10 season (single underlined) and 2010/11 (double underlined). Sources: references 7-67.

(Table 4, Figure 3). Also, the expected epidemiological effect of vaccine immunity was not achieved. This suggests that infectious immunity has greater epidemiological significance than vaccine immunity. This is supported by the fact that people older than 55 years had lower morbidity in all parts of the world (7-67), indicating that they had been actively immunized with the infectious virus AH1N1 2009 during their life. No less important is the fact that infectious immunity provides a high degree of crossed immunity to other influenza viruses (90), while vaccine immunity lasts no longer than a year, is highly type-specific, and the possibility of crossed immunity is minimal (88,89,91). We believe that these findings clearly demonstrate that, from an epidemiological point of view, the vaccination for influenza during its outbreak should be reserved for health-risk groups. Healthy people need not get vaccinated, especially not in mass vaccination.

Data obtained by type-specific diagnostic tests in the two AH1N1 2009 influenza seasons brought into the question the previous estimates of 250 000 to 500 000 annual deaths from influenza (77-79). It was estimated that in the 2009/2010 season, the overall laboratory-confirmed influenza mortality rate in 214 countries with 6.742 million population would be 0.57/100 000, ie 38 500 deaths (Table 4). Taking into consideration the Centers for Disease Control estimate that only a third of influenza deaths are laboratory-confirmed (48), this number could reach 115 500 deaths. So far in the 2010/2011 influenza season, which is at its very end, the final estimated death toll is 25 000.

In addition to AH1N1 2009 influenza virus, other influenza viruses A and B were in circulation in different parts of the world (92). In the countries that used laboratory confirmation of influenza deaths, the total mortality of other influenza deaths did not exceed that of the AH1N1 2009 influenza (13), suggesting that the total annual number of deaths from all types influenza viruses did not exceed 50 000 in 2010/2011. From this perspective, the estimates of 250 000 to 500 000 annual deaths should be replaced by 50 000 to 150 000 annual deaths.

By studying the natural experiment of the influenza AH1N1 2009 epidemics during two seasons and by using the number of laboratory-confirmed deaths, we can provide a more accurate and reliable prognosis for the upcoming 2011/2012 season. Because of the attenuation of the epidemic potential, countries of West hemisphere will not have epidemic occurrence of influenza a H1N1 2009 above the usual average of any seasonal influenza.

The countries of Eastern hemisphere will have a low epidemic occurrence only in the countries and areas where the total mortality rate was below 1.25/100 000 during the previous two seasons. The equatorial area countries will have the usual epidemic activity for another season but of lower intensity than in the previous season (Table 4, Figure 3). Influenza virus AH1N1 2009 will continue its circulation around the world as the common seasonal influenza virus did at the beginning of April 2009.

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