An outbreak of influenza A (H1N1) among long-term-care facility patients in Taif – KSA: challenges faced and lessons learned

Sherif R. Omar*, Raouf M. Affifi**, Ahmad A. El Raggal***, Reem El Bedewy****.

Abstract: ***Aim:*** To describe and analyze an outbreak of novel 2009 influenza A (H1N1) among patients of a long term care facility (LTCF) in Prince Mansour Military Hospital (PMMH), Taif - Kingdom of Saudi Arabia. Those patients were admitted to the LTCF months or years before the outbreak due to several reasons (e.g. cerebral palsy, neurological deficits due to road traffic accidents with handicapping, chronic diseases associates with old age). ***Methods*****:** An observational study was done to demonstrate and analyze the epidemiological characteristics (demographic factors, risk factors, and outcomes) associated the outbreak, to elucidate prevention and control measures taken, and recommendations concluded. ***Results*****:** During the period from October 28-November 11, 2010, twenty-one LTCF residents suspected clinically to be involved (fever $\geq$ 38ºC with influenza like illness), their age ranged from 9 - 91 years (mean age = 46 ±24.13), 62% were males. Among them, 12 (57%) proved by RT-PCR to be influenza A (H1N1) positive. Mortality involved 2 (17%) of the A (H1N1) -lab- confirmed individuals. Implementation of the recommended infection control measures mitigated the transmission of infection to new individuals. ***Conclusions*****:** The fulfillment of strict infection control measures could limit H1N1 infection among LTCF-PMMH patients. Routine influenza, including specific H1N1 immunization of all LTCF residents together with their healthcare staff should be mandatory in those settings serving immunocompromised patients.
Keywords: Outbreak, novel 2009 influenza, A (H1N1), long term care facility, Taif, Saudi Arabia.

INTRODUCTION

Influenza-A infection (2009 H1N1) was associated with a worldwide outbreak of febrile respiratory infection.(1) Although usually it results in a mild illness, certain patient groups are at increased risk for complications.(2) Early in the outbreak,

*Associate Professor of Tropical Health - Department of Tropical Health - High Institute of Public Health -University of Alexandria - Egypt
**Head, Preventive Medicine Department, Al Hada and Taif Armed Forces Hospitals, Taif-Kingdom of Saudi Arabia
***Consultant of Tropical Health and Preventive Medicine, Prince Mansour Military Hospital, Taif - Kingdom of Saudi Arabia
****Head, Long Term Care Facility, Prince Mansour Military Hospital, Taif - Kingdom of Saudi Arabia

serious steps in facing a predicted increase in the spread were taken worldwide, and locally. By October-November, 2010, the overall influenza activity was already low, worldwide. Notably, there has been co-circulation of seasonal influenza B viruses, in addition to post-season rise in influenza A (H3N2), and to a lesser extent localized outbreak of influenza (2009 H1N1). During epidemiological weeks 41 to 42 (10 -23 October, 2010), a total of 1,749 specimens were reported worldwide as positive for influenza viruses, 1,512 (86.4%) as influenza A and 237 (13.6%) as influenza B. Of sub-typed influenza, 15.6% were influenza (2009 H1N1) and 84.0 % were A (H3N2).[3] In LTCFs, outbreaks of influenza are common, despite presumed vaccination coverage among residents. According to the clinical practice guidelines of the Infectious Diseases Society of America, an epidemiological investigation should be carried out for such outbreaks and measures taken to prevent the spread of the virus among such residents.[4] The fragility of patients with debilitating health-conditions, e.g. LTCF patients, to influenza viruses outbreaks, and the risk of developing complications, warrants improving our knowledge of the epidemiological characteristics of such small subsets of populations. The current work built on the hypothesis that rigorous adherence to strict infection prevention and control measures, including standard and droplet precautions within a confined long-term care setting could minimize influenza A (H1N1) transmission among exposed individuals.

This work aimed to describe and evaluate the epidemiological characteristics of a confined influenza A (H1N1) outbreak that involved a cluster of LTCF residents in PMMH during the 2010-influenza season, to show the prevention and control measures taken, and the recommendations concluded.

METHODS

The study was carried out between

October 28-till November-11, 2010 at the inpatient setting of the LTCF in PMMH, Taif, KSA. The facility (66 beds), delivers care for severely injured, handicapped, individuals with crippling physical (and often mental) health problems that make them totally dependent. The outbreak inadvertently coincided with a delay in H1N1 flu vaccine supply, mostly due to logistics problems. There was a need to protect LTCF patients and staff against H1N1 infection, especially those who, were not immunized during 2009 season. Moreover, repeated vaccination for pre-immunized individuals too, to optimize their seroprotection against H1N1 virus.[5] Vigilance for early intervention against febrile episodes during the flu season, in which case, enforcing intensified infection-prevention and control precautions, conducting prompt surveillance procedures, starting oseltamivir chemoprophylaxis, and wide H1N1 vaccine coverage once available, all would be considered.

The Preventive Medicine Department (PMD) in PMMH was first notified with a febrile episode among two LTCF residents on October 28, 2010 with influenza like illness (ILI) fulfilling “suspected H1N1” case definition. The suspected influenza outbreak curve was on the rise over the next five days when the number of subjects with fever was up to twenty-one (out of total forty-four residents staying in the facility, resident attack rate = 47.7%). In integration with concerned hospital services, a surveillance plan was promptly established, including, prevention, control, notification, and containment measures. The primary aim was to contain the outbreak, mitigate disease transmission to unaffected patients, staff, and visitors. Minimizing probability of complications, mainly respiratory was part of the objectives.

Oseltamivir was considered according to the following policy:[6,7] i) Start chemoprophylaxis (75mg twice daily for ten days) for all residents, and staff, did not previously received H1N1 vaccine, ii) Oro

and Nasopharyngeal swabs for febrile patients (see later) for A (H1N1) virus detection, iii) continue oseltamivir for all LTCF ward, pending lab results, so that 1) patients with confirmed A (H1N1) would only complete a five-day medication course, unless a longer course would otherwise be needed, 2) withdraw oseltamivir from negative patients who were initially symptomatic, 3) continue 10-day oseltamivir prophylaxis for unimmunized patients who were not clinically affected.

Other particular prevention and control procedures included:[8] a) isolation of symptomatic individuals from other patients, b) lab-confirmed cases were cohorted together till full treatment, c) reviewing seasonal and H1N1 influenza immunization status of LTCF residents and staff, immunizing those non protected once the specific vaccine is available, d) reinforcing hand hygiene and cough etiquette precautions, as appropriate, e) intensified standard and droplet precautions used with infected residents for five days after onset of illness, e) restrict residents, nurses, as well as other health workers, housekeeping, catering staff movement among the wings of the facility and to other hospital premises, f) restrict entry and exit throughout LTCF ward to only one port, g) temporary closure of the facility to new admissions and visitors on October 28, to minimize virus transmission among residents, followed by gradual release of visitation ban, guided by daily assessment of outbreak progress,[9] h) active daily surveillance for all suspected H1N1 patients, including clinical evaluation, vital signs, O_2 saturation, and i) close observation of un-isolated residents who remained afebrile, till the outbreak's tapering.[10] Throughout the outbreak, continuous liaison with the local public health authority, in terms of new case notification, lab results, and daily case-progress reporting.

In this study, the twenty-one LTCF subjects who developed fever with suspected clinical presentation, during course of the outbreak, were included based on certain definitions set to verify the study population with respect to type of involvement.[11] A confirmed H1N1 case means “a patient who fell ill and febrile (≥38ºC) with positive viral RNA confirmed by real-time reverse-transcription polymerase chain reaction (RT-RTPCR)” (see later). A suspected H1N1 case was defined after modification as “a patient from the febrile cohort who was epidemiologically linked to a confirmed case.” In the study, suspected clinical presentation included the following symptoms and signs: a) fever ≥38ºC (with or without exacerbation of cough and rhinorrhea), or b) fever ≥38ºC plus muscle pain, diarrhea, and/or vomiting,[12] or c**)** one or more of the following symptoms: *i)* dyspnea or difficult breathing, *ii)* oxygen saturation (O_2 sat.) at room air (RA) <90%, or O_2 sat. <93% on O_2 (by mask), *iii)* respiratory rate (RR) >30 cycles per minute (cpm), *iv)* systolic blood pressure (SBP) <90mmHg and/or diastolic BP<60mmHg, *v)* heart rate (HR)>120 beats per minute (bpm), (iii, iv, and v, adults only) *vi)* severe dehydration (loss of >10% of body weight), *vii)* central nervous signs such as altered level of consciousness (e.g. confusion or severe agitation), and seizures, *viii)* recurrent fever after initial improvement, *ix)* persistent fever for more than three days not responding to antipyretics, excluding other possible causes for pyrexia, *x)* and abnormal, or worsening, chest radiography.

Two specimens, oropharyngeal and nasopharyngeal swabs, combined, were taken from each patient to collect upper respiratory tract (URT) material, to detect the presence of influenza A (H1N1) virus in the patients URT mucosa.[13] (no endotracheal aspirate collection was needed as no patients were intubation, also no broncho-alveolar lavage or sputum

specimens were collected). The virus isolation samples were taken by assigned PMD staff, applying recommended infection control procedures, including using personal protective equipment (PPE).[14] The "Vircell® Viral Transport Medium (VTM), REF: MTV001, LOT number 09MTV013" kit was used for specimen collection. The assay procedure was performed following the manufacturer's instructions (sample collection with swab, swab put into VTM tube, end of swab stick cut standing out of the tube, taking care not to touch the tube rim, tube closed tightly, patient data filled out, tube immediately placed in a refrigerator at 2-8ºC for transport to the laboratory via refrigerated delivery at 2-8ºC).[15] Samples were often stored at 2-8ºC overnight until delivered to laboratory. A real-time polymerase chain reaction (RT-PCR) assay,[16] to confirm influenza A (H1N1) infection was set up on a RT-PCR cycler, using primers and a probe set used by the Western Province Laboratories, Ministry Of Health (MOH), KSA. Equal priority was given to LTCF patients, and swab results were reported mostly within 24 hours.

The study variables included the following: a) demographic criteria, such as age (as an interval ratio scale), and sex, b) diagnostic criteria, including A (H1N1) RT-PCR test (binary: positive/negative), c) outcome data, namely survivability (binary: lived/died). Potential risk-outcome relationships were studied, in attempt to describe impact of some independent variables, e.g. age, sex, upon the H1N1-PCR test status, to confirm the presence of confirmed pandemic influenza virus infection.

Generally, the following statistical approaches were used, as appropriate: a) univariate techniques, e.g. chi-square goodness of fit, single-sample *t*-test, b) bivariate analyses, e.g. independent-samples *t*-test, chi-square test of independence, c) multivariate techniques,

e.g., multiple logistic regression. For instance, in the likely event that there was a desire to test the probability of a novel influenza A (H1N1)-PCR-test result against gender, a chi-square test of independence (or Fisher's exact test when appropriate) would be performed. In which case, chi-square and its *p*-value or the odds ratio (OR) with 95% confidence interval (CI), to measure test-significance would be used. Likewise, survivability would also be analyzed in association with other relevant variables, such as sex and PCR-test results (both are binary), mostly using chi-square tests with ORs and their 95% CIs for measuring the strengths and stability of such associations. When the normality of age distribution has been ascertained, e.g., using Kolmogorov Smirnov test, a *t*-test for the differences in the mean ages of the study's grouping variables, e.g., A (H1N1)-PCR-test and survivability outcome would be calculated. A combination of any two of these risk variables, e.g., H1N1-PCR status by gender or survivability status by H1N1-PCR-test result may often be "sub-analyzed" against relevant variable using appropriate statistical techniques. All study data and individual variables were coded, entered into a Microsoft program with adequate backup until analyzed. The SPSS version-15 software was used for running the selected statistical tests. Our tolerable level for α error was 0.05; results with *p*-value <0.05 would be considered significant.

RESULTS

Twenty-one LTCU residents (13 male: 8 female= 1.6:1), constituted the study population. The study population age ranged from 9 years to 91 years, with a mean of 46 years (±24.13). Stratified into five age categories (<30y, 30-39y, 40-49y, 50-59y, ≥60y), most subjects fell under the most two extreme age groups (28.5% under <30y subgroup, 33.3% under ≥60y subgroup). Generally, 19/21 (90.4%) of patients who took part in the H1N1 outbreak of LTCF

significantly survived the attack, compared to those (2/21 = 9.6%) who succumbed [X^2(1) 13.76, *p* 0.0001). (The two deceased patients were subject to respiratory failure, secondary to descending respiratory tract complications; and both were among those who did not have "code", so were not incubated. By analysis, one patient was 16-yar old girl who had underlying cerebral palsy (CP) and mental retardation, and the other patient was a 40-yerar old man with longstanding brain atrophy and mental retardation on top of a road traffic accident).

Table 1: Distribution of the LTCF - H1N1 Ourbreak Patients by the Main Study Variables (N = 21)

	No. of cases	%	Total	%	X^2	*p* (2-Sided)
Age Category						
Age <30	06	28.5				
Age 30-39	04	19.1				
Age 40-49	03	14.3	21	100	-	-
Age 50-59	01	04.8				
Age ≥ 60	07	33.3				
H1N1-PCR Result						
H1N1-PCR +ve	12	57.1	21	100	0.429	0.513
H1N1-PCR – ve	09	42.9				
Survivability						
Survived	19	90.4	21	100	1.76	0.0001
Died	02	09.6				
Survivability by PCR Result						
Survived -PCR +ve	10	47.6				
Died -PCR +ve	02	09.5	21	100	1.66	0.198
Survived -PCR –ve	09	42.9				
Died -PCR –ve	00	00.0				

With respect to lab results, 12/21 (57.1%) patients tested H1N1-PCR-positive and 9/21 (42.9%) patients tested negative [X^2(1) 0.429, *p* 0.513]. Consequently, no significant difference in the frequency of positive-vs.-negative H1N1-PCR-tests among individuals who developed similar febrile and/or ILI symptoms was found. However, the tendency

of surviving lab-confirmed influenza A (H1N1) attack was significantly greater than the tendency of fatality among the LTCF patient population [10/12 (83.3%) vs. 2/12 (16.7%), respectively, $X^2(1)$ 5.33, p 0.021]. Otherwise, there was not a significant relationship between survivability outcomes (lived/died) and H1N1-PCR results (PCR-positive/ negative), [survived-PCR-positive 47.6%, died-PCR-positive 9.5%; survived-PCR-negative 42.9%, died-PCR-negative 0.0% (n = 21), $X^2(1)$ 1.66, Table 1; and OR 7.2, CI 0.102 - 506.4, Table 3].

Table 2: Distribution of the LTCF- H1N1 Outbreak Patients by the Main Study Variables by Gender (N = 21)

	Male n1=13 (61.9%)	%	Female n2=8 (38.1%)	%	Subtotal [n1 + n2] (100%)	%	Total	%	OR	95%CI
Age Category										
Age <30	2	09.5	4	19.0	06	28.5				
Age 30-39	3	14.3	1	04.8	04	19.1				
Age 40-49	2	09.5	1	04.8	03	14.3	21	100	-	-
Age 50-59	1	04.8	0	00.0	01	04.8				
Age ≥ 60	5	23.8	2	09.5	07	33.3				
Survivability										
Survived	12	57.1	7	33.3	19	90.4	21	100	1.71	0.092, 32.25
Died	1	04.8	1	04.8	02	09.6				
Survivability by PCR										
Survived-PCR+ve	6	28.6	4	19%	10	47.6	12	50	1.5	0.071, 31.58
Died -PCR +ve	1	04.8	1	04.8	02	09.5				
Survivor-PCR –ve	6	28.6	3	14.3	09	42.9	09	50	2.0	0.0063, 640.9
Died -PCR –ve	0	0.0	0	00.0	00	00.0				

In order to analyze the relationship between age and H1N1-PCR-test results, a *t*-test was calculated comparing the mean ages for the two H1N1-PCR-test groups (PCR-positive/negative). No significant difference in the mean ages between the two groups was found [$t(17.585) = -0.558$, p 0.584. The mean age for the PCR positive group was 43.42y ±SD 24.77y, mean age for the PCR negative group was

49.44y, ±SD 24.25y]. Age was also analyzed in association with survivability, *t*-test was calculated to compare mean ages for the outcome groups (survived/died) (Table 4). No significant difference between the mean ages for the two groups was found [*t*(19) = 1.116, *p* 0.278; mean age-survived = 47.89y ± 24.31, mean age deceased = 28.0y, ±16.97].

Table 3: Distribution of the LTCF- H1N1 Outbreak Patients by H1N1-PCR Results by Gender and by Survivability (N = 21)

	n	%	OR	95% CI
H1N1-PCR by Gender				
PCR+ve [7/21(33.3%) male, 5/21 (23.7%) female]	12	57.0%	1.43	0.236, 8.637
PCR –ve [6/21(28.6%) male, 3/21(14.4%) female]	09	43.0%		
H1N1-PCR by Survivability (*)				
PCR+ve *[10/21(47.6%) survived, 2/21(9.4%%) died]*	12	57%	7.2	0.102, 506.4
PCR –ve *[9/21 (43.0%) survived, 0/21(0.0%) died]*	09	43%		

(*) Chi-square goodness of fit: Survivability/PCR +ve group: [Survived 10/12(83.3%) vs. died 2/12(16.7%) [(X^2(1) 5.33, *p* 0.021]. Patients with H1N1-infection are more likely to test +ve for H1N1-PCR.

The study individuals were further analyzed by gender, as far as the study variables of interest. There was no significant difference in the age means for the male and female patient groups with suspected A/H1N1 infection [mean age male 52.0y ±21.6y SD, mean age female 36.3y ± 26.3y SD, *t*(19)= – 1.49, *p* 0.15]. There was no significant difference in the frequency of PCR- positive vs. negative results among male and female individuals, too (OR 1.43, CI 0.236, 8.637). Table 2 shows that there was no significant relationship between gender and survivability [male-survivor 12/21 (57.1%) and male-deceased 1/21 (4.8%) vs. female-survivor 7/21 (33.3%) and female deceased 1/21 (4.8%), OR 1.71, CI 0.092-32.25]. Similarly, no significant relationship between gender and survivability among

the H1N1-PCR-poitive group was found, [male-survivor-PCR-positive: 6 (28.4%) and male-deceased-PCR-positive: 1 (4.8%) vs. female-survivor-PCR-positive: 4 (19%) and female-deceased-PCR-positive: 1 (4.8%), OR 1.5, CI 0.071-31.58]. [In parallel, no significant relationship between gender and survivability among the H1N1-PCR-negative group was found, (male-survivor-PCR-negative: 6 = 28.4% and female-survivor-PCR-negative: 3 = 14.3%, no deaths encountered in both sexes, OR 2, CI 0.0063 - 640.9].

Table 4: Age *t*-Teat Statistics: Age among H1N1-PCR, Survivability, and Gender groups

	t	**df**	**Mean Age Difference**	***p* (2-Sided)**
Age and Gender*	-1.49	19	15.9 (52.2 – 36.3)	0.15
Age and H1N1-PCR*	-0.558	17.585	6.03 (49.44 – 43.42)	0.584
Age and Survivability **	1.116	19	19.89 (47.89 – 16.97)	0.278

* Equal variances assumed. ** Equal variances not assumed.

DISCUSSION

The outbreak environment: On August 10, 2010, Dr. Margaret Chan, WHO Director-General announced that H1N1 influenza virus has moved into the post-pandemic period.[17] However, localized outbreaks of various magnitudes are likely to continue. As such, our study's H1N1 outbreak actually occurred in the time interval when H1N1 virus had already run its course.[18] Expectedly, H1N1 virus would take on the behavior of a seasonal influenza virus, continue to circulate for some years to come. In Saudi Arabia, H1N1 pandemic course was parallel to the surrounding geographical areas in the northern hemisphere. For instance, until

mid-August, 2010, only 875 lab-confirmed H1N1 cases, and zero case-fatality, were reported in the Kingdom, compared to more than 17,000 confirmed cases and 124 H1N1-associated deaths through 2009.[19] During post-pandemic phase, reported H1N1 incidents took picture of either sporadic cases or limited outbreaks, e.g. boarding institutions, small community settings, etc. Also, among around sixty-five million H1N1 vaccine doses received, worldwide, only 60,000 doses were given in Saudi Arabia since the launch of the global immunization campaign until the time of the study.[20]

There was a relative decline, but not complete disappearance, of H1N1 pandemic curve, may be due to: a) extensive preparedness and support from the international community, e.g. WHO prevention and surveillance plan, b) timely development of specific H1N1 vaccine, made available for public use shortly after being licensed mid-September 2009 (the vaccine proved a good match with the circulating virus and excellent safety profile), c) the use of oseltamivir,[6,7] to shorten and limit the disease symptoms and complications, d) the virus did not mutate during the pandemic to a more lethal form, f) widespread resistance to oseltamivir did not develop,[18] and e) the steady development of herd immunity, either due to mass immunization or widespread natural infection worldwide. Nonetheless, the WHO has issued advice on recommended surveillance, vaccination, and clinical management during the post-pandemic period.[17,18]

Based on available experience from past pandemics, it was likely that the virus would continue to cause serious disease, especially in groups identified during the pandemic as at higher risk of severe or fatal illness e.g. LTCF residents. In this study, resident attack rate (47.7%) was comparable, e.g. to the Slovenian's (43%), yet was higher, e.g. than that reported in

the LTCFs outbreaks in Colorado (28%) and New York (11%), (considering the total bed capacity of each facility: 23, 39, 386, respectively).[21,22]. This LTCF outbreak also had a slightly lower than average duration until the last new case reported compared to the previous studies (7 days vs. 8 days). Evidently, the initiation and reinforcement of recommended infection control practices played a role in such relatively short influenza outbreak attack duration. One limitation in this study, which is the way influenza virus was introduced into the facility. The virus often introduced via ill health-care personnel or visitor. However, role of healthcare personnel in serving as a source of infection could not be proven, especially that no healthcare worker fell ill either before, during or after the outbreak.

On the other hand, some “indicators” showed the success of the selected preventive measures most appropriate for the patient’s health and outbreak control. Those indicators included: a) steady decline in the disease severity after initiating all infection control precautions previously addressed, b) shortened primary attack rate and the absence of secondary attacks, c) a fatality limited to severely ill patients with severe underlying crippling health condition, and d) no spread of the disease from the isolation areas to the other facility wards throughout the outbreak.

In this work, no resident, either the H1N1-PCR positive or negative patients, recurred H1N1 infection until the end of the 2010 influenza season. In the literature, few data are available on the success of influenza vaccination in mentally and/or physically handicapped children and adults. A recent study by Otsuka and colleagues.[23] showed that the immune response after vaccination depends more on age than on the level and type of physical and mental impairment. The Otsuka et al. residents were children and

adults, yet they failed to develop protection after vaccination. Sex of our patients did not impact the attack rate of confirmed H1N1 infection (Table 3). It also did not influence the disease survivability, so that both sexes have had the same chance of surviving influenza outbreak (Table 2). In the similarly Slovenian investigation,[21] March-April 2009, 60.8% (n = 23) of residents from both sexes (male: female 52.2%:47.8%) developed suspected H1N1 symptoms. The mean ages for our male vs. female patients (52.0y ±21.6 vs. 36.3y± 26.3, respectively) and those of the Slovenians' (22.8y± 5.9 vs. 20.7y±7.1, respectively) were not significantly different [*p* 0.15 (Table 4), and 0.46, respectively]. [We have conducted a *t*-test to compare the mean ages of the Slovenian male and female patients using the published Slovenian data, after assuring normality distribution using Kolmogorov Smirnov test (*p* 0.928). No significant difference between the two means was found: $t(20.87) = 0.76$, $p = 0.46$]. On the other hand, the attack rate for confirmed H1N1 was higher in the Slovenian males vs. females (9/12 = 75%, $p<0.05$), compared to our study, where no difference was found between the two rates. No explanation could be found for sex difference in H1N1 lab output in the Slovenian study. On our part, we agree on the "role" that women may generally mount higher immune responses to viral infections that help heightened virus clearance. Whether or not such immunologic tendency applies to influenza virus, including novel 2009 H1N1 should be a matter of thorough population-based research.

In their study to analyze the sex differences in the immune responses to influenza viruses, Fish, too, reported that sex has not been systematically examined in those studies handling community-acquired influenza infections.[24] Further, given the remarkably different mean age in our study (46y ±24.13) from that of the

Slovenian's (21.7y ±6.5), as well as the wide difference in the age range profile (9y to 91y, range 82y vs. 9y to 34y, range 25y, respectively); a perfectly matched head-to-head comparison could not be fulfilled with respect to sex and H1N1-PCR association. Different studies, otherwise, reflecting other countries' experience with the H1N1 pandemic, reported no significant male/female differences in the number of confirmed 2009-H1N1 cases.[25,26]

Having no difference in the types of seroconversion among suspected H1N1 patients (Table 1) largely indicates that other influenza subtypes, namely influenza A (H3N2) and/or influenza B viruses may have been contributed to the current outbreak. According to the WHO "Influenza update-8 November 2010," [3] seasonal influenza A (H3N2) viruses continued to be the predominant circulating influenza virus worldwide at that time, alongside with co-circulation of seasonal influenza B viruses and to a lesser extent, influenza H1N1 (2009) viruses. A variation in the rates of H1N1 seroconversion, however, could be found, comparing our investigation with similar LTCF investigations from the 2009 influenza season: LTCF-PMMH 52%, LTCF-Slovenia 100%, LTCF Colorado 27%, LTCF New York 18% (considering the total number of ILI patients: 21, 10, 11, 41, respectively).

Age, too, did not impact influenza A (H1N1) seroconversion, as well as survivability potential among our study patients (Table 4). Age, thereby [as a ratio scale by a *t*-test, or categorically by a logistic regression (analysis not shown in this report) could not be used to predict H1N1-PCR test result]. Despite the lower risk for infection with 2009 H1N1, and its unfavorable outcomes among persons aged ≥65 years compared with seasonal influenza, probably due to the fact that anti-influenza A antibodies that cross-react with 2009 H1N1 could be detected in up to one third of healthy adults aged >60 years,[27] all

LTCF age groups, including elderly people, can still suffer 2009 H1N1 outbreaks.[28] A rather benign course throughout the outbreak was met with by the majority of patients (survival rate: death rate 90.4%: 9.6%). Different death rates have been reported with LTCF influenza A (H1N1) outbreaks, elsewhere. In the CDC-led ILI outbreak investigations.[22] between October and November 2009 in three USA states, one patient (=33.3%) in the LTCF in Maine died of respiratory failure secondary to H1N1- infection during the outbreak, [where 7/125 residents developed ILI, 3/7 (43%) of which tested H1N1-PCR-positive. No H1N1-associatied deaths were reported in the two other participating LTCFs (New York and Colorado); same as in the Slovenian investigation. In our study, we could not find a difference in the survival rate between H1N1-PCR positive and negative-patients.

In conclusion, prompt response to a suspected H1N1 influenza virus outbreak within a long-term care facility, aiming to rapid detection and containment of virus transmission between exposed individuals helps improve outbreak outcome. With such setting where bed-ridden, physically- and mentally handicapped-patients constitute a considerable portion of the facility's population at risk, adherence to infection control precautions as prescribed for the H1N1 influenza outbreak is crucial. Since influenza is almost clinically indistinguishable from other respiratory infections, especially in the "chesty" bed-ridden patients, virological diagnosis, e.g. RT-PCR sub-typing becomes a prime quest. The latter assists in predicting outbreak course and adapting recommended preventive measures, accordingly. The study results provide that reinforcing strict infection control measures pertinent to influenza A (H1N1) during seasonal flu outbreaks at LTCF settings, minimizes complicated course opportunities, and alleviates the disease

burden upon the facility and the public health system. The role of seasonal influenza immunization in preventing severe influenza attacks and their unfavorable consequences within the LTCF community should be emphasized. In the presence of a relatively low local H1N1 influenza immunization coverage, including some healthcare workers, mandates devoting an extra effort to enhance the favorable perception of influenza A, including H1N1, immunization by LTCF clients and affiliated staff.

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