Article

Vaccination coverage increase among adolescent and young adults of the Palermo District (Italy) as a result of a Public health strategy to contrast an "epidemic of panic"

Claudio Costantino [1], Vincenzo Restivo [1], Gianmarco Ventura [1], Claudio D'Angelo [2], Maria Angela Randazzo [2], Nicolò Casuccio [2], Mario Palermo [3], Alessandra Casuccio [1,*], Francesco Vitale [1]

[1]Department of Science for Health Promotion and Mother to Child Care "G. D'Alessandro", University of Palermo, Italy
[2]Department of Medical Prevention, Local Health Unit of Palermo, Italy
[3]Public Health and Environmental Risks service of the Sicilian Health Department, Palermo, Italy
Corresponding author: alessandra.casuccio@unipa.it; tel +39 0916553606

Abstract: During summer 2016 in the District of Palermo, Italy, the rapid succession of four cases of invasive meningococcal disease among young adults, with one death, have had an extraordinary emphasis by Local and National mass media. The resultant "epidemic of panic" among general population overloaded vaccination Units of the Palermo District during following months. Strategies implemented by Sicilian and Local Public Health Authorities to counteract "meningitis fear" were: a) extension of active and free of charge anti-meningococcal tetravalent vaccination from age class 12-18 to 12-30 years old; b) implementation of vaccination units usual opening hours and rooms tailored for vaccine administration; c) development of informative institutional tools and timely communications throughout local mass media to reassure general population. In 2016, was observed an increase of anti-meningococcal coverage in Palermo District (+18% for 16th y.o. and + 14% for 18th y.o. cohorts) and at Regional Level (+11.2% and +13.5% respectively). Concurrent catch-up of other recommended vaccination for age (diphtheria-tetanus-pertussis-poliomyelitis and papillomavirus), resulted in further increase of doses administered. The fear for meningitis, managed by Sicilian Public Health Authorities, had positive reverberations in terms of prevention. In particular, informative strategies adopted sensibly contributed to get Sicilian young adults closer to vaccination issues.

Keywords: Meningitis; vaccination campaign; mass media; outbreak

Introduction

In 2016, in Italy, *Neisseria meningitidis* was the most frequent responsible for invasive meningococcal disease (IMD). The incidence rate was 0.38/100,000, slightly increasing compared to previous years (0.23 in 2012, 0.29 in 2013, 0.27 in 2014 and 0.31 in 2015) [1].

In Europe, northern regions (Lithuania, UK, Ireland and Iceland) resulted the most affected, with incidence rates of more than 1 case per 100,000[2].

These trends result to be decreasing in each area in which vaccination campaigns against *N. meningitidis* was carried out, since the introduction of the vaccination against serotype C in 1999 [3].

Vaccination has been indeed recognized as the best way to counteract the spread of the bacterium and, consequently, the development of epidemic outbreaks [4].

Since 2016, Italian vaccination schedule consist of one administration of conjugate anti-meningococcal C vaccination at the age of 13-15 months and a second dose, with tetravalent conjugate formulation (ACW135Y), from the age of 11 to 18years old (y.o.) [5]. Anti-meningococcal tetravalent

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 28 February 2018 doi:10.20944/preprints201802.0191.v1

vaccination coverages reported by Italian Health Department during 2016 were 19.69% among sixteen and 7.64% among eighteens [6, 7].

As specifically reported in Table 1, between June and August 2016 four cases of invasive meningococcal disease occurred in the city of Palermo, Italy, at very short distance from each other. The first affected subjects were two young girls who, for working reasons, had attended, during previous weeks, the nightlife places of Palermo. The first case, with fatal outcome within 24 hours from the onset of symptoms, hit a 22 year old girl and was provoked by*N. meningiditidis* serogroup C.

The second case, a 23 y.o. girl affected by *N. meningiditidis* serogroup B, received therapy allowing a healing without relics. The third case, that was caused by *N. meningiditidis* W135 strain, was identified in an Eritrean migrant adolescent, disembarked at the Palermo harbor. Also in this case symptoms have been resolved after hospital assistance. Finally, in August 2016 there was the fourth case, in a 22 y.o. girl passing in Sicily for holiday and then treated in a Tuscan hospital, healed without serious consequences.

Table 1. Brief summary of invasive meningococcal disease cases observed in the Palermo District during 2016 summer

ID	Notification Date	Age (y.o.)	Serotype	Outcome	Tight contact identified during previous 4-6 weeks
01	13rd June 2016	23	C	Death	Nightlife co-workers, Japanese course colleagues, friends/family
02	7th July 2016	22	B	Hospitalization, healing	Nightlife co-workers, family, aunt, boyfriend
03	20th July 2016	15	W135	Hospitalization, healing	travel companions, health care workers
04	5th August 2016	22	Unknown	Hospitalization, healing	Family, travel companions

Although only one death occurred, the rapid succession of the four cases among young adults, in addition to an assiduous nightlife attendance of the first two girls affected, have had an extraordinary prominence by Local and National mass media.

The huge impact on the imaginary of the population, emphasized by mass media resonance of the cases, resulted in an "epidemic of panic", overloading vaccination Units of the Palermo District during following months.

The aim of this study was to assess whether such a sanitary emergency could led not only to a simple increase of anti-meningococcal vaccination coverage in the target population, but also with adequate communication strategies and measure provided by Sicilian Public Health Authorities, could produce a positive effect on vaccine compliance by general population and increase coverage of other vaccination of Sicilian schedule.

Materials and Methods

Sicily have the larger area and represents the fourth most populated among the twenty Italian Regions. Sicilian Health Department has divided the 9 Sicilian District in 9 corresponding Local Health Unit (Agrigento, Caltanissetta, Catania, Enna, Messina, Palermo, Ragusa, Siracusa, Trapani).

 doi:10.20944/preprints201802.0191.v1

Data on vaccination coverage for all vaccines included in the Sicilian Vaccination Schedule were available yearly for Regional and District Level.

After every meningitis cases occurred, the Prevention Department of the Palermo Local Health Unit promptly arranged the routine epidemiological investigation for each of the suspected cases reported. Therefore, closer contacts of the affected subjects were treated with Ciprofloxacin for an anti-meningococcal prophylaxis and occasional contacts have been promptly informed about the precautions to be taken in case of symptoms.

At the same time, all the laboratory tests were prepared for the diagnosis of certainty and the ascertainment of the etiological agent. Once the necessary information has been obtained, punctual communication of the results by Public Health authorities was carried out trough institutional channels and mass media, also in order to inform and reassure general population about the real risk of contracting the disease [8, 9].

Despite the massive information campaign of Local Health Authorities, the local and national media emphasis of the cases was disproportionate, on every platform (papers, TV, web pages and social networks) dedicating wide space for these news. In the following days, news and updates about even suspicious cases were disseminated, without waiting for the laboratory confirmations of the case and without any general population denial. This situation caused an unjustified fear of contagion among general population and the mistaken idea that it was a real meningitis outbreak.

As a consequence, subjects of any ages, but above all adolescents and young adults, assaulted vaccination services, not only in the city of Palermo, but also in the entire District to request anti-meningococcal vaccination [10].

As shown in Table 2, until June 2016, according to Sicilian Vaccination Schedule, anti-meningococcal vaccination was actively and free of charge offered between the 13th and the 15th month of life (anti-meningococcal C conjugate monovalent vaccine) and between 12th and 18th years of life (anti-meningococcal ACW135Yconjugate tetravalent vaccine). Subjects of age >18 years old who requested tetravalent vaccination, could be vaccinated in copayment (half price of the vaccine was paid by Sicilian Health Department) [11].

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 28 February 2018 doi:10.20944/preprints201802.0191.v1

Table 2. Sicilian Vaccination Schedule at 30th June of 2016 [11]

Vaccine	3rd month (since 61st day of life)		After 1 month since Hexavalent/ PCV13 and Rota	5th month (since 121st day of life)		After 1 month since Hexavalent/ PCV13 and Rota	Since 1 month since the second Meningo B dose	11th-12th month		13th-15th month	Since 1 month from MMRV	5th-6th year of life	12th year of life	15th-18th year of life	19th-64th year of life	> 65 years
Diphtheria, Tetanus and Pertussis	DTPa	HEXAVALENT		DTPa	HEXAVALENT			DTPa	HEXAVALENT			dTpa + IPV or dTpa/IPV		dTpa + IPV or dTpa/IPV	dTpa every 10 years	
Polio	IPV			IPV				IPV								
Hepatitis B	HBV			HBV				HBV								
Haemophilus influenzae type b (Hib)	HiB			HiB				HiB								
Pneumococcal (Conjugate)	PCV13			PCV13				PCV13		For high-risk subjects PCV13 (conjugate) e PPV 23 (polysaccharide)						PCV13 / PPV23
Rotavirus	Rotavirus (oral)			Rotavirus (oral)												
Meningococcal B			Meningo B			Meningo B	Meningo B				Meningo B					
Meningococcal C										Meningo C						
Meningococcal ACW135Y													Meningo ACW135Y			
Measles, Mumps, Rubella and Varicella										MMRV o MMR + V		MMRV o MMR + V				
Papillomavirus													HPV (Males and females)		(F) until 45 years	

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 28 February 2018 doi:10.20944/preprints201802.0191.v1

											(M) until 26 years	
Seasonal Influenza					For high-risk subjects seasonal influenza vaccination							Seasonal influenza
Herpes Zoster											> 50 anni se a rischio (altre patologie)	Zoster

106

107 One of the first actions implemented by Sicilian Public Health Authorities was, in July 2016, the
108 extension of the active and free vaccination offer of the tetravalent anti-meningococcal vaccine to
109 subjects aged between 18 and 30 years[12].
110 Subsequently, a further Decree issued by Sicilian Health Department extended vaccination offer
111 to health professionals of the emergency department and to anyone who, for study or work reasons,
112 had to go to the Tuscany Region, where the notifications of IMD were constantly growing from 2015
113 [13].
114 To counteract the growing request of vaccination from the general population, vaccination
115 services of the Palermo District extended working hours and days and Healthcare workers were
116 recalled from holidays. Moreover, in collaboration with the School in Hygiene and Preventive
117 Medicine of the University of Palermo, Italy, twelve medical resident were recruited within the staff
118 of the vaccination services, to support the extra workload generated. Furthermore, during the second
119 semester of 2016, were intensified communication activities for all subjects afferent to vaccination
120 services and were offered, together with anti-meningococcal tetravalent vaccine, catch up of anti-
121 diphtheria-tetanus-pertussis-poliomyelitis (dTpa+IPV) or the anti-papillomavirus (HPV)
122 vaccinations.
123 Finally, in order to contrast the "epidemic of panic", numerous interviews and spontaneous
124 declarations to local and national media, by public health authorities, took place throughout the
125 summer, to explain the real extent of the phenomenon. In addition, both on the official site of the
126 Local Health Unit, and in the main sites of youth aggregation as schools, public and nightlife places,
127 informative material on preventive measure for meningitis infection was disseminated.
128 Coverage data of anti-meningococcal vaccination for the two age groups (16 year-olds and 18
129 year-olds) for which the Regional Health Department produces an annual report, as requested by
130 National Health Department, were reported. Coverage rates for eligible cohort were calculated for
131 2015 and 2016 and it was also analyzed differences in anti-meningococcal vaccination coverage
132 among the various Sicilian LHU. In Sicily, the 16th year old cohort for the year 2015 was made up of
133 53,162 subjects, while for the year 2016, 51,478 adolescents. The 18th y.o. cohort included 53,886
134 subjects in 2015 and 53,002 in 2016 [14].
135 Finally, number of doses for the other two vaccines actively and free of charge offered in Sicily
136 to adolescent (anti-diphtheria-tetanus-pertussis-poliomyelitis and anti-papillomavirus) were
137 evaluated during 2015 and 2016.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 28 February 2018 doi:10.20944/preprints201802.0191.v1

The study was approved by Ethics Committee of the Policlinico "Paolo Giaccone" Hospital (Palermo 1).

Results

As reported in Table 3, from 2015 to 2016 in Sicily the overall coverage rate for the anti-meningococcal vaccination in the 16th-year-old cohort showed, an increase from 39.8% to 51% (+11.2%).In 7 of the 9 Sicilian LHU were observed coverage increases, with the highest growth achieved in the LHU of Agrigento (+ 29.7%) and Palermo (+ 18%), which also reached the highest coverage rate for the cohort considered at Regional Level (78.2%).

Table 3. Vaccination coverages of anti-meningococcal vaccination among 16th and 18thyears old cohorts in the nine Local Health Unit of the Sicilian Districts (2015 vs 2016)

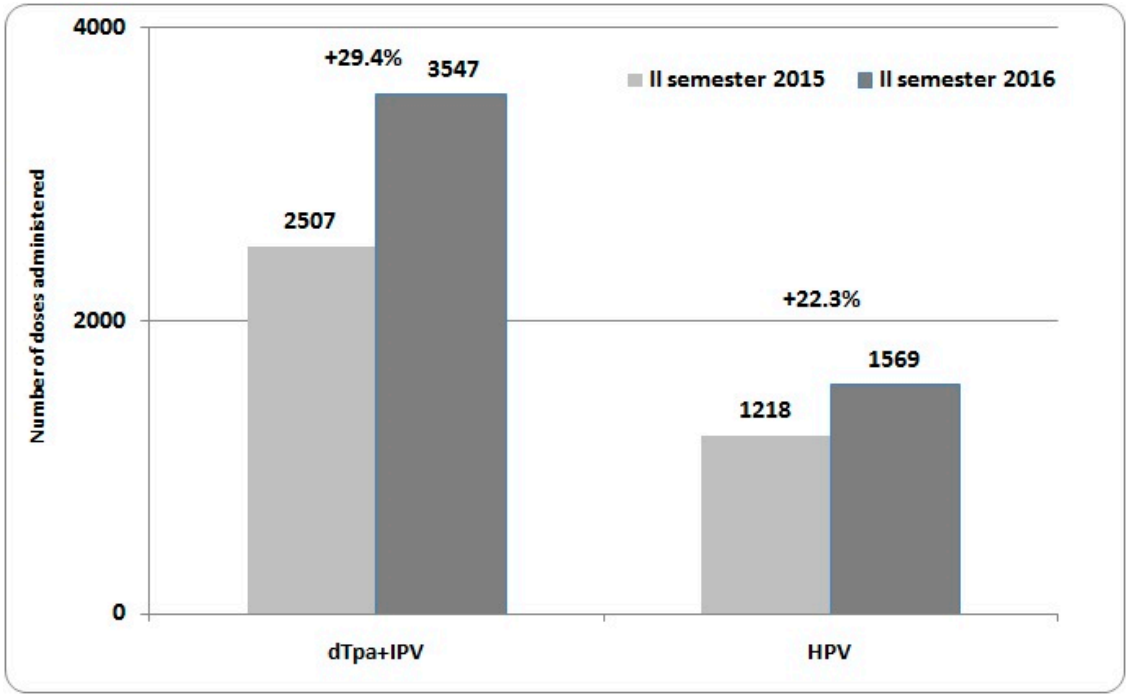
Local Health Unit	16th y.o. cohort			18th y.o. cohort		
	Coverage 2015 (%)	Coverage 2016 (%)	Percent change	Coverage 2015 (%)	Coverage 2016 (%)	Percent change
Agrigento	42.7	72.4	29.7	29	62.6	33.6
Caltanissetta	53.6	49.9	-3.7	36.8	46.8	10
Catania	15.8	31.8	16	15.8	23.6	7.8
Enna	41.6	48.1	6.5	41.6	48.1	6.5
Messina	30.1	35.1	5	24	22.2	-1.8
Palermo	60.2	78.2	18	57.2	71.2	14
Ragusa	59.4	29.8	-29.6	43.9	37.9	-6
Siracusa	35	48.1	13.1	20.1	38.2	18.1
Trapani	32.6	46.6	14	20.3	34.7	14.4
Overall	39.8	51	11.2	30.2	43.7	13.5

Only, the LHU of Ragusa went down from 59.4% to 29.8% (-29.7%). Positive results were also recorded among the 18th y.o. cohort with an increasing vaccination coverage from 30.2% in 2015 to 43.7% in 2016 (+ 13.5%). Local Health Unit of Agrigento confirmed the higher increase (+ 33.6%), followed by Syracuse, Trapani and Palermo with a similar raising of vaccination coverages (+ 18.1%, + 14.4% and + 14% respectively). Overall, higher anti-meningococcal vaccination rate among the 18th y.o. cohort was observed in the Palermo District (71.2%).

In figure 1, were reported the single doses of anti-diphtheria-tetanus-pertussis-poliomyelitis (dTpa+IPV) and anti-papillomavirus (HPV) vaccines carried out in the District of Palermo during the second semester of 2015 and 2016. dTpa+IPV doses increased of29.3% , (passing from 2,507 to 3,547), and HPV administered doses of 22.4% , (increasing from 1,218 to 1,569).

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 28 February 2018 doi:10.20944/preprints201802.0191.v1

Figure 1. Number of doses of dTpa+IPV and HPV vaccines administered in the Local Health Unit of Palermo among 12-18 y.o. adolescents during the second semester of 2015 and 2016



Discussion

Sicilian Public Health Authorities responded promptly to the requests of general population by implementing: an active and free offer of the anti-meningococcal vaccine C and ACW135Y from 12-18 to 12-30 years; information in places of aggregation and communication through institutional websites and social media; punctual counseling activity at the vaccination unitsto sensitize young adults about vaccine prevention and to make appropriate vaccines recalls or administration according to Sicilian Vaccination Schedule.

Data analyzed in the present study showed a consistent increase in anti-meningococcal vaccination rates in the two cohorts of 16th and 18thy.o. Of note, the LHU of Palermo, where occurred the four meningitis cases, showed higher vaccination rate for both cohorts considered. Neverthless, in 7 of 9 Sicilian LHU were reported increase in vaccination coverage from 2015 to 2016. The highest incremental values were however found in the LHU of Agrigento, probably for two reasons: firstly, the second case of meningitis involved a girl residing in Agrigento LHU and moreover, a non-negligible percentage of the population residing there, for study or work reasons, often goes to Palermo during the week. Similar considerations could be applied to the LHU of Trapani and Caltanissetta, where for study or working reasons, part of the young adults population often goes to the Palermo.

The epidemic of panic among general population probably originated from the fear that in Sicily could be repeated what, in 2015, occurred in the Tuscany Region, where there has been a noticeable increase in cases of IMD, due to a particularly aggressive Neisseria strain [13].

Specifically, in Tuscany, IMD cases raised from 0.08 per 100,000 in 2012 to 1.98 per 100,000 in January-February 2016 and have affected all ages, but more significantly the adolescence and young adults cohorts. Instead in Sicily, dissimilarly to what happened in other Italian regions, the incidence rate of IMD remained essentially unchanged in all age groups [1, 15]. Moreover, the main etiological agent of IMD in Sicily was, in 2016, the *S. Pneumoniae* [1, 15].

The alarm of an eventual epidemic was therefore unjustified, as correctly reiterated on several occasions by the local Authorities. On the other hand, as reported in different contexts and with different pathologies, correct communication can make the difference in the management of an emergency caused by the explosion of a possible epidemic outbreak [16, 17].

The unruly access to vaccination services in the days immediately following the first two cases of meningitis confirmed that communication to general population on relevant public health topics should not be left to the work of journalists who are not experts in the field, generating an uncontrolled bouncing of news on the web. Only in the following weeks, throughout the prompt response and the preventive measures implemented by public health authorities, the flow of users to vaccination services was controlled.

This event has allowed an unavoidable activity of counselling to adolescents and young adults not only on the anti-meningococcal vaccination, but also and above all aimed at the recovery, within the same vaccination session or with deferred appointments, of any vaccinations or recalls not carried out (eg. anti-HPV, anti-dTpa + IPV).

The observed increase primarily of anti-meningococcal vaccination coverage, but also, as a result, of the other vaccinations was a positive effect of the "epidemic of panic".

In future, when will be in similar circumstances, Public Health authorities should be operate at least on two levels: the institutional, timely and effective providing the most correct information (risk communication and appropriate prevention measures to be adopted, addressing the population towards a regulated access to vaccination services) and the local one, where the health care workers of the vaccination services have exploited not only the abnormal number of accesses to their services but also a counseling targeted to adolescent and young adult population groups, in order to promote greater confidence in vaccination.

Conclusions

In conclusion, we can affirm that the "media outbreak" that took place in Palermo during the summer of 2016 also had positive implications on vaccination coverage raising awareness among youngsters about vaccination topic. In the future it is hoped that the media will treat health issues with the right precautions to make the population aware of risks, dangers and ways to minimize them. Even the Public Health Authorities, however, will have to watch over the new communication platforms, widespread especially among the very young, with a constant and massive presence able to convey the right information for the right target.

Author Contributions: Costantino C, Ventura G, Restivo V, Casuccio A and Vitale F conceived and designed the experiments; Casuccio N, Palermo M, Randazzo MA, D'Angelo C performed the interventions; Costantino C and Ventura G analyzed the data; Ventura G, Costantino C, Restivo V, Casuccio A wrote the paper.
Conflicts of Interest: The authors declare no conflict of interest

References

1. Rapporto Malattie Batteriche Invasive. National Health Unit. Available online: http://www.iss.it/binary/mabi/cont/Report_MBI_20170403_finale.pdf (accessed on 18th February 2018).
2. Surveillance Atlas of Infectious Disease. Available online: https://ecdc.europa.eu/en/surveillance-atlas-infectious-diseases (accessed on 18th February 2018).

3. Annual Epidemiological Report 2016 – Invasive meningococcal disease. ECDC 2016. Available online: https://ecdc.europa.eu/sites/portal/files/documents/Invasive%20meningococcal%20disease%20AER.pdf (accessed on 18th February 2018).
4. Crum-Cianflone N.; SullivanE. MeningococcalVaccinations. *Infect Dis Ther.* **2016**, *5(2):* 89-112; DOI: 10.1007/s40121-016-0107-0.
5. Piano Nazionale Prevenzione Vaccinale (PNPV 2012-2014). Ministero della Salute. Available online: http://www.salute.gov.it/imgs/C_17_pubblicazioni_1721_allegato.pdf (accessed on 18th February 2018).
6. Vaccinazioni dell'adolescente – Coperture vaccinali. Ministero della Salute. Available online: http://www.salute.gov.it/imgs/C_17_tavole_20_allegati_iitemAllegati_3_fileAllegati_itemFile_5_file.pdf (accessed on 18th February 2018).
7. Vaccinazioni dell'adolescente – Coperture vaccinali. Ministero della Salute. Available online: http://www.salute.gov.it/imgs/C_17_tavole_20_allegati_iitemAllegati_4_fileAllegati_itemFile_5_file.pdf (accessed on 18th February 2018).
8. Corriere del Mezzogiorno. Palermo, muore a 24 anni per sospetta meningite. Su Facebook l'appello dei locali frequentati dalla ragazza. Available online: http://corrieredelmezzogiorno.corriere.it/palermo/cronaca/16_giugno_15/palermo-muore-24-anni-sospetta-meningite-fb-l-appello-locali-frequentati-ragazza-89ddf722-330e-11e6-815d-85ddede72c17.shtml (accessed on 18th February 2018).
9. Live Sicilia. Meningite, paura a Palermo. L'Asp: "Nessun allarme". Available online: http://livesicilia.it/2016/08/10/meningite-paura-a-palermo-lasp-nessun-allarme_775229/ (accessed on 18th February 2018).
10. Giornale di Sicilia. La meningite fa paura. Caos per i vaccini a Palermo. Available online: http://tgs.gds.it/2016/08/11/la-meningite-fa-paura-caos-per-i-vaccini-a-palermo_551132/ (accessed on 18th February 2018).
11. Sicilian Health Department. Modifica ed integrazione del "Calendario Vaccinale per la Vita" adottato con D.A. n°0820/2012. Available online:

http://pti.regione.sicilia.it/portal/page/portal/PIR_PORTALE/PIR_LaStrutturaRegionale/PIR_AssessoratoSalute/PIR_Decreti/PIR_Decreti2015/PIR_Decretiassessorialianno2015/12%2001%202015%20SERV%201%20(38).pdf (accessed on 18th February 2018).

12. Emergenza meningite meningococcica. Integrazione offerta vaccino antimeningococcico tetravalente coniugato. Nota prot. 62169 del 21.07.2016. Assessorato della Salute – Regione Sicilia. Available online: http://epidemiologia.asppalermo.org/Nota%20prot-%20n%2062169%20del%2021%20luglio%202016%20%284%29.pdf (accessed on 18th February 2018).
13. Stefanelli P; Miglietta A; Pezzotti P; Fazio C; Neri A; Vacca P; Voller F; D'Ancona FP; Guerra R; Iannazzo S; Pompa MG; Rezza G. Increased incidence of invasive meningococcal disease of serogroup C / clonal complex 11, Tuscany, Italy, 2015 to 2016. *Euro Surveill.* **2016**, *21(12).* DOI: 10.2807/1560-7917.ES.2016.21.12.30176.
14. DemoIstat. Available online: http://demo.istat.it/ (accessed on 18th February 2018).
15. Ventura G; Restivo V; Costantino C; Casuccio N; D'Angelo C; Stefanelli P; Casuccio A; Vitale F. [Alert for meningitis in Palermo? Successful strategies to counteract the impact of mass media]. *Ig Sanita Pubbl.* **2017** *73(5):* 533-543. [Article in Italian]
16. European Centre For Disease Prevention And Control. Ongoing outbreak of measles in Romania, risk of spread and epidemiological situation in EU/EEA countries, 3 March 2017. Available online: https://ecdc.europa.eu/sites/portal/files/media/en/publications/Publications/27-02-2017-RRA-Measles-Romania,%20European%20Union%20countries.pdf (accessed on 18th February 2018).
17. Hsu Y.C.; Chen Y.L.; Wei H.N.; Yang Y.W.; Chen Y.H. Risk and outbreak communication: lessons from Taiwan's experiences in the Post-SARS era. *Health Secur.* **2017** *15(2):* 165-169. DOI: 10.1089/hs.2016.0111