Relationship between hospital morbidity and vaccination coverage against Influenza A*

Relação entre morbidade hospitalar e cobertura vacinal contra Influenza A

Relación entre morbilidad hospitalaria y cobertura de inmunización contra la Influenza A

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ABSTRACT

Objective: To analyze the profile of the individuals affected by the Influenza A virus (H1N1), and the impact of vaccination on priority groups for vaccination. **Methods:** An ecological, observational, retrospective study, with a population of individuals living in the city of Maringá-PR who were hospitalized for Influenza A between 2009 and 2010. **Results:** In 2009, there were 614 hospitalizations due to influenza A virus infection in Maringá-PR. The availability of the vaccine led to a decrease in the number of affected to 169 in 2010, with the vaccine impact occurring in the following population groups: pregnant women, people with chronic illnesses and adults 20 to 39 years. **Conclusion:** We identified the need to extend the age range for vaccination for children aged 2 to 4 years and to complete vaccination forms of vaccinated individuals and groups with greater rigor.
Keywords: Influenza A vírus; Epidemiology; Nursing; Influenza vaccines/adverse effects

RESUMO

Objetivo: Analisar o perfil dos indivíduos acometidos pelo vírus Influenza A (H1N1), e o impacto vacinal nos grupos prioritários à vacinação. **Métodos**: Estudo ecológico, observacional, de caráter retrospectivo, com população de indivíduos residentes na cidade de Maringá-PR e submetidos à internação por Influenza A entre 2009 e 2010. **Resultados:** No ano de 2009, ocorreram 614 internações decorrentes de infecção pelo vírus Influenza A em Maringá-PR. A disponibilização da vacina fez com que o número de acometidos diminuísse para 169 em 2010, ocorrendo impacto vacinal nos seguintes grupos populacionais: gestantes, portadores de doenças crônicas e adultos de 20 a 39 anos. **Conclusão:** Identificou-se a necessidade de estender a faixa etária de vacinação para crianças de 2 a 4 anos e preenchimento dos impressos de vacinação dos indivíduos e grupos vacinados com maior rigor.
Descritores: Vírus da Influenza A; Epidemiologia; Enfermagem; Vacinas contra Influenza/efeitos adversos

RESUMEN

Objetivo: Analizar el perfil de los individuos afectados por el virus Influenza A (H1N1), y el impacto de las inmunizaciones en los grupos prioritarios a la vacunación. **Métodos**: Estudio ecológico, observacional, de carácter retrospectivo, realizado con población de individuos residentes en la ciudad de Maringá-PR y sometidos a internamiento por Influenza A entre 2009 y 2010. **Resultados:** En el año de 2009, ocurrieron 614 internamientos como consecuencia de infección por el virus Influenza A en Maringá-PR. La disponibilidad de la vacuna hizo con que el número de efectados disminuya a 169 en 2010, ocurriendo impacto de las inmunizaciones en los siguientes grupos poblacionales: gestantes, portadores de enfermedades crónicas y adultos de 20 a 39 años. **Conclusión:** Se identificó la necesidad de extender el grupo etáreo de vacunación para niños de 2 a 4 años y el llenado con mayor rigor de los impresos de vacunación de los individuos y grupos vacunados.
Descriptores: Virus de la Influenza A; Epidemiologia; Enfermería; Vacunas contra la Influenza/efectos adversos

INTRODUCTION

Influenza A (H1N1), known as the "swine flu", is a respiratory disease known as acute influenza caused by the A virus. This is a new subtype of the Influenza virus resulting from the genetic recombination of the swine, avian and human virus with high potential to spread among humans[1]. It is transmitted from one person to another through coughing, sneezing and contact with respiratory secretions from infected persons[2].

In April 2009, a pandemic caused by the new strain of Influenza A virus was declared by the International Public Health community, placing World Public Health in state of alert. On June 11th, the World Health Organization raised the influenza pandemic alert to level 6[3].

In Brazil, the infection was considered generalized on June 16th 2009 and immediate reporting was mandatory in cases of Severe Acute Respiratory Syndrome (SARS) which is characterized by fever, coughing, and dyspnoea.

In 2009, the incidence rate of SARS by pandemic influenza was of 14.5 cases in every 100,000 inhabitants. Since then, the country began to prepare for a second wave of pandemic Influenza; representatives attended a meeting with other American countries during which vaccination strategies were developed/discussed in order to maintain the health services involved in the care of pandemic influenza in a well-functioning condition, reducing the associated morbidity and mortality. Next, a goal was established to vaccinate some groups, giving priority to the following groups: public and private health service workers involved in response to dealing with the epidemic, pregnant women, indigenous people, and those with chronic diseases. If there was vaccine available for purchase, it was recommended that each country should assess the epidemiological situation and eventually include other groups of healthy individuals who were at higher risk of becoming sick or dying as the target population[2].

The follow-up of the profile of those affected by the disease and the effectiveness of the vaccination is imperative, as well as the social and economic impact and the high morbidity and mortality rates caused by Influenza A virus (H1N1).

Thus, the aim of this study was to analyze the profile of those affected by Influenza A virus (H1N1) from 2009 to 2010 and the vaccination impact on the priority groups.

METHODS

The present retrospective observational ecological study was conducted with a population of individuals living in Maringá-PR, who underwent hospitalization for Influenza A in 2009 and 2010 and/or who received H1N1 vaccine. Ecological studies are appropriate to assess the effectiveness of interventions in a group of people who belong to a specific geographical area.

The municipality of Maringá is geographically located in the Northeast region of the State of Paraná and it is one of the most important cities in the state. It has a population of 325,968 inhabitants and 283,792 live in the urban area with a growth rate of 1.86% per year[6].

The data were collected at two time intervals: first by consulting the notification forms for the new human Influenza (pandemic) subtype between October and December 2010, filed in the sector of Secretary of Health Surveillance of the Epidemiological Department of the city of Maringá, PR. The notifications corresponded to the individuals infected with Influenza within the period of January 2009 and December 2010. The variables sought to be identified were as follows: age, sex, ethnicity, presence of pregnancy, education level, symptoms and pre-existing chronic diseases.

During the second stage, data related to the number of doses administered and vaccination coverage of the immunization campaign against Influenza A virus (H1N1), held from March 8 to June 2, 2010, were collected from the Program of National Immunization Information System (Sistema de Informação do Programa Nacional de Imunizações/SI-PNI).

After data collection, revision and pre-codification, tables were drawn up showing the frequency distribution and percentages for the data referent to the profile of the affected population and vaccination coverage against Influenza A.

To verify if there were differences in the behavior of Influenza A-related hospitalizations, before and after the intervention with vaccination of targeted priority groups, data obtained from the population hospitalized in 2009 and 2010 due to the disease and the total population were used. The population of each group were established using data available in the Live Birth Information System (SINASC) from the data of 2008 for children under the age of 2 years and the estimate by IBGE for 2009 (latest data available) of 2-year-old children and older. To calculate the population of patients with chronic diseases, 10% of the population not included in the other groups was used (referring to the population from 2 to 19 years and from 40 to 59 years of age)[2]. To determine the elderly population targeted to receive the vaccination, 20% of the elderly who had chronic diseases were considered [2].

The data were analyzed using the Z-test for proportions. The results were considered significant when the value of p was <0.05. Statistical analyzes were performed using the Statdisk 9.5 program.

The study was conducted in accordance with the disciplinary guidelines in Resolution 196/96 of the National Health Council[6] and the project was approved by the Permanent Ethics Committee on Human Research

(COPEP) of the State University of Maringá (Process No 678/2010) after authorization of the Permanent Training Centre in Health (Cecaps) of the Municipal Secretary of Health of Maringá-PR.

RESULTS

From 2009 to 2010, 783 hospitalizations occurred in Maringá-PR as a result of the Influenza A virus (H1N1) and within six months (July 2009 to January 2010) the 15th Regional Health Center, which comprises 30 municipalities, recorded 2,015 cases of which 624 occurred in the city of Maringá-PR, i.e, 30.96% of admissions were concentrated at the 15th Regional Health Center. The data in Table 1 show some of the characteristics of the individuals hospitalized due to Influenza A (H1N1) in Maringá-PR.

Fever and coughing were the most common symptoms in the analysis of symptoms in the individuals hospitalized/cases notified due to Influenza A (H1N1) in both years. With regard to the variable pre-existing chronic disease, it was found that in 2009 there was a higher incidence rate of metabolic diseases (9.2%), but this percentage declined the following year (2.3%). Pneumopathy was significant in 2009 (8.1%) and 2010 (8.2%).

After the vaccination intervention, according to the data in Table 3, in 2010 it was found that the number of hospitalizations due to influenza A (H1N1) in the group of children under the age of 2 years did not decrease in comparison with 2009, and showed a trend towards increasing.

With regard to the vaccination coverage, the goal set was exceeded in all groups, being much higher in the groups of health workers and patients under the age of 60 years, who had chronic diseases.

Table 1 – Distribution of individuals notified and hospitalized due to Influenza A (H1N1) in Maringá-PR, 2009 and 2010

Variables	2009 (n=614)	2010 (n=169)	Total (n=783)
	n (%)	n (%)	n (%)
Sex			
Women	290 (47.2)	84 (49. 7)	374 (47.8)
Men	324 (52.7)	84 (49.7)	408 (52.1)
Ignored	- (-)	1 (0.1)	1 (0.1)
Ethnicity			
White	460 (74.9)	132 (78.1)	592 (75.6)
Afro-Brazilian	24 (3.9)	5 (2.9)	29 (3.7)
Yellow	12 (1.9)	3 (1.7)	15 (1.9)
Mulatto	69 (11.2)	17 (10.0)	86 (11.0)
Indigenous	1 (0.1)	1 (0.1)	2 (0.3)
Ignored	48 (7.8)	11 (6.5)	59 (7.5)
Education level			
Incomplete Primary School	190 (30.9)	80 (47.3)	270 (34.5)
Complete Primary School	26 (4.2)	6 (3.5)	32 (4.1)
Incomplete High School	37 (6.0)	9 (5.3)	46 (5.9)
Complete High School	66 (10.7)	11 (6.5)	77 (9.8)
Incomplete Higher Education	14 (2.2)	- (-)	14 (1.8)
Complete Higher Education	35 (5.7)	12 (7.1)	47 (6.0)
Does not apply	24 (3.9)	19 (11.2)	43 (5.5)
Ignored	222 (36.1)	32 (18.9)	254 (32.4)

Source: Municipal Secretary of Health of Maringá

Table 2 – Distribution of symptoms and pre-existing chronic diseases in individuals notified and hospitalized due to Influenza A (H1N1). Maringá-PR, 2009 and 2010

Variables	2009 (n=614)	2010 (n=169)	Total (n=783)
	n (%)	n (%)	n (%)
Symptoms			
Fever	522 (85.0)	141 (83.4)	663 (84.7)
Coughing	541 (88.1)	146 (86.3)	687 (87.7)
Shivering	274 (44.6)	65 (38.4)	339 (43.3)
Dyspnoea	300 (48.8)	102 (60.3)	402 (51.3)
Sore throat	297 (48.3)	61 (36)	358 (45.7)
Arthralgia	225 (36.6)	41 (24.2)	266 (34.0)
Myalgia	329 (53.5)	64 (37.8)	393 (50.2)
Conjunctivitis	57 (9.2)	18 (10.6)	75 (9.6)
Coryza	269 (43.8)	72 (42.6)	341 (43.6)
Diarrhea	79 (12.8)	27 (15.9)	106 (13.5)
Others	113 (18.4)	56 (32.5)	169 (21.6)
Pre-existing chronic disease			
Cardiopathy	31 (5.0)	6 (3.5)	37 (4.7)
Pneumopathy	50 (8.1)	14 (8.2)	64 (8.2)
Chronic renal disease	10 (1.6)	1 (0.6)	11 (1.4)
Hemoglobinopathy	24 (3.9)	3 (1.7)	27 (3.4)
Immunosupressed	38 (6.1)	4 (2.3)	42 (5.4)
Smoking	29 (4.7)	9 (5.3)	38 (4.9)
Metabolic disease	57 (9.2)	4 (2.3)	61 (7.8)
Others	113 (18.4)	14 (8.2)	127 (16.2)

Source: Municipal Secretary of Health of Maringá

Table 3 – Hospital morbidity before and after vaccination against Influenza A (H1N1). Maringá-PR, 2009 and 2010

Variables	Hospital morbidity due to Influenza A		Value of p*
	2009 n	2010 n	
Pregnant women	39	6	<0.001**
Patients with chronic diseases < than 60 years	122	38	<0.001**
Patients with chronic diseases > than 60 years	34	14	0.0038**
Children < than 2 years	46	49	0.7574
Adults from 20 to 29 years	96	24	<0.001**
Adults from 30 to 39 years	75	16	<0.001**

* The Z-test used to investigate hospital morbidity before and after the introduction of the vaccination against Influenza A.
** $p < 0.05$.
Source: Municipal Secretary of Health of Maringá – PR

Table 4 – Distribution of vaccination coverage against Influenza A for priority groups. Maringá-PR, 2010

Groups	Goal	Doses n	Coverage %
Health workers	4362	16954	388.6
Indigenous	–	30	–
Pregnant women	3423	6297	183.9
Patients with chronic diseases < than 60 years	29438	110689	376
Patients with chronic diseases > than 60 years	29438	110689	337.6
Children < than 2 years	6740	10834	160.7
Adults from 20 to 29 years	60108	70666	117.5
Adults from 30 to 39 years	53089	67576	127.2

Source: Brazil. Ministry of Health. Secretary of Health Surveillance. Vaccination strategy against pandemic Influenza virus strain (H1N1) 2009: Technical-operational information. Brasília (DF): Ministry of Health; 2009.

DISCUSSION

Up to November 2009, laboratory-confirmed cases of pandemic Influenza H1N1 were notified in 207 countries, including the occurrence of at least 8,768 deaths[7]. In Brazil, immediate reporting was mandatory in cases of SARS, which is characterized by fever, coughing, and dyspnoea, as of June 16th, 2009. Thus, all cases are now reported/notified by the National Notifiable Diseases Surveillance System (NNDSS) and investigated epidemiologically and in laboratory[7].

In 2009, the incidence rate for pandemic influenza (H1N1) in our country was 14.5 cases per 100,000 inhabitants, especially in the South with 66.2 cases, and in the Southeast 9.7 cases per 100,000 inhabitants since the winter season in these locations is more prevalent and transmission of the virus is more favorable in this kind of weather[7].

Since the first case was notified on April 27th 2009 in the state of Paraná until February 2010, there were 60,514 confirmed cases, 291 deaths and 21.585 cases were negative for Influenza by examinations. The state of Parana has 22 Regional Health Centers of which the 2nd Regional Metropolitan Health Center was the one with the highest number of confirmed cases (15,347), followed by the 17th Regional Health Center of Londrina (8,730) and third the 15th Regional Health Center of Maringá (7,626)[8].

In Maringá, between July 2009 and January 2010, the initial health care provided for users with symptoms of Influenza A was concentrated in the referral hospitals, one being public and seven private hospitals. These were the port of entry for these patients who, if case of complications, were transferred to two counter-reference hospitals – Regional University Hospital of Maringá (Hospital Universitário Regional de Maringá – HURM) and Hospital Santa Casa de Maringa.

No significant difference was found with regard to variable gender/sex, which corroborates the number of cases reported in the state of Paraná from April 27 to February 1 of which 47% of patients were men and 53% women[8].

It is important to point out that there were a high number of variables that were not filled out (ignored) such as, for example, ethnicity and education level (Table 1). The fact may be related to several factors, such as lack of attention of the health professionals; deficit in the number of workers for the demand; inability of the patient to answer them or ignorance or absence of the partner since one of the precautionary measures against Influenza A is isolation.

With regard to the symptoms, it was noted that in Maringa the most frequent symptoms coincided with those identified in other studies, including those from Mexico, United States of America (USA) and Spain, where there were the pandemic presented a high number of cases. In the United States of America (USA) the most common symptoms were coughing (92%) and fever (94.2%), and in Spain, headache (64.4%). In Brazil up to the 47th epidemiological week, the clinical symptoms fever, coughing, and dyspnoea were present in almost 100% of the cases. Particularly, fever was present in 92% of the individuals and myalgia in 65% of the cases in the state of Paraná. It should be noted that these symptoms are similar to those presented by individuals affected by seasonal Influenza even in percentage terms, making it difficult to distinguish between seasonal and pandemic Influenza when diagnosis is based on the clinical manifestations only[9].

Generally, seasonal Influenza causes mild and rapidly developing symptoms (2-4 days), however, it might trig-

ger otitis, sinusitis and bronchitis and serious conditions, according to the etiological agent involved. In Brazil, for the purpose of Influenza surveillance, the Influenza syndrome (IS) is that which affects an individual with acute disease (lasting up to a maximum of five days) with fever (if reported), accompanied by coughing or sore throat in the absence of other diagnoses[1].

Fever is one of the most important and troublesome symptoms and it has an average duration of three days with possible progression; respiratory symptoms generally remain for 3 to 4 days after the disappearance of fever. In more severe cases of Influenza, the patient is capable of perceiving and reporting the exact moment the disease began[10].

Gastrointestinal symptoms such as diarrhea, vomiting and abdominal pain can be explained by studies conducted in animals infected with the A virus (H1N1), which indicate the presence of viral particles in the intestine. Furthermore, a high viral load was found in lung tissues. This finding may be related to the respiratory symptoms in approximately ¼ of the symptomatic patients. Pleuritic pain, nasal and gingival bleeding, conjunctivitis and parotiditis may occur, but with lower prevalence[11].

It was noticed in most cases of Influenza A (H1N1) in 2009, both in the city of Maringá and studies abroad, that the majority of patients presented benign, self-limited and clinically mild conditions, but a number of the patients affected by Influenza faced the severe form of the disease with significant pulmonary impairment that progressed rapidly to respiratory failure, especially in groups at risk. Thus, cases presenting high fever (body temperature above 38ºC), coughing, and dyspnoea were classified as SARS[12].

At the beginning of infection, there are mild respiratory symptoms that progress to respiratory distress in approximately 5 days after the onset of symptoms (ranging from 1 to 16 days), sibilant breathing and sputum (often hemoptic). The evolution to acute respiratory failure (ARF) is common and it has been associated with pulmonary infiltrates with bilateral and diffuse ground-glass appearance, developing in 6 days on an average (interval of 4 to 13 days) after initial symptoms, which is a case of primary viral pneumonia in practically all patients[12].

Because the clinical condition of the disease progresses rapidly, with high mortality, high transmissibility, and because of the failure of the traditional, universal preventive measures of hygiene, associated with the high estimated cost of the disease, there is need for safe and effective prophylactic measures, for example, vaccinations. Moreover, today prevention and health promotion are the main bases of the new approach to public health. In 1973, the development of the National Immunization Program (NIP) and the gradual incorporation of several vaccines into the program allowed almost 180 million Brazilian citizens to have a reduced incidence of deaths from immune-preventable diseases. Moreover, vaccine occupies an undeniably outstanding place among public health instruments responsible for saving countless lives and preventing the spread of a series of diseases[13].

Thus, only 6 months after the announcement of the new pandemic virus A (H1N1) specific vaccines were produced using similar methods to those used for seasonal Influenza. These vaccines were licensed and first used in the Northern Hemisphere and in the rest of the world in 2010. The swift production of the vaccine occurred due to the CDC (Centers for Disease Control), since April 2009 in the U.S., identifying cases and analyzing the antigenic action of the virus, for when there is coincidence between the strains contemplated in the vaccine and the circulating strains, the vaccine prevents Influenza in around 70% to 90% of cases[14].

The vaccination campaign against Influenza A (H1N1) in Brazil gave priority to some population groups. The health workers were first to be vaccinated, in order to maintain the health services involved in the pandemic in a working condition. After this, some selected groups, which included the indigenous people, pregnant women, patients with chronic diseases, children under the age of 2 years and adults from the ages of 20 to 39 years, were vaccinated to reduce the risk of developing the severe disease and dying. During the course of the pandemic in Brazil and in other countries, these groups were shown to be those at higher risk and present serious complications and deaths due to the Influenza virus A (H1N1) infection.

The main mechanism for prevention against Influenza and its complications is vaccination, however, this was not offered to the whole population because there was not enough worldwide availability of the product in quantities sufficient to serve the entire population. This is because the laboratories had a limited production capacity, making it impossible to deliver the vaccination in a timely manner, i.e, before the second wave of pandemic Influenza in the countries of the Southern Hemisphere.

However, the present study found that the vaccination goal for all the priority groups was exceeded, which leads to questions regarding the veracity of the data because, when observing other vaccination coverage campaigns, a low compliance rate was found among adults and especially adolescents. This is because, as people get older they feel more autonomous, and consider themselves independent of the care of family and others. They tend to believe they are immortal, and therefore they show little appreciation of the care directed towards health promotion and protection, i.e. primary health[15].

With regard to vaccination of the indigenous population in the city of Maringa, it was found that there was no goal and this occurred because there was no record or village of this ethnicity in the municipality, so the 30 doses of the vaccine against Influenza A (H1N1) administered in this group resulted from the presence of some indigenous persons and their families, who are students at the State University of Maringá, since the institution offers specific quotas for this population. (Table 4).

With regard to high incidence of persons vaccinated, the municipality Immunobiology Coordinators report that during a specific phase of the campaign, the vaccine was offered to people who did not belong to any of the mentioned groups mentioned, however, when filling out the report to control the vaccination campaign, many professionals included this population with the other groups. In addition, the city of Maringá-PR received a significant amount of users from the metropolitan cities requiring immunobiological administration.

However, failure in the vaccination records limits the planning actions for immunobiological administration. Thus, the nursing profession plays a key role in the planning and implementation of the actions of the National Vaccination Program (NVP). It is their responsibility, for example, to adequately training the staff to work in the vaccination clinics (halls/rooms), which involves technical and communicational skills[16].

Furthermore, to improve the quality of care of the health team in the vaccination clinics a concern with the quality of the record of the work process is needed. The daily and effective record of vaccines performed/administered in the vaccination clinics and complete and updated reports are important strategies for the success of the NVP for it enables obtaining reliable information of the vaccine doses applied[16].

With regard to the high rate of hospital admissions of children under the age of 2 years due to Influenza A, even after the implementation of immunobiological doses/process?/program, it is believed that children under the age of 1 year did not received two doses of vaccine as recommended. Studies that compare the efficacy of the vaccine in children who received one or two doses identified greater efficiency when two doses were applied. Moreover, 14 days are needed after the vaccination to provide an adequate immune response and for children under the age of 9 years vaccinated for the first time, this time interval should be considered before administering the second dose[17].

Influenza H1N1 is a common disease among adolescents and more severe in children under the age of 2 years. In a study that reported the first 45 cases of the disease, the age ranged from 40 days to 15 years of age and fives cases required hospitalization (11%)[18]. These hospitalizations lasted 3 to 4 days and no deaths occurred. In another study with 78 hospitalized children, the mean age was 5 years (ranging from 1 month to 16 years), the mean hospital stay amounted to 24h, six children required intensive care, and 15.8% had possible secondary bacterial infection[19].

In 2009, an Argentinean study conducted with 251 children in six public hospitals of Buenos Aires found that 47 (19%) of them required intensive treatment care, 24 (17%) were on mechanical ventilation, and 13 (5%) died. Finally, they concluded that the rate of hospitalization was two times higher than the mortality rate of seasonal Influenza in previous years[20].

CONCLUSION

The results initially pointed to the fact that the implementation of vaccination against Influenza was successful with regard to its effectiveness. However, extending the age range for children from 2 to 4 years of age is of great relevance due to the incidence of the disease in this population.

However, we must be aware of the fact that the minority of hospitalizations do not result from the vaccine, although this is of great value, other factors may also be associated, such as: massive adherence to the use of hygienic measures by a large part of the population, quality of health services combating the pandemic, the Epidemiological Surveillance system of positive cases of infection and even the possibility of the circulating virus changing, among others.

It is important to highlight the need for greater rigor in filling out the forms of the groups of individuals vaccinated, by the excessive number of doses administered to the target population, as well as filling out notification forms, in order to obtain a better data on the pandemic, thus enabling to plan campaign goals related to reality.

A limitation of the present study refers to the inadequate filling out of the forms, that is, the notifications forms contained variables in blank or ignored, given that the presence of these results could indicate other results. This is an important indicator for nursing professionals who should spare no efforts towards this problem through better training of the staff with monitoring and supervision of activities.

However, further studies are needed for comparison among regions of the profile of those affected by the new pandemic virus, so that new health programs may be implemented, since the results of this study can also be obtained in other studies.

Furthermore, evidence that the vaccination campaign against Influenza A (H1N1) is positively reflected on the health of the population must be a valuable subsidy in convincing health professionals and the target population about the importance of vaccination against the disease.

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