

Why influenza vaccination is important for health care workers (HCWs)

Every year the flu vaccine is offered to health care workers to protect them and to prevent the spread of influenza to vulnerable patients. Health care workers should get the flu vaccine to protect themselves, their patients and their families.

This year, in the middle of a Covid-19 pandemic, flu vaccination of healthcare workers is crucial, to ensure that influenza isn't spread by HCWs to vulnerable patients. Dual influenza and Covid-19 infection could be devastating for those with chronic health conditions and older people. Furthermore influenza poses a significant burden on health services - which are also dealing with the burden of Covid-19.

This year the HSE aims to achieve a target of 75% flu vaccine uptake among health care workers. In 2019/2020 there was an increase in flu vaccine uptake both in hospital staff (58.32% compared to 53.2.8% in 2018/2019) and in staff working in long term care facilities (where there was a slight increase in uptake 43.1% compared to 42.2% in 2018/2019) [1]. Although this increase is encouraging, uptake remains well below the target.

Furthermore uptake of flu vaccine among healthcare workers for one hospital group was only 38.7%, while flu vaccine uptake in healthcare workers in some CHOs was below the 43.1% national average. .

Please read this information which answers some common questions about influenza and the flu vaccine. It provides clinical evidence showing why vaccination of healthcare workers is so important.

Why is influenza an issue?

Influenza is a serious infection that can cause life-threatening complications such as pneumonia and bronchitis, especially in those aged 65 and older, children under 4 years of age, those with long term medical conditions and pregnant women. Influenza also leads to an increased incidence of heart attacks and strokes. [2, 3, 4]

Between 200 and 500 people die as a result of influenza each year in Ireland. In a severe season up to 1000 people could die.

Thousands of people are hospitalised each year as a result of influenza placing a significant burden on healthcare services.

In the 2017/2018 season, which was a severe season, 4,713 people with influenza were hospitalised and 191 people needed admission to critical care units. A total of 255 people with notified influenza died. [30]

Transmission of influenza

Influenza is highly transmissible and those who are infected, including healthcare workers, can spread the disease from 1 day before symptoms begin and for 5 to 7 days after developing symptoms.

Influenza occurs every winter but the extent of infection is unpredictable so it is not possible to know whether there will be a mild or a severe season in any particular year.

Influenza is spread by coughing and sneezing. Anyone with influenza can be infectious from 1 day before to 5 -7 days after onset of symptoms. This means that a healthcare worker can pass on influenza to somebody they care for even before they know that they are sick.

Up to 75% of people with influenza will have no symptoms-but they can transmit infection.

This means that healthcare workers can spread can spread infection when they have no symptoms.

Why is vaccination important for health care workers?

Healthcare staff are up to 10 times more likely to get influenza compared to the general population [7]. It is estimated that at least 20% of healthcare workers are infected with influenza every year [8] and many continue to work despite being ill, which increases the risk of spread of influenza to their colleagues and patients.

Flu vaccine is recommended for healthcare workers to protect them from getting influenza and to reduce transmission of influenza from them to their patients, their family and their colleagues. It is especially important because healthcare workers care for and come into contact with elderly and at risk patients who are not able to generate the same level of protection from the flu vaccine [10]. These vulnerable patients rely on the immunity of those who care for them to keep them safe.

During hospitalisation, patients in general are 5-35 times more likely to acquire influenza if exposed to infected patients or healthcare workers. [9]

There are many reports of influenza outbreaks within hospitals and long term care facilities where unvaccinated healthcare workers are likely to have infected patients and facilitated the spread of the disease. [11, 12]

Institutions with high levels of healthcare worker immunisation in Europe have shown reduced rates of influenza -like illness, hospitalisation and deaths from influenza in the elderly, and a reduction in healthcare worker sick leave. [13-15]

Who should get vaccinated?

Flu vaccine is recommended for all those working in health care settings including:

- Medical, nursing, paramedical and allied health professional staff
- Medical, nursing, paramedical and allied health professional students
- Dental personnel

- Hospital porters
- Cleaners
- General support staff
- Ambulance personnel
- Staff in disability and social care services especially those in residential settings
- Healthcare administrative staff
- Carers and home helps
- All GP practice staff
- Agency staff that fall into the above categories.

Should pregnant healthcare workers be vaccinated?

Yes. Flu vaccine is recommended for all pregnant women. Pregnant women are more likely to get complications from influenza because of changes in their heart and lung function during pregnancy. If they get influenza, they are more likely to need admission to hospital and even to critical care units. In 2017/2018 flu season, nine pregnant women were admitted to critical care units (intensive care units) in Ireland as a result of influenza [30]. Getting influenza in pregnancy may also lead to premature birth, lower birth weight and even stillbirth. There is evidence that flu vaccination reduces the rate of stillbirth by over 50%. After birth, the flu vaccine continues to provide protection to the mother and baby for up to six months after birth. Infants under the age of 6 months have the highest rate of hospitalisation and death from influenza. [24, 27, 28, 29]

The vaccine can be given at any stage of pregnancy.

How can flu be prevented?

The best way to prevent influenza is to get the flu vaccine. Flu vaccine is a safe, effective way to help prevent influenza infection, avoid hospitalisation and reduce influenza related deaths and illnesses. Vaccination of healthcare workers has been shown to reduce influenza -related deaths by 40%.

What is influenza (flu)?

Influenza is a highly infectious acute respiratory illness caused by the influenza virus. Influenza affects people of all ages. Influenza spreads rapidly and outbreaks of influenza occur almost every year, usually in winter. This is why it is also known as seasonal influenza.

How common is influenza?

Each year in Ireland influenza causes significant illness and mortality. During the 2017/2018 influenza season which was a severe influenza season:

- Sentinel GP influenza-like illness (ILI) consultation rates were higher than in the previous five seasons, peaking at 110.8 per 100,000 population,
- 4,713 cases of influenza were hospitalised and 191 were admitted to Critical Care Units. The highest admission rates were amongst adults aged 65 years and over.
- The number of deaths in notified influenza cases was 255. These deaths occurred in both community and hospital settings.
- 223 confirmed influenza outbreaks were reported. [30]

How serious is influenza?

Influenza is an unpredictable illness. It is often a self-limiting illness in healthy younger people but can cause headache, fever, cough, aching muscles weakness fatigue. Recovery is usually within 7 days but some people recover more quickly. However, influenza can be severe and can cause serious illness and death, especially in the very young, pregnant women and in the elderly. Hundreds of people die from influenza each winter in Ireland.

Serious respiratory complications can develop, including pneumonia and bronchitis, to which older people and those with certain chronic medical conditions are particularly susceptible. Pregnant women have also been found to be at increased risk of the complications of influenza.

The number of deaths due to influenza is high compared to other infectious diseases -for example invasive meningococcal disease causes around 2-12 deaths per year in Ireland. [5] Influenza causes an average of 200-500 deaths per year in Ireland, and may be up to 1000 in a severe season. Worldwide, influenza causes between 3 and 5 million cases of severe disease each year and 291,000 and 646,000 deaths every year. [32]

It is estimated that influenza associated deaths and complications, in addition to work absenteeism and reduced productivity, contribute to an economic burden of €6-14 billion per year in the EU. [6]

Is it a cold or flu?

A cold is a much less severe illness than influenza. The influenza symptoms come on suddenly with fevers and muscle aches, (although older people often do not generate a fever). A cold usually starts gradually with symptoms of a sore throat and a blocked or runny nose. It may be difficult to tell the difference between influenza symptoms and symptoms of Covid-19

How is influenza spread?

Influenza is a highly infectious illness. A person carrying the virus can spread the illness by coughing or sneezing from 1 day before they develop symptoms and for up to 5 days after symptoms develop. Influenza can survive on worktops/objects especially in low temperatures and in low humidity. Less often, a person might get influenza by touching a surface or object with influenza virus on it and then touching their own mouth, eyes or possibly their nose. The virus can live on a hard surface for up to 24 hours and a soft surface for around 20 minutes.

Why is flu vaccination required every year?

Each year the flu vaccine offered to healthcare workers contains inactivated (killed) forms of the most common influenza virus strains that are circulating. The circulating influenza viruses change each year which is why a new flu vaccine has to be given each year.

What strains are in the 2020/2021 seasonal flu vaccine?

This year's seasonal flu vaccine is a quadrivalent vaccine that protects against the 4 strains of influenza virus recommended by the World Health Organization (WHO) as the strains most likely to be circulating this season (northern hemisphere) [16].

These are:

- an A/Guangdong-Maonan/SWL1536/2019 (H1N1)pdm09-like virus;
- an A/Hong Kong/2671/2019 (H3N2)-like virus;
- a B/Washington/02/2019 (B/Victoria lineage)-like virus; and
- a B/Phuket/3073/2013 (B/Yamagata lineage)-like virus.

What vaccine is available for the 2020/2021 seasonal flu programme?

The flu vaccine used in the 2020/2021 HSE seasonal vaccination programme Quadrivalent Influenza Vaccine (split virion, inactivated) manufactured by Sanofi Pasteur. The vaccine is also marketed as Vaxigrip Tetra.

When should you get the flu vaccine?

The best time to get the flu vaccine is at the beginning of the flu season at the end of September or in early October. Flu vaccine is recommended for all those in the at-risk groups from the beginning of the flu season until the end of the flu season (end of April). Women who are pregnant at any stage during the flu season should get flu vaccine. Therefore two flu vaccines, one in each season, may be necessary during pregnancy. [33]

Is there anyone who cannot get flu vaccine?

History	Recommendation
Non-anaphylactic egg allergy and anaphylaxis to egg without admission to ICU	Those with confirmed egg anaphylaxis (without admission to ICU) or non-anaphylactic egg allergy can be given influenza vaccine with an ovalbumin content <0.1µg per dose, in primary care or in school
Those who have required admission to ICU for a previous severe anaphylaxis to egg.	Refer to hospital specialist for vaccination with seasonal influenza vaccine with ovalbumin content <0.1µg per dose. QIV vaccines have an ovalbumin content of ≤0.06 micrograms per dose

Most people can get flu vaccine.

It is not recommended for those who have:

- A history of anaphylaxis following a previous dose of flu vaccine or any part of the vaccine.
- People taking combination checkpoint inhibitors (e.g. ipilimumab plus nivolumab) should not receive any flu vaccines, because of a potential association with immune-related adverse reactions. [33].

What about those with an egg allergy?

Those with confirmed egg anaphylaxis and non-anaphylactic egg allergy can be given an influenza vaccine with an ovalbumin content <0.1µg per dose. [33]

The flu vaccine in the 2019/2020 HSE seasonal vaccination programme is Quadrivalent Influenza Vaccine (split virion, inactivated) manufactured by Sanofi Pasteur. It contains less than 0.1µg ovalbumin per dose and so can be administered in accordance with the Table below. [33]

When should vaccination be postponed?

There are very few reasons why vaccination should be postponed. Vaccination should be re-scheduled if you have an acute illness with a temperature greater than 38°C.

How does flu vaccine work?

Flu vaccine helps the person's immune system to produce antibodies to the influenza virus. When someone who has been vaccinated comes into contact with the virus these antibodies attack the virus.

How effective is the vaccine?

Annual vaccination is important because flu viruses are constantly changing and immunity from vaccination declines over time.

Vaccine effectiveness depends on how closely circulating strains of influenza match with those in the vaccine. Influenza vaccines provide seasonally variable protection of 40-90% in persons less than 65 years. [19]

However, the vaccine is only 30%-40% effective in preventing illness among persons 65 years of age and older. Although the vaccine is not highly effective in preventing clinical influenza among the elderly, it is effective in preventing complications and death. Among elderly persons living in long-term care facilities, the vaccine is 50-60% effective in preventing hospitalisation for all causes and 70-80% effective in preventing death. [19, 20, 21]

Influenza vaccination remains the best protection against influenza and is recommended by all major expert bodies including the World Health Organization, US Centers for Disease Control and Prevention, European Centre for Disease Prevention and Control and the National Immunisation Advisory Committee of the Royal College of Physicians of Ireland.

How safe is the vaccine?

The flu vaccine is very safe. It has been given for more than 60 years to millions of people worldwide. Common side effects are: Local: redness, swelling, pain, and induration at the site of the injection Headache, myalgia and fatigue and are also common.

These reactions usually disappear within a couple of days without needing treatment. [22]

How safe is the flu vaccine during pregnancy?

Flu vaccines have been given to millions of pregnant women. The flu vaccine has been given to protect pregnant women for almost 60 years in the US. Reactions are generally mild and serious side effects are very rare. [25-29]

What about severe reactions?

The risk of having an anaphylactic reaction to the seasonal flu vaccine is very rare (1 person per million), but those who have had a severe reaction (anaphylaxis) to a previous dose of seasonal flu vaccine or to any part of the vaccine should not receive it.

How is safety of the vaccines monitored?

All medicines including flu vaccines require licensing by the Health Products Regulatory Authority (HPRA) or the European Medicines Agency (EMA). Any adverse events should be reported to the HPRA.

Is there thiomersal in the seasonal flu vaccine?

No. There is no thiomersal in the vaccine being used in the 2020/2021 flu campaign.

Is there porcine gelatin in the vaccine?

No, there is no gelatin or porcine gelatin in the vaccine for healthcare workers used in the 2020/2021 flu campaign.

Can the vaccine cause the flu?

Sometimes the short lived side effects from the vaccine may be thought to be from flu itself. This is not possible as the viruses in the vaccine are inactivated (killed), which means they cannot cause infection. Flu vaccine manufacturers kill the viruses used in the vaccine during the process of making the vaccine and the vaccine is rigorously tested prior to release.

How long does the vaccine take to give immunity?

It takes up to two weeks to develop immunity after vaccination.

What should I expect after vaccination?

You may get soreness, redness or swelling around the injection site. You may experience a mild aches and pains, fatigue and headache for up to 48 hours after receiving the vaccine. These non-specific side effects do not mean that you are getting influenza.

Why are some healthcare workers not vaccinated?

There are a variety of reasons why healthcare workers are not vaccinated. The National Immunisation Office carried out focus groups with healthcare workers in 2011. Research carried out by the Department of Public Health HSE West and NUIG in 2017 [34], also identified reasons why healthcare workers do not get vaccinated:

Some healthcare workers had misconceptions about flu vaccine similar to those reported from other countries, such as:

"I'm very healthy so my immune system will protect me from flu. Why should I get the flu vaccine?"

FACT:

- Healthcare workers are at increased risk of influenza infection compared to the general adult population.
- Even healthy people can get seriously ill from influenza
- Many healthcare workers may be asymptomatic or only have mild symptoms and may continue to work.
- Influenza is very infectious and those who are infected can spread the disease
- Influenza is infectious from 1 day before symptoms develop, so healthcare workers may spread the flu before they even know they are sick
- This increases the risk to their colleagues and patients.

"I know the symptoms of the flu, and would stay at home if I get sick. So, I wouldn't infect my colleagues or patients. Why should I get the vaccine?"

FACT

- Influenza can result in serious illness even in those who are young and healthy
- Influenza can be transmitted from one day before (while asymptomatic) and for 5-7 days after developing symptoms during which time patients, colleagues and family members could be infected.
- Influenza can be asymptomatic, which means you won't know you are unwell and can spread flu to others.

"I believe infection control practices such as hand hygiene are a key deterrent to the risk of flu"

FACT

- Infection prevention and control procedures including hand hygiene are essential in health care settings but they will not prevent influenza.
- Vaccination is the best protection against influenza.

"I had the vaccine before and still got the flu"

FACT

- There may be other circulating viruses that can cause symptoms similar to influenza .
- The vaccine protects against influenza and no other viruses.
- There may have been exposure to influenza around the time of the vaccination or during the two week period it takes to develop immunity.

“I got the flu after getting the flu vaccine”

FACT

- The vaccine can't give you influenza because it doesn't contain any live viruses.

“I'm worried about the side effects of the vaccine”

FACT

Common side effects of the vaccine are mild and usually resolve in 1-3 days. Serious side effects are very rare. In contrast Influenza can be a serious illness. Even in healthy young people who are not in a risk group, influenza can cause fever, headache, myalgia weakness and fatigue. It can take a week to resolve and you will need to take time off work to recover.

When should I be vaccinated?

Influenza vaccine is available from the beginning of October and all health care workers with direct patient contact should be vaccinated as soon as possible.

How do I get vaccinated?

Contact your line manager, occupational health department, general practitioner or pharmacist for further details.

- The flu vaccine is free to healthcare staff (all those working in healthcare settings or in the community with patients/clients in at risk groups) and to all those in the recommended at risk groups. The vaccine is available free of charge from your occupational health department.
- The vaccine and administration of the vaccine is also free from GPs or pharmacists for all healthcare workers (whether or not you have a medical card)

Where can I find out more?

- Seasonal Flu Vaccine Presentation at <http://www.hpsc.ie/az/respiratory/influenza/seasonalinfluenza/>

More information is also available from

- Royal College of Physicians of Ireland Immunisation Guidelines for Ireland
<https://www.hse.ie/eng/health/immunisation/hcpinfo/guidelines/chapter11.pdf>
- Health Protection Surveillance Centre website <http://www.hpsc.ie/A-Z/Respiratory/Influenza/Seasonal/Influenza/>

- Centers for Disease Control and Prevention-Epidemiology and Prevention of Vaccine Preventable Diseases "The Pink Book-13th edition, 2015 available at:
<http://www.cdc.gov/vaccines/pubs/pinkbook/chapters.html>
- Department of Health UK. Immunisation against infectious diseases "The Green Book" and updates available at Department of Health UK. Immunisation against infectious diseases "The Green Book" Influenza Chapter. Last updated 23 April 2019 .Available from:
<https://www.gov.uk/government/publications/influenza-the-green-book-chapter-19>

References

1. Uptake of the Seasonal Influenza Vaccine in Acute Hospitals and Long Term/Residential Care Facilities in Ireland in 2018-2019. A Report by the Health Protection Surveillance Centre (provisional), 2019.
2. Smeeth L, Thomas SL, Hall AJ, et al. 2004, 'Risk of myocardial infarction and stroke after acute infection or vaccination', *N Engl J Med*, 351:2611-8.
3. Nichol KL, Nordin J, Mullooly J, et al. 2003 'Influenza vaccination and reduction in hospitalizations for cardiac disease and stroke among the elderly', *N Engl J Med*, 348:1322-32.
4. Udell J Zawi R, Bhatt D, Keshtkar-Jahromi M, Gaughran F, Phrommintikul A, Ciszewski A, Vakili H, Hoffman E, Forkouh M, Cannon C, 2013 'Association between Influenza vaccination and Cardiovascular outcomes in High risk patients A meta-analysis' *JAMA* 310 (16): 1711-1720
5. HPSC Annual Epidemiological Report 2015, 1. Vaccine Preventable Diseases, 1.3 Meningococcal disease, accessed 14 August 2017 http://www.hpsc.ie/a-z/vaccinepreventable/bacteriameningitis/publications/annualreports/meningococcal-disease-annual-reports/File_15972.en.pdf
6. Preaud E, Durand L, Macabeo B, Farkas N, Sloesen B, Palkache A et al. Annual public health and economic benefits of seasonal influenza vaccination: a European estimate. *BMC Public Health* 2014;14:813. <http://dx.doi.org/10.1186/1471-2458-14-813>
7. Kuster SP, Shah PS, Coleman BL, Lam PP, Tong A, Wormsbecker A, & McGeer A, 2011. 'Incidence of influenza in healthy adults and healthcare workers: a systematic review and meta-analysis' *PLoS ONE* 6(10):e26239. doi:10.1371/journal.pone.0026239
8. Elder G, O'Donnell B, McCrudden EA, Symington IS, & Carman WF, 1996, 'Incidence and recall of influenza in a cohort of Glasgow healthcare workers during the 1993-4 epidemic: results of serum testing and questionnaire', *BMJ*. 313:1241-2.
9. Vanhems P, Voirin N, Roche S, Escuret V, Regis C, Gorain C et al. Risk of influenza-like illness in an acute health care setting during community influenza epidemics in 2004-2005, 2005-2006, and 2006-2007: a prospective study. *Archives of Internal Medicine* 2011;171(2):151-7
10. World Health Organization 2012. Strategic Advisory Group of Experts on Immunization. Background Paper on Influenza Vaccines and Immunisation. Accessed 14 August 2017:

11. Cunney RJ, Bialachowski A, Thornley D, Smaill FM, & Pennie RA, 2000, 'An outbreak of influenza A in a neonatal intensive care unit', *Infect Control Hosp Epidemiol.* 2000;21:449-51
12. Malavaud S, Malavaud B, Sandres K, Durand D, Marty N, Icart J, & Rostaing L, 2001, 'Nosocomial outbreak of influenza virus A (H3N2) infection in a solid organ transplant department' *Transplantation.* 2001;72:535-7
13. Carman WF, Elder AG, Wallace LA et al. 2000, 'Effects of influenza vaccination of healthcare workers on mortality of elderly people in long term care: a randomised control trial', *The Lancet.* 355:93-97.
14. Hayward AV, Harling R, Wetten S et al. 2006, 'Effectiveness of an influenza vaccine programme for care home staff to prevent death, morbidity and health service use among residents: cluster randomised controlled trials' *British Medical Journal*, doi:10.1136/bmj.39010.581354.55
15. Lemaitre M, Meret T, Rothan-Tondeur M, Belmin J, Lejonc JL, Luquel L et al. Effect of influenza vaccination of nursing home staff on mortality of residents: a cluster-randomised trial. *Journal of the American Geriatrics Society* 2009;57(9):1580-6.
16. World Health Organization. "Recommended composition of influenza virus vaccines for use in the 2019-2020 northern hemisphere influenza season" accessed on 10th July 2019: https://www.who.int/influenza/vaccines/virus/recommendations/2019_20_north/en/
17. National Immunisation Advisory Committee, Influenza chapter Immunisation Guidelines for Ireland, (updated June 2020) Available from: <https://www.hse.ie/eng/health/immunisation/hcpinfo/guidelines/chapter11.pdf>
18. National Immunisation Office, Seasonal Influenza Vaccination Programme 2019-2020 Available from: <https://www.hse.ie/eng/health/immunisation/pubinfo/flu-vaccination/>
19. Osterholm MT, Kelley, NS, Sommer, A, Belongia, EA. 2012, 'Efficacy and effectiveness of influenza vaccines: a systematic review and meta-analysis', *Lancet Infect Dis*, 12: 36-44.
20. World Health Organization 2005. Influenza Vaccines, WHO position paper. 33 ed.
21. Centers for Disease Control. 'Influenza Chapter', In: Centers for Disease Control and Prevention, ed. *The Pink Book-Course Textbook -13th Edition* (2015).
22. Medicines information online 2017, Inactivated Influenza Vaccine (Split Virion) BP Summary of Product Characteristics, viewed 14 August 2017 [http://www.medicines.ie/medicine/10483/SPC/Inactivated+Influenza+Vaccine+\(Split+Virion\)+BP/](http://www.medicines.ie/medicine/10483/SPC/Inactivated+Influenza+Vaccine+(Split+Virion)+BP/)
23. Bridges C, Thompson WW, Meltzer MI, Reeve GR, Talamonti WJ, Cox NJ, Lilac HA, Hall H, Klimov A, Fukuda K, 2000. 'Effectiveness and cost-benefit of influenza vaccination of healthy working adults: A randomized controlled trial', *JAMA.* 284(13):1655-1663

24. Nichol KL, Lind A, Margolis KL, Murdoch M, McFadden R, Hauge M, Magnan S, Drake M, 1995. 'The effectiveness of vaccination against influenza in healthy working adults', *New England Journal of Medicine*. 333(14): 889-893.
25. Cleary BJ, Rice Ú, Eogan M, Metwally N, McAuliffe F. 2014. '2009 A/H1N1 influenza vaccination in pregnancy: uptake and pregnancy outcomes -a historical cohort study. *European Journal of Obstetrics and Gynecology and Reproductive Biology*'. 178:163-8. doi:10.1016/j.ejogrb.2014.04.015.
26. Steinhoff MC, MacDonald N, Pfeifer D, Muglia LJ, 2014 'Influenza vaccine in pregnancy: policy and research strategies', *Lancet*, 383: 1611-1612
27. Naleway A, Irving S, Henninger M Li D, Shifflett P, Ball S, Willima J Cragan J Gee J, Thompson M for the Vaccine Safety Datalink and Pregnancy and Influenza Project 2014 'Safety of influenza vaccination during pregnancy : A review of subsequent maternal obstetric events and findings from two recent cohort studies'. *Vaccine*, 32: 3122-3127
28. Yudin M. 2014 Risk management of seasonal influenza during pregnancy: current perspectives. *International Journal of Women's Health*: 6 681-689
29. Stowe J, Andrews N, Wise L, Miller E 2009, 'Investigation of the Temporal Association of Guillain-Barré Syndrome with Influenza Vaccine and Influenza like Illness Using the United Kingdom General Practice Research Database', *American Journal of Epidemiology*. 169(3):382-388; doi:10.1093/aje/kwn310
30. Regan AK, Moore HC, de Klerk N, Omer SB, Shellam G, Mak DB, Effler PV, 2016. 'Seasonal Trivalent Influenza Vaccination During Pregnancy and the Incidence of Stillbirth: Population-Based Retrospective Cohort Study', *Clinical Infectious Diseases*, Volume 62, Issue 10, 15 May 2016, Pages 1221–1227. <https://doi.org/10.1093/cid/ciw082>
31. Influenza Surveillance in Ireland – Annual Epidemiological Report. Influenza and Other Seasonal Respiratory Viruses in Ireland, 2017/2018 Available from: http://www.hpsc.ie/a-z/respiratory/influenza/seasonalinfluenza/surveillance/influenzasurveillancereports/seasonsummaries/Influenza%202017-2018%20Annual%20Summary_Final.pdf
32. Doyle JD, Chung JR, Kim SS, et al. Interim Estimates of 2018–19 Seasonal Influenza Vaccine Effectiveness — United States, February 2019. *MMWR Morb Mortal Wkly Rep* 2019;68:135–139. DOI: <http://dx.doi.org/10.15585/mmwr.mm6806a2External>.
33. Iuliano AD, Roguski KM, Chang HH, Muscatello DJ, Palekar R, Tempia S et al. Global Seasonal Influenza-associated Mortality Collaborator Network. Estimates of global seasonal influenza-associated respiratory mortality: a modelling study. *Lancet*. 2018 Mar 31;391 (10127):1285-1300.
34. National Immunisation Advisory Committee. Immunisation Guidelines for Ireland. Available from: <https://www.hse.ie/eng/health/immunisation/hcpinfo/guidelines/> [Accessed August 2020]
35. Domegan, C., McHugh, P., Harkin, K., McNamara, Á., O'Donovan D., Brychkov, D. and Fitzgerald, C. (2017) "Healthcare Worker Flu Vaccination Research and Strategy: A Summary Report", Whitaker Institute, NUI Galway, Ireland.