Flu Evolution

Flu virus composition

Different types of flu viruses circulate each year.[1,2]
Almost all seasonal flu is caused by four strains, two A strains and two B strains.[2]

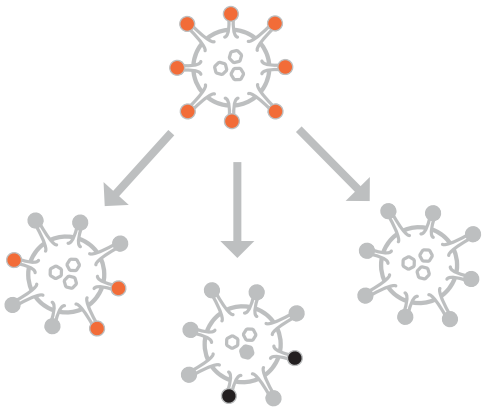
2 A subtypes:		2 B lineages:	
A/H1N1	A/H3N2	B/Yamagata	B/Victoria

Both A and B strains cause significant illness, which can lead to hospitalisation and death.[2]

HOW A FLU VIRUS CHANGES

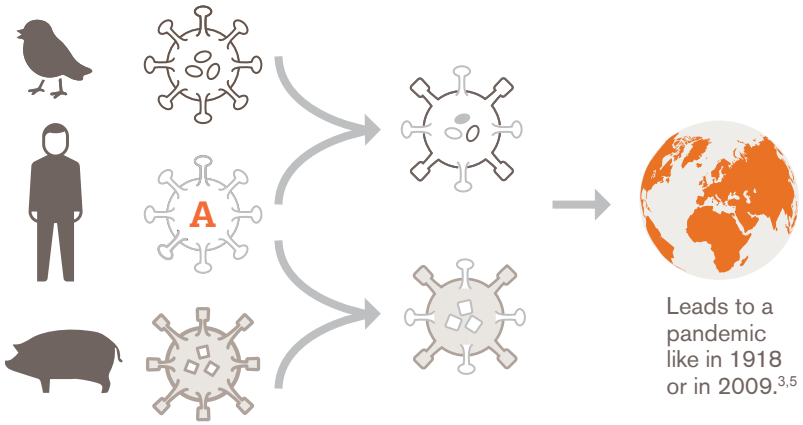
Flu viruses constantly change. This happens in two ways: **drift and shift.**[3]

DRIFT: small continual mutations



Because of these mutations the strains in the annual seasonal flu vaccine are updated every year.[4]

SHIFT: an abrupt major change

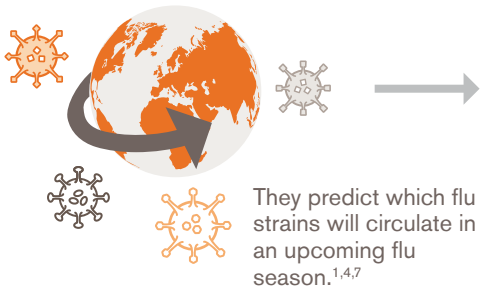


Leads to a pandemic like in 1918 or in 2009.[3,5]

- Shift only occurs in A-strain flu viruses.
- Shift is caused by a change in the genetic code of the virus and may contain gene segments from other species like a bird or pig.

The challenges of predicting **seasonal flu vaccine composition**[6]

The World Health Organization (WHO) conducts surveillance all year.



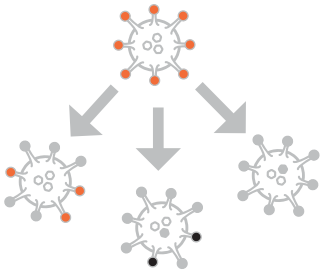
They predict which flu strains will circulate in an upcoming flu season.[1,4,7]

The strains recommended annually by the WHO are included in the vaccine.

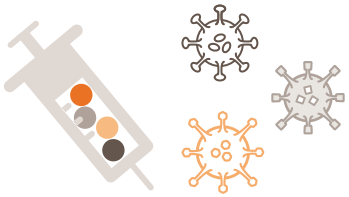
Flu strain predictions are made months before the vaccine is used.

DRIFT[3]

means:
the circulating strain can occassionally be different from those in the vaccine.



Drift happened in 2014



The flu A strain H3N2 in the vaccine did not match the H3N2 circulating that year.

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VACCINE MISMATCH

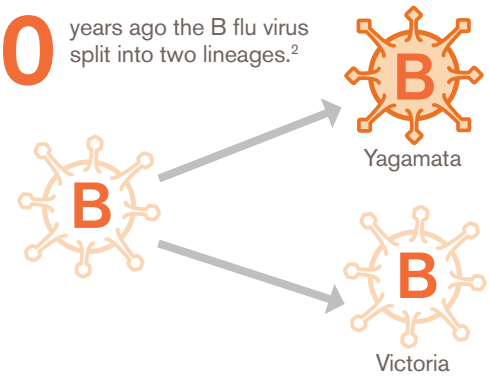
means:

- The vaccine may have reduced protection against mismatched strains.
- But the vaccine still protects against other flu strains in circulation.

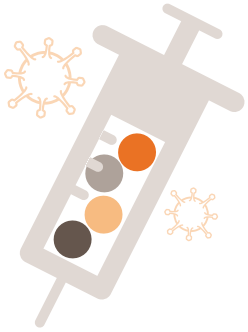
Helping overcome vaccine mismatch: broader B strain protection

Vaccine mismatch can happen with both A and B strains, and when it occurs, the flu vaccine for that year may be less effective.[4,6]

30 years ago the B flu virus split into two lineages.[2]

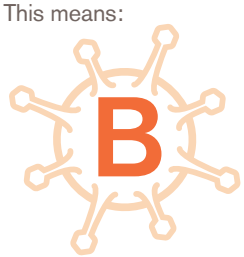


When the B strain contained in the flu vaccine is not from the same lineage as the circulating B strain, **this is known as influenza B strain mismatch.**



Although A-drift happens every 2–8 years on average, it is unpredictable and there is currently no solution to tackle it.[8,9] However, it is now possible to improve influenza vaccination effectiveness by reviewing influenza B strain protection.[1,2]

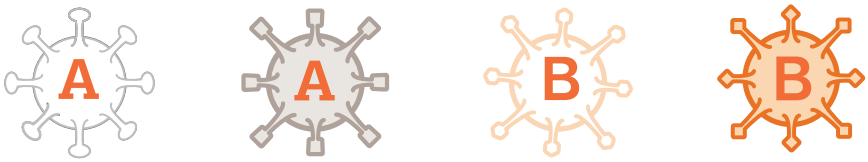
This means:



Strains Cause

33.3% of flu illness[7]

6.3% of flu deaths in Canada in 2010-13[10]



Prior to 2013, the WHO recomended three strains for inclusion in the seasonal flu vaccine (two A strains and one B strain). Since 2013, the WHO recommends four strains for inclusion in the seasonal flu vaccine (two A strains and two B strains):[1]

= Broader protection against disease from B strains

Vaccination might not be suitable for everyone. 100% protection cannot be guaranteed. Side effects and allergic reactions may occur. Side effect of influenza vaccines are generally mild and temporary. Pain at the injection site, headache, myalgia and fatigue are commonly reported. Ask your healthcare professional if vaccination is suitable for you.

REFERENCES

[1]World Health Organization. Influenza (seasonal) factsheet. 2014. Available at: http://www.who.int/mediacentre/factsheets/fs211/en/. Last accessed October 2015. [2]Ambrose CS, *et al.* The rationale for quadrivalent influenza vaccines. *Hum Vaccin Immunother*. 2012; 8: 81–88. [3]US CDC. How the flu virus can change: "drift" and "shift". 2014. Available at: http://www.cdc.gov/flu/about/viruses/change.htm. Last accessed October 2015. [4]US CDC. Selecting the viruses in the seasonal influenza (flu) vaccine. 2014. Available at: http://www.cdc.gov/flu/professionals/vaccination/virusqa.htm. Last accessed October 2015. [5]Khanna M, *et al*. Influenza pandemics of 1918 and 2009. *Future Virology*. 2013; 8(4): 335–342. [6]WHO. Questions and answers: vaccine effectiveness estimates for seasonal influenza vaccines. 2015. Available at: http://www.who.int/influenza/vaccines/virus/recommendations/201502_qanda_vaccineeffectiveness.pdf. Last accessed October 2015. [7]WHO. Influenza virus activity in the world. 2015. Available at: www.who.int/influenza/gisrs_laboratory/updates/summaryreport/en/. Last accessed October 2015. [8]Wolf Y, *et al*., Long intervals of stasis punctuated by bursts of positive selection in the seasonal evolution of influenza A virus. *Biol Direct.* 2006; 1(34): 357–360. [9]Smith D, *et al*., Mapping the antigenic and genetic evolution of influenza virus. *Science.* 2004; 305(5682): 371–376. [10]Public Health Agency of Canada. Statement on seasonal influenza vaccine for 2014–2015. 2014. Available at: http://www.phac-aspc.gc.ca/naci-ccni/flu-grippe-eng.php. Last accessed October 2015.