Centre Hospitalier Sud Francilien

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Service d'Hygiène, Prévention et Contrôle des Infections

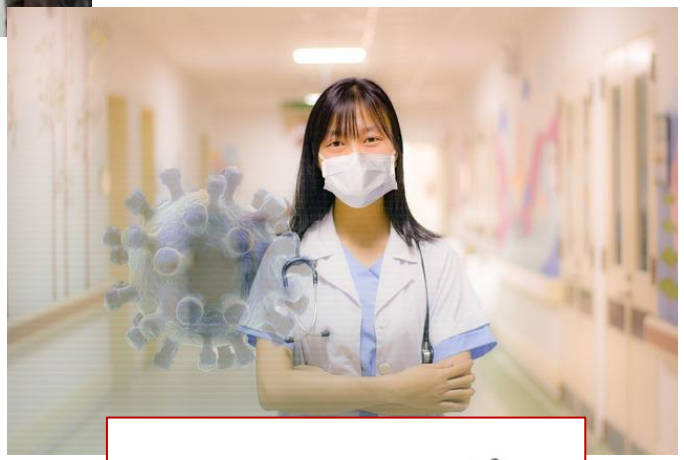
CH Sud Francilien, Corbeil-Essonnes

Prevention, inner air pollution and environmental aspects :

Prevention of viral respiratory infections

Which contexts?

- **Which viral respiratory infections?**
  - ✓ Seasonal: **influenza**, **bronchiolitis**, **COVID** (?)
  - ✓ Non-seasonal: measles, COVID (?)



- **Which viruses?**
  - ✓ Rhinovirus, seasonal coronaviruses, **SARS-CoV-2**, **Respiratory syncytial virus (RSV)**, **Influenza** and Parainfluenza viruses, Metapneumovirus, Adenovirus
- **Under what circumstances?**
  - ✓ Both in the **community** and in **healthcare institutions** (HI)
- **For what purpose?**
  - ✓ Not to acquire and then not to pass on
  - ✓ In the community: to prevent the **spread of viruses in the general population**
  - ✓ In HI : to prevent **nosocomial infections** in immunocompromised patients

Which transmission modes?

- From the **"droplet" versus "aerosol" dichotomy** to the **notion of continuum**

Respiratory transmission routes of infectious diseases

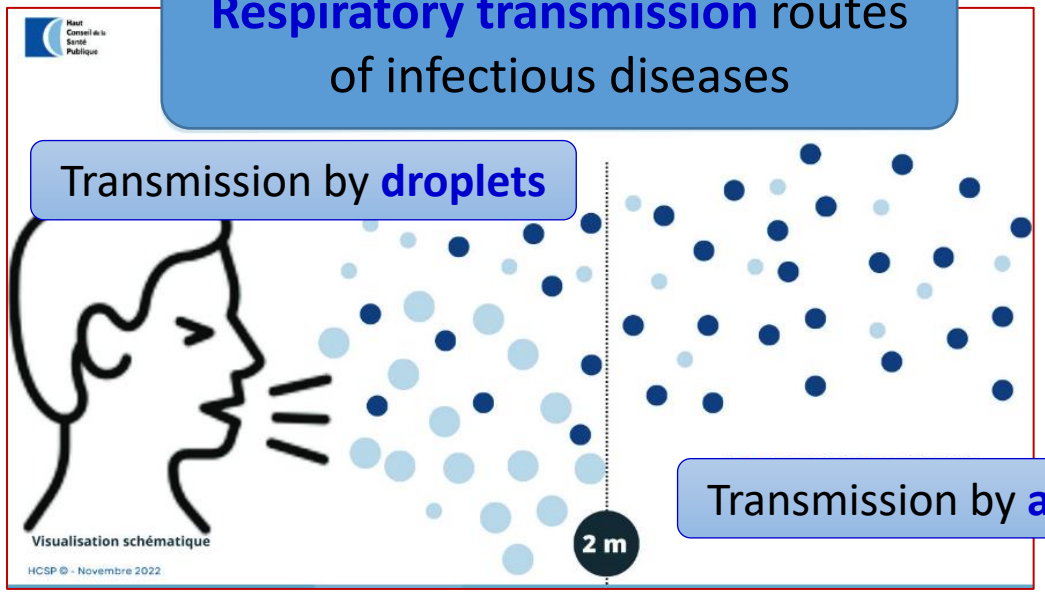
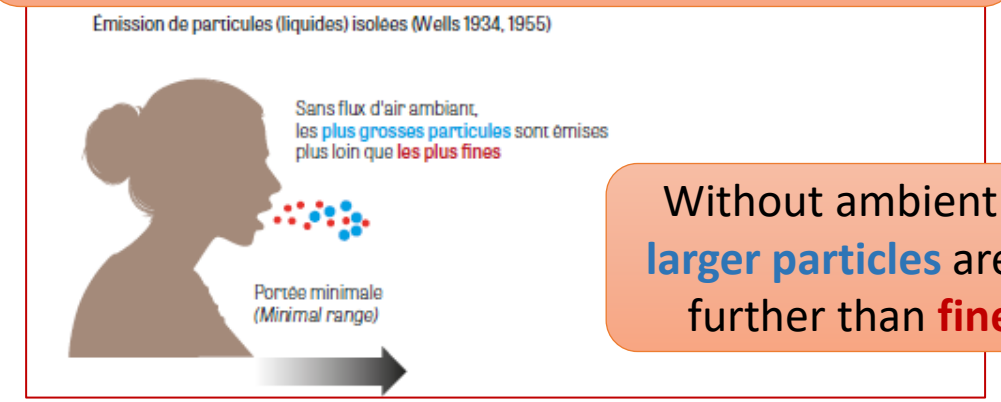
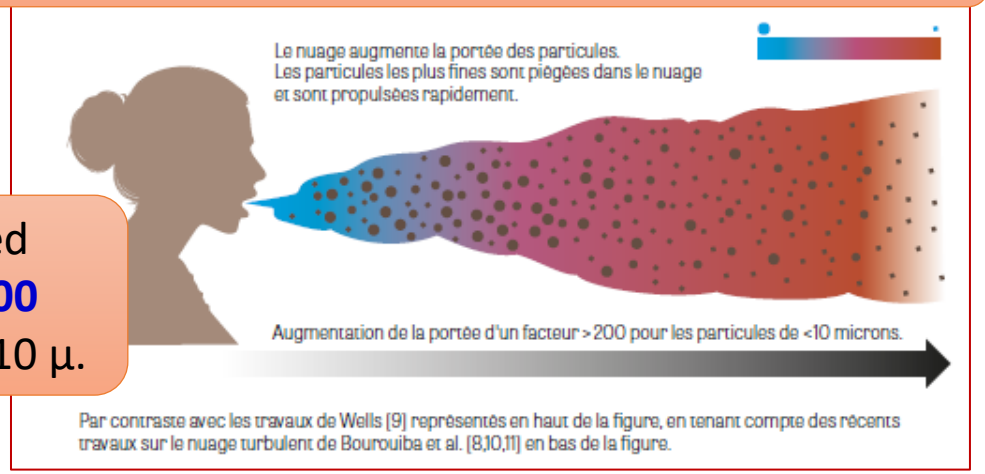


Diagram of the **continuum of respiratory infectious particles (RIP)** after emission and their evolution in the turbulent cloud.



Without ambient air flow, **larger particles** are emitted further than **finer ones**

The cloud increases the range of particles.
Finer particles are trapped in the cloud and propelled rapidly.



Range increased by a **factor > 200** for particles < 10 µ.

Which transmission modes?

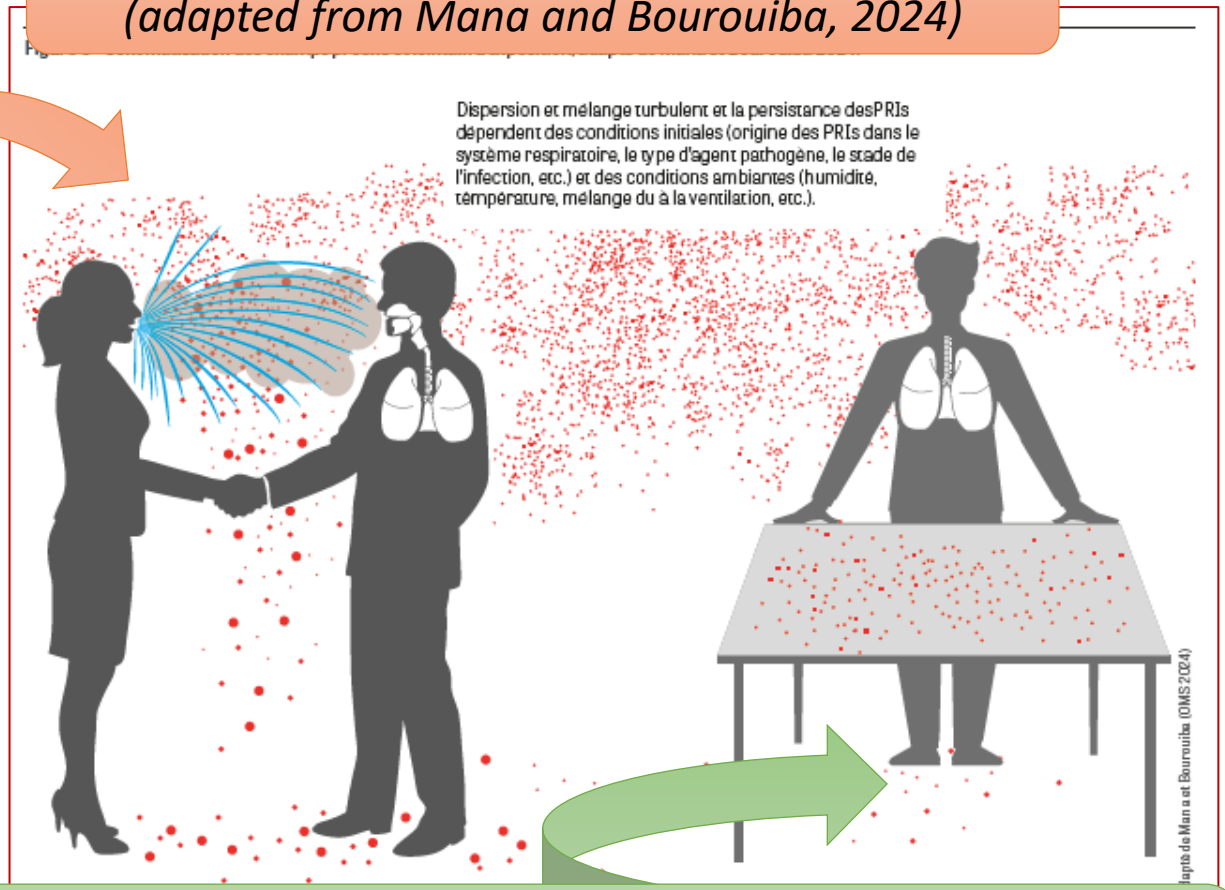
- From the **"droplet" versus "aerosol" dichotomy** to the **notion of continuum**

Near field

Exposure by inhalation of parts of the turbulent cloud concentrated in RIP **AND** by direct impact of RIP on mucous membranes.

Concentrated exposure and heavy inhalation.

Diagram of **near and far fields of exposure**
(adapted from Mana and Bourouiba, 2024)



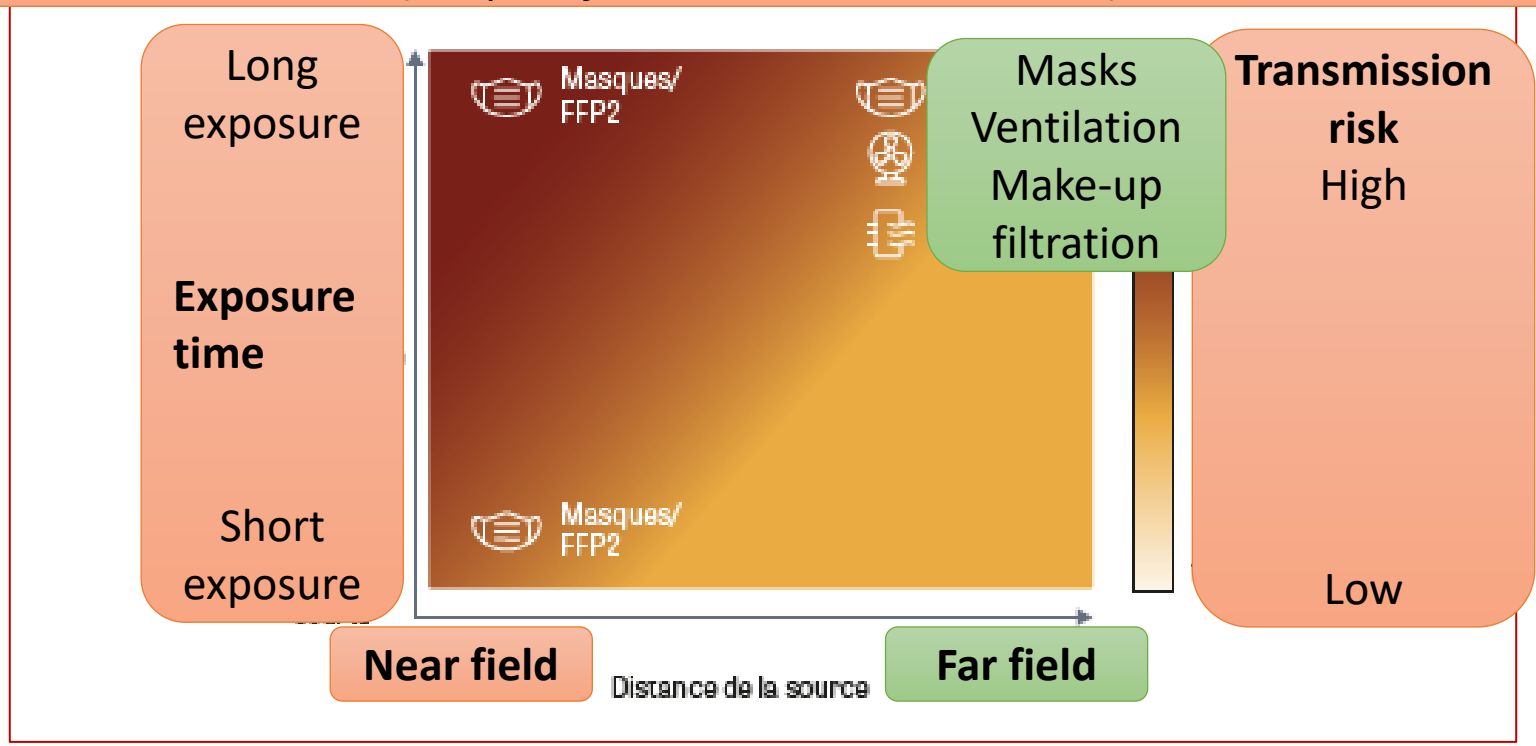
Far field

Inhalation exposure to parts of the dilute turbulent cloud containing RIP.
Dilution and cloud heterogeneity (presence of persistent concentrated pockets) **depend on strength and ventilation**.

Which transmission modes?

- From the **"droplet" versus "aerosol" dichotomy** to the **notion of continuum**

Combining exposure duration and distance to assess cumulative exposure and therefore relative transmission risk for a given pathogen and infectious dose
(adapted from Bourouiba et al, 2021)

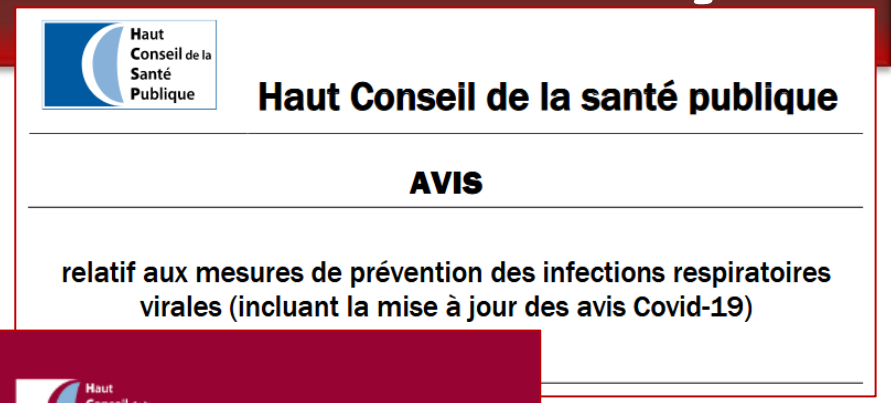


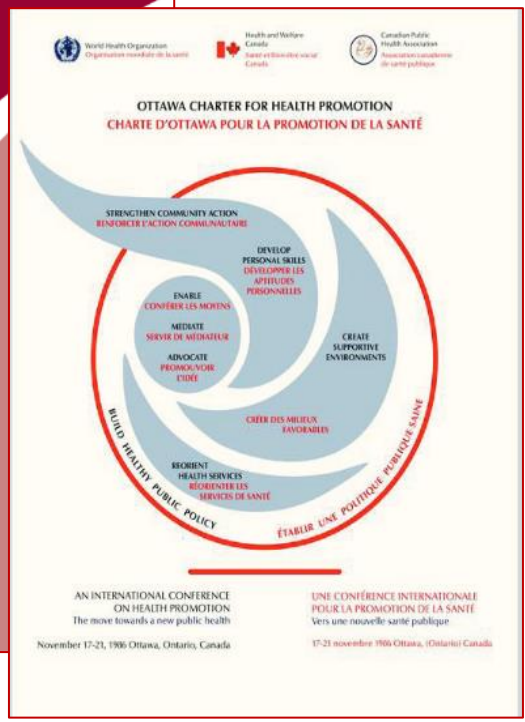
Which measures in the community?

- "Avis du Haut Conseil de la Santé Publique" (HCSP) in 2023 : = universal hygiene measures, vaccination and prophylactic treatment

- **Universal hygiene measures** had already been reviewed by the HCSP in 2022
- The HCSP adapted the **5 priority actions of the Ottawa Charter** (1986) to hygiene measures:
  1. Developing sound public policies
  2. Create healthy environments
  3. Strengthen community action
  4. Acquire individual skills
  5. Reorienting health services

  Available on: https://apps.who.int/iris/handle/10665/349653





Which measures in the community?

Developing sound public policies

Stratégie nat. de prévention des infections et de l'antibiorésistance
Ventilation standards for residential and commercial buildings

Create healthy environments

At school: hand-washing equipment
In companies, communities, HI
Accessibility of personal protective equipment...

Strengthen community action

Social and community mobilization

Projects by community

Acquire individual skills

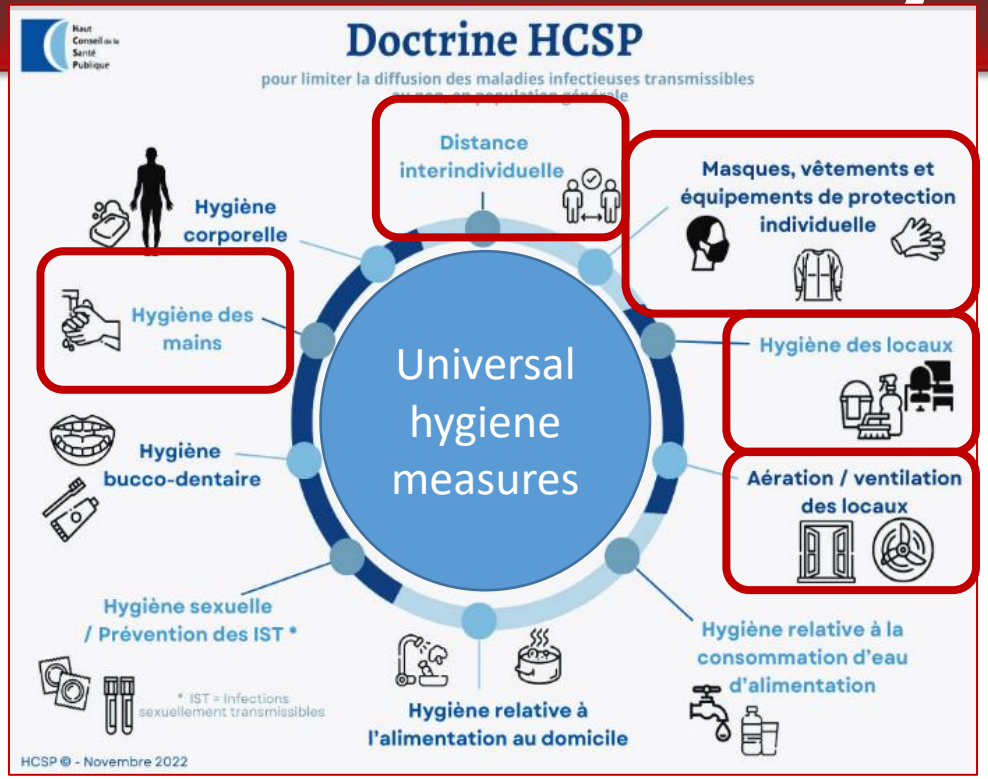
Knowledge and understanding of best practice guidelines

Education

Reorienting health services

Raising awareness and equipping professionals to communicate with the general public

Which measures in the community?

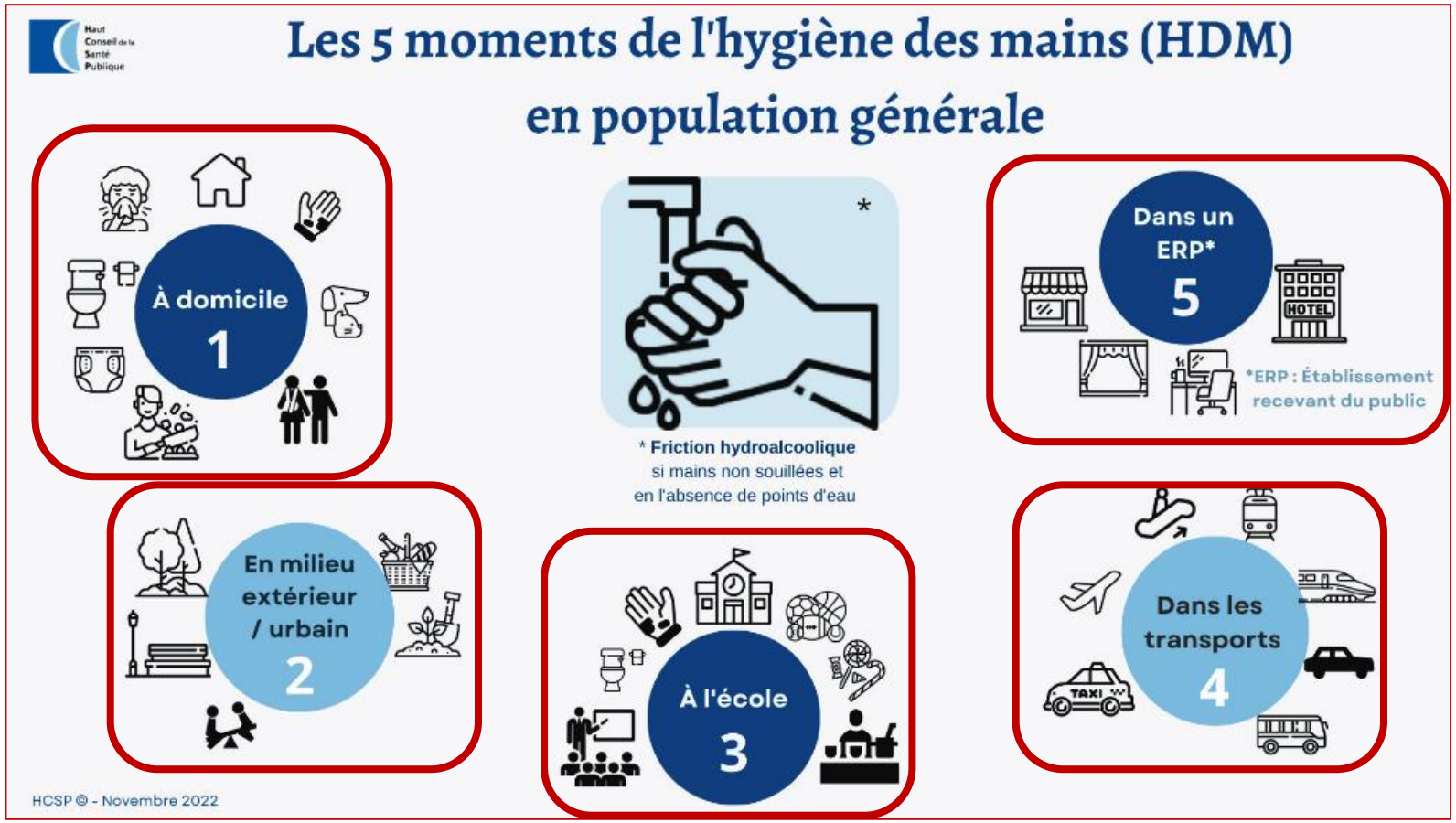


- For infections linked to viruses with respiratory tropism, **in summary** :
  - ✓ Wear a **surgical mask**
  - ✓ Implement regular **hand hygiene**
  - ✓ **Avoid shaking hands** with a sick person
  - ✓ Use a **single-use** handkerchief
  - ✓ Do not touch **mucous** membranes
  - ✓ **Clean** frequently touched surfaces at home
  - ✓ In the event of **bronchiolitis**: **1)** avoid contact with people at risk of developing a severe form of the disease, **2)** avoid bringing infants or children into contact with infected people, if possible, **3)** avoid day-care centers, nurseries and community centers, and **4)** avoid taking infants and children into confined areas with large crowds of people
  - ✓ Use physical measures to **renew the air**

Which measures in the community?

And especially for the **regular hand hygiene**: 5 moments

- ✓ at **home**,
- ✓ in **outdoor/urban** environments,
- ✓ at **school**,
- ✓ on **public transport**
- ✓ and in **public buildings**



Which meas

Canadian Journal of Public Health (2023) 114:547–554
https://doi.org/10.17269/s41997-023-00777-2

SPECIAL SECTION ON COVID-19: QUANTITATIVE RESEARCH

Check for updates

A population-based assessment of avoidable hospitalizations and resource use of non-vaccinated patients with COVID-19

Sean M. Bagshaw[1,2,3,4] · Annalise Abbott[5] · Sanjay Beesoon[5,6,7] · Samantha L. Bowker[2] · Danny J. Zuege[2,8] · Nguyen X. Thanh[2,3,7]

- **Vaccination against COVID:**
  - ✓ **Reduction** of morbidity and mortality
  - ✓ Canadian study [*Bagshaw 2023*]: unvaccinated, vaccine-eligible people with Covid-19 were 10 times more likely to be hospitalized than those who received a 2-dose vaccination regimen, and 21 times more likely than those who received a booster dose.
    → This translated into potentially avoidable hospital bed-days and substantial costs.
  - ✓ **Bivalent vaccines** (historical strain + variant strain): adapting to the evolution of SARS-Cov-2 strains to avoid vaccine escape
  - ✓ Has been **included in the vaccination calendar** and recommendations since 2021
  - ✓ Vaccination **in children** provides little collective benefit, since it has little effect on blocking transmission
  - ✓ A **booster dose** is recommended: **1) Twice a year**, in spring and autumn: for people aged 80 and over, residents in establishments for dependent elderly people and long-term care units, immunocompromised people and people at very high risk of severe disease, whatever their age, according to each individual situation and based on a decision shared with the care team. **2) Every autumn**: for people aged 65 to 79, pregnant women, people at risk of severe disease and their families, regardless of age.

Which measures in the community?

- **Vaccination against influenza:**
  - ✓ Vaccination against seasonal influenza is recommended for all persons targeted by the recommendations of the vaccination calendar and vaccine recommendations in force.
  - ✓ Dual vaccination, Covid-19 and influenza, is recommended whenever a person is eligible for both vaccinations.
- **Vaccination and prophylactic treatment against bronchiolitis:**
  - ✓ The European Medicines Agency recently recommended that **2 RSV vaccine candidates** be approved for use **in certain situations**: **1) protection of newborns** by administration of the vaccine during pregnancy, and **2) protection of the elderly** against RSV infections of the lower respiratory tract.
  - ✓ In children, **2 monoclonal antibody-based drugs** are approved for the prevention of RSV infection: palivizumab (Synagys®) in premature infants and infants with chronic cardio-respiratory diseases, and nirvesimab (Beyfortus®) in premature infants up to 24 months of age, and in infants with no risk factors up to 12 months of age.
  - ✓ The **maternal vaccine**, designed to protect newborns from birth, should soon be on the market. **Vaccines to protect infants** will be available at a later date.

Which measures in the community?

- **Ethical and legal aspects of vaccination:**
  - ✓ **Legally speaking**, vaccination requires that the person to whom it is proposed **be informed** and that his or her **consent be obtained**.

    → If the **adult** is unable to express his or her wishes, consent must be sought from the trusted support person or, failing that, family members or close friends.

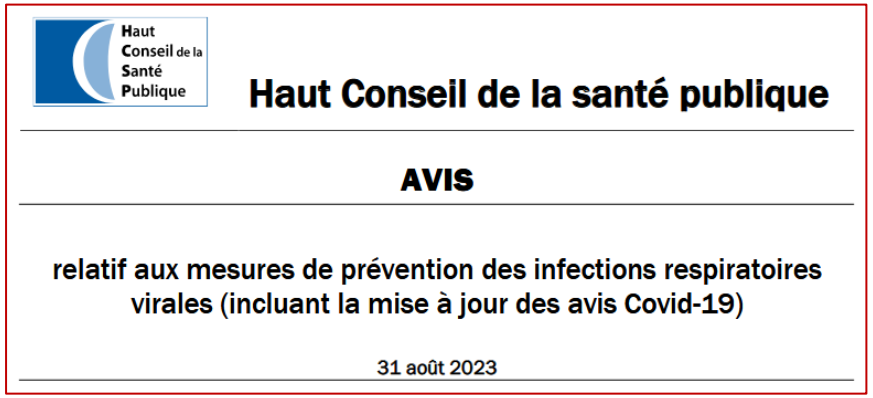
    → If the person is a **minor or under legal protection** (curatorship, guardianship, family habilitation, spousal habilitation), the legal representative should be contacted.

    → If the person is **no longer able to act alone** and has signed a mandate for future protection, contact his or her mandatary.
  - ✓ **From an ethical point of view**, vaccination is an **act that can benefit the vaccinated individual**, but also **helps to protect those around him or her**, including people who cannot be vaccinated because of their state of health, and who will therefore only be protected by sufficient herd immunity.

    → **collective dimension** to the decision to be vaccinated, which needs to be thought through and which, for this reason, cannot be based on the principle of autonomy alone.

Which measures in healthcare institutions?

- Healthcare institutions (HI) = hospitals, medical-social establishments, homes for the elderly
- According to the **level of risk** defined by Santé publique France SpF :
  - ✓ **Low**: no epidemic,
  - ✓ **Moderate**: pre- or post-epidemic,
  - ✓ **High**: epidemic


Haut Conseil de la Santé Publique

Haut Conseil de la santé publique

AVIS

relatif aux mesures de prévention des infections respiratoires virales (incluant la mise à jour des avis Covid-19)

31 août 2023

- Based on **composite criteria** that take into account data from the various acute respiratory infection surveillance networks and available information systems.
- Source: **Bulletin on acute respiratory infections**. Weekly and regional updates during periods of viral circulation.
- The measures defined by the HCSP according to the level of risk **must also be adapted** to the specific features of each institution and to the local epidemic situation.

Which measures in healthcare institutions?

- Definition of **5 decision matrices** based on 5 areas of prevention.

- **Decision-making matrix** for:
  - ✓ HI or homecare **professionals** (**Matrix 1**): implemented or lifted by each facility, in conjunction with the infection control unit and the occupational health department, taking into account local and regional epidemic data ;

    → Surgical masks / FFP2, hydro-alcoholic rub, ventilation and aeration of premises
  - ✓ **patients, residents and visitors** to HI (**Matrix 2**): implemented or lifted by each facility, in conjunction with the infection control unit and the occupational health department, taking into account local and regional epidemic data ;

    → Surgical masks, hydro-alcoholic rub, vaccination and universal hygiene measures, biological confirmation in the presence of signs suggestive of ARI in people at risk of severe disease and in residents of medical-social establishments and homes for the elderly, at least for the first cases

Which measures in healthcare institutions?

- **Decision-making matrix** for:
  - ✓ **monitoring pregnant women** and **hospitalizing mothers for childbirth** (**Matrix 3**): Influenza and SARS-CoV-2 infections but not RSV infections cause severe illness in pregnant women and newborns

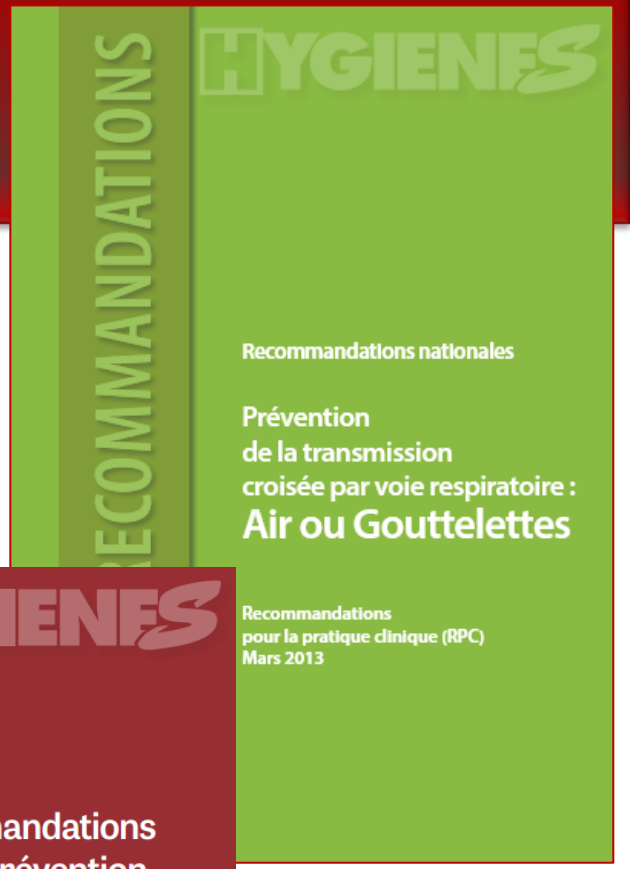
    → offer vaccination against Covid-19 and influenza throughout pregnancy, hydro-alcoholic rub, surgical masks, biological confirmation at every suspicion, …
  - ✓ **the return home of mothers and newborns, infants and their environment up to 3 months of age** (**Matrix 4**): based on the recommendations of pediatric learned societies

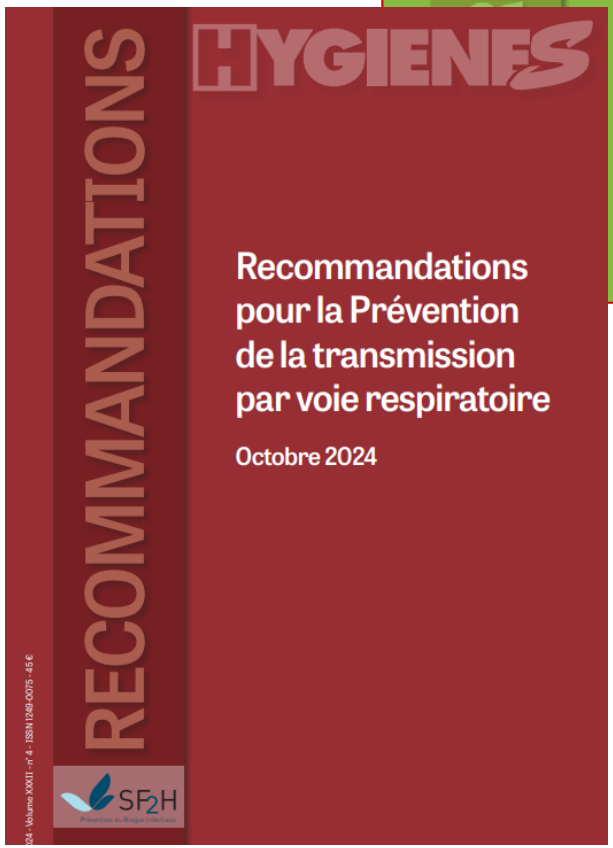
    → strict hand hygiene, surgical masks, limit visits to close adults with no clinical signs of illness, avoid family and friends gatherings as much as possible, and if possible, avoid going into the community before 3 months of age
  - ✓ **environmental measures** in HI (**Matrix 5**): <u>room cooling management</u> using fans, misting, mobile air conditioning

    → fans only possible in a closed room with one person; misting possible; air-conditioning possible with a closed door, but at reduced speed or turned off before any treatment.

Which measures in healthcare institutions?

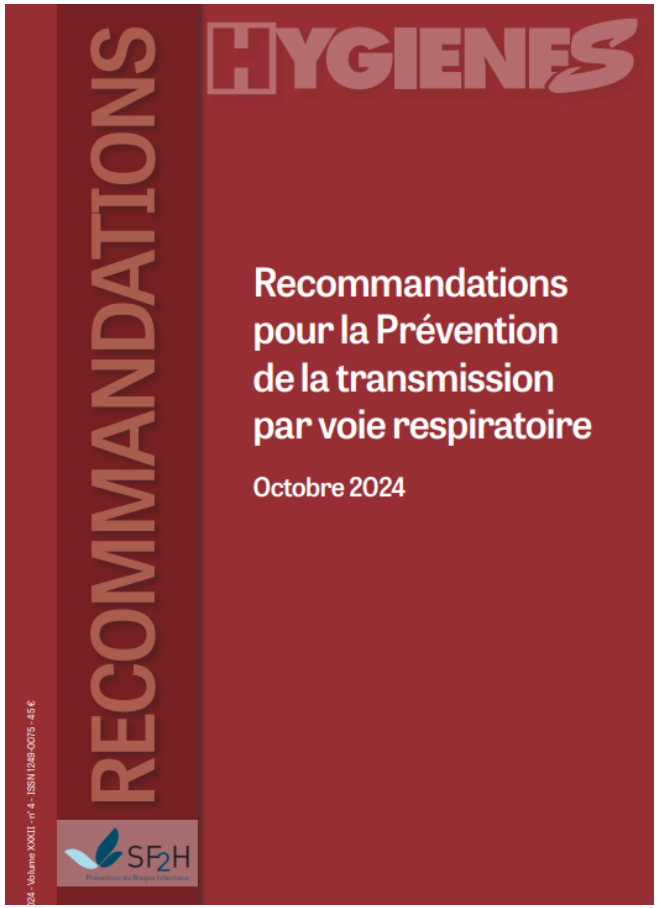
- But the **Haut Conseil de la Santé Publique** opinion of August 31, 2023 does not address the issue of preventing **cross-transmission** in HI
- Theoretically, it is based on standard precautions, vaccination and additional precautions
- For **additional precautions**: a **new French guidelines** very recently published by the Société Française d'Hygiène Hospitalière (SF2H)
- Which replaces the previous standard dating from 2013





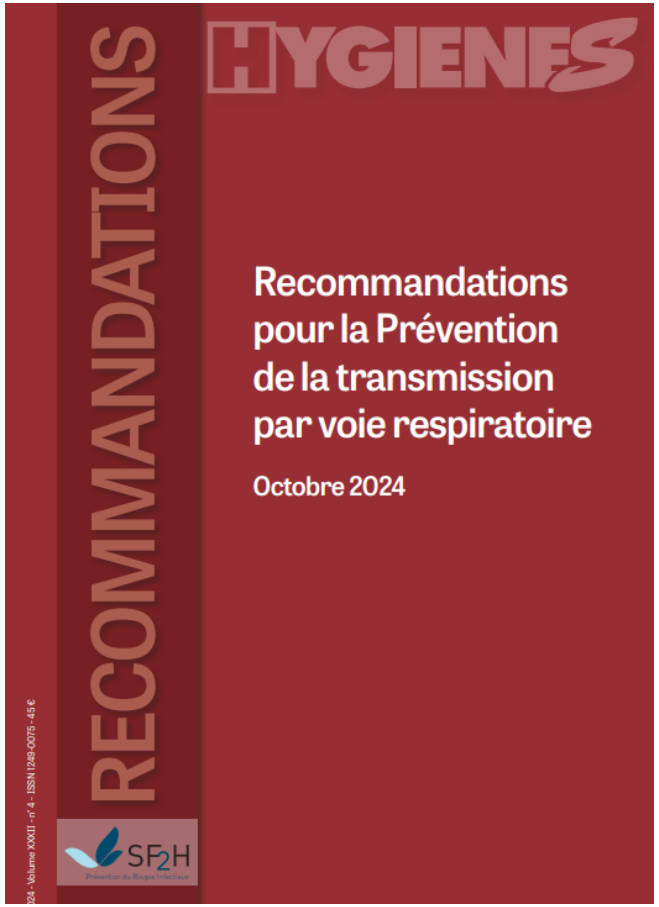
Which measures in healthcare institutions?

- "Merging" of additional air and droplet precautions
- **32** recommendations
- **R1 to R11**: Technical prerequisites and reminders regulations and the French Labour Code
- **R12 to R15**: Mask prerequisites
- **R16 to R22**: Additional respiratory precautions
- ~~**R23 to R25**: The special case of tuberculosis~~
- ~~**R26**: Special case of respiratory infections caused by multidrug resistant bacteria~~
- **R27 to R29**: Collective preventive measures during epidemics
- **R30**: Nosocomial cluster cases
- **R31 to R33**: Patient/resident grouping
- **R34**: Vaccination and immunoprophylaxis



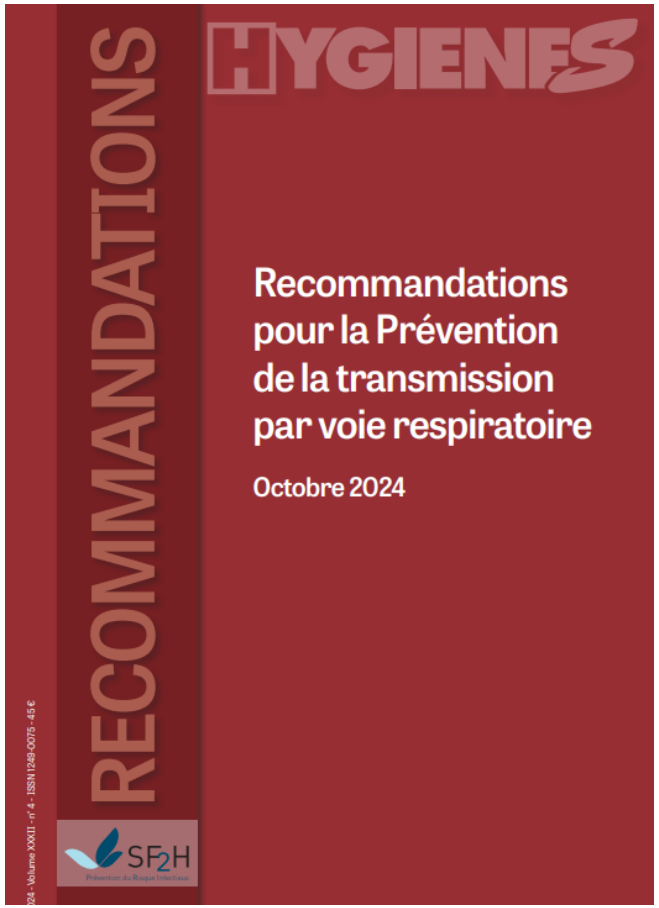
Which measures in healthcare institutions?

- **R1 to R11**: Technical prerequisites and reminders regulations and the French Labour Code
  - ✓ When building a new unit or facility: single rooms, mechanical ventilations, fresh air supply, extraction
  - ✓ Check ventilation parameters, patient room windows can be opened, minimum airflow rates of fresh air per person, CO2 concentration < 1300 ppm, works if not respected, mapping of the effective ventilation and update if any modification, annual and documented preventive maintenance
  - ✓ Risk analysis before any mobile air treatment, with HEPA filtration H13
- **R12 to R15**: Mask prerequisites
  - ✓ Involvement of the infection control unit in drawing up specifications and choosing masks
  - ✓ Several models and sizes of medical masks / FFP2; professional training for the fit-check



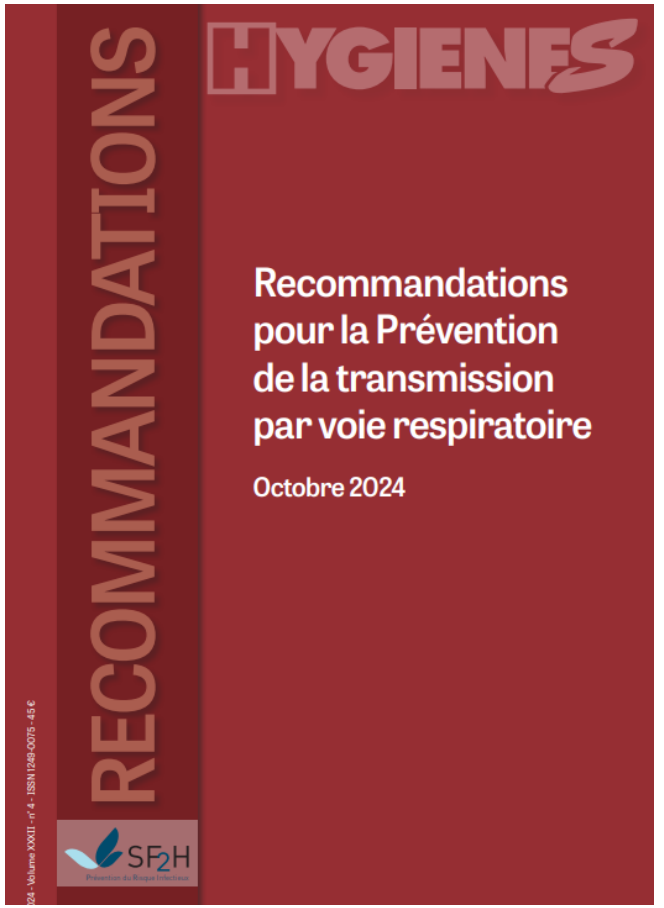
Which measures in healthcare institutions?

- **R16 to R22**: Additional respiratory precautions
  - ✓ **FFP2 wearing** by at-risk professionals or immunocompromised patients
  - ✓ **Medical prescription** to confirm or interrupt respiratory precautions and signalization
  - ✓ Patient **information** and his traceability; visitors information
  - ✓ **Information** of all new-integrated personnel
  - ✓ **Three levels** of respiratory precautions: simple, reinforced and maximum
- **R27 to R29**: Collective preventive measures during epidemics
  - ✓ Wear **medical masks** when entering buildings where patients are circulated by professionals, hospitalized or outpatient patients/residents > 6 years old, workers in contact with patients/residents, visitors > 6 years old.
  - ✓ Use of **single rooms**



Which measures in healthcare institutions?

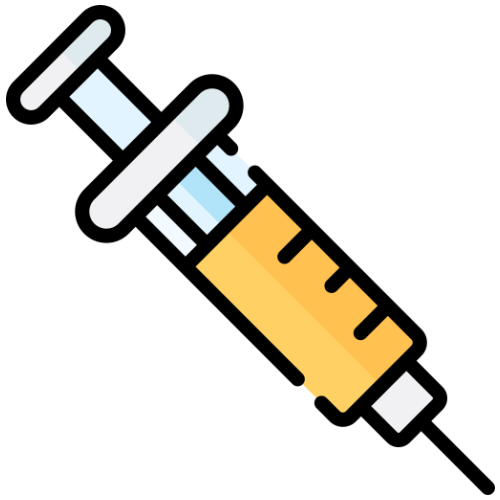
- **R30**: Nosocomial cluster cases
  - ✓ **Temporary measures**: masks to be worn by all care staff/patients/residents, screening of care staff/patients, special attention or even eviction from common areas/selfs/break or meeting rooms...
- **R31 to R33**: Patient/resident grouping
  - ✓ **In certain situations**: circulation of a highly pathogenic micro-organism, units accommodating patients/residents at high risk of serious illness in the event of infection, nosocomial epidemics that are difficult to control, several patients hospitalized for the same transmissible respiratory infection, etc.
  - ✓ **Gauges** determining the maximum number of people present
  - ✓ Community epidemic: define **visiting conditions** and their organization, define measures to prevent infectious risk for visitors, raise visitor awareness, restrict visits.
- **R34**: Vaccination and immunoprophylaxis
  - ✓ Apply **standard and additional precautions** to vaccinated persons.



In conclusion…

- Whether in the **community** or in **healthcare institutions**…
- **Vaccination** against Covid-19, influenza and RSV, and prevention of RSV bronchiolitis with **monoclonal antibodies**, effectively **protect** against the risk of severe forms of the disease (hospitalization and death) and **reduce** the overall risk of infection.
- Vaccinated people can be infected with few or no symptoms and **still transmit** the virus.
- Vaccination therefore **does not dispense** with the strict application of **universal hygiene measures**.

Thank you for your attention



and protect yourself to protect others!