Haut Conseil de la Santé Publique

High Council for Public Health

STATEMENT

on management of the Covid-19 epidemic in the event of the population's exposure to heatwaves

6 May 2020

On 16 April 2020, the *Direction générale de la santé* (DGS - Directorate-General of Health) referred to the *Haut Conseil de la santé publique* (HCSP – High Council for Public Health) with regard to management of the Covid-19 epidemic in the event of the population's exposure to heatwaves (see Appendix 1).

The HCSP was asked to draw up recommendations on:

- the clinical, diagnostic and therapeutic aspects of patients with Covid-19 and/or heat-related medical conditions, in particular among the elderly, people with disabilities and people at risk due to comorbidities, whether such patients are in healthcare or medicosocial institutions or at home, as well as any therapeutic adaptations that might be required;
- the organisational aspects to be adapted to the heatwave and Covid-19 epidemic lockdown context, as regards the elderly, people with disabilities and people at risk monitored at home or treated in healthcare and medicosocial institutions;
- the various categories of professionals and volunteers active in healthcare and medicosocial facilities and in provision of care at home;

Finally, the HCSP was asked to draw up recommendations for the general population, *a fortiori* in the event of the lockdown being continued during a heatwave.

With the spread of the Covid-19 epidemic, the HCSP reactivated the *"flu, coronavirus, and emerging respiratory infections"* working group, made up of experts from inside and outside the HCSP. A subgroup dedicated to questions on "organisation of care" was created in order to respond to the DGS's referral, chaired by Philippe Michel, President of the HCSP's "Health System and Patients' Safety" Specialist Committee (CS 3SP). Work focusing specifically on the Heatwaves and Covid-19 problem is overseen by Dominique Bonnet-Zamponi (CS 3SP's geriatrician) and Didier Febvrel (public health physician, member of the "Risks Connected with the Environment" Specialist Committee (see composition of the WG in Appendix 2).

The WG worked in accordance with the HCSP's usual methodology, with collection and analysis of available documentation (scientific articles and existing recommendations), organisation of hearings and requests for written contributions from stakeholders (see Appendix 5).

Background information

On 31 December 2019, the Chinese authorities informed the World Health Organisation of an episode of grouped cases of pneumonia, all initially confirmed cases of which were connected with a wet market in the city of Wuhan (Hubei region) in China.

On 9 January 2020, the WHO identified a newly emerged virus as being responsible for the grouped cases of pneumonia in China. It was a coronavirus, which the WHO temporarily named 2019-nCoV virus (*novel coronavirus*), and on 11 February 2020 officially named SARS-CoV-2, responsible for the Covid-19 disease (Coronavirus disease).

On 30 January 2020, in view of the scale of the epidemic, the WHO declared that it constituted a Public Health Emergency of International Concern (PHEIC).

On 28 February 2020, France entered stage 2 (isolated households) of the SARS-CoV-2 epidemic; moving to stage 3 (active circulation of the virus in the country) on 14 March 2020.

On 17 March 2020, a general lockdown of the population was instituted, with limitation of authorised movement.

A gradually controlled lifting of the lockdown was planned as from 11 May 2020 [1].

Covid-19 and climate (see Appendix 3)

How the Covid-19 pandemic will develop over the course of the coming summer is a question that preoccupies professionals and the general public alike, remembering that the disappearance of SARS in summer 2003 is a precedent that had nothing to do with seasonality but rather with the tracing of infected individuals and the people they came into contact with [2].

Seasonality of infections depends on a great many factors, including the effects of a summer climate on a virus' infectiousness, life and activities in the open air reducing close contacts, better efficiency on the part of the immune system, and school holidays.

As regards respiratory viruses, data exists on the seasonality of flu, infant bronchiolitis and coronavirus colds. Such data shows that these viruses' reproduction rate (R0, which corresponds to the average number of secondary cases generated by one individual during the period that he/she is infectious, whether symptomatic or not) is sensitive to various environmental factors, including humidity and temperature, as well as to the seasonal variation of group immunity.

Review of the literature available on the subject gives little cause to believe that Covid-19 will disappear this summer. However, it is reasonable to assume that its R0 will stay below 1, all the more so if physical distancing and restriction of movement measures are maintained and complied with. A rate lower than 1 means that the number of cases decreases with each generation until the transmission chain finally breaks. All modellers stress the importance of the few months of relative summer respite in order to prepare healthcare facilities for a peak next winter, which could well be more intense or, more probably, longer-lasting than what we have experienced over the past weeks (for more information, see Appendix 3).

The HCSP took the following into account.

1. Reminder of risks, and clinical, therapeutic and organisational measures implemented in each situation independently of each other

1-1 Risks connected with heatwaves, how they are to be dealt with, and the preventive health measures provided for in the present Heatwave Plan

There are two medical conditions connected with heat: dehydration and heatstroke. Both of them may occur within the first few hot days and are potentially fatal. A study by *Santé Publique France* (SPF – French Public Health Agency) on mortality connected with heat and cold in 18 French cities [3] concluded that above average temperatures of between 23 and 28°C, depending on city, each extra degree results in a rapid and immediate increase in the risk of death, so justifying special action in the event of extreme heat.

The main clinical signs of the two conditions are as follows (from earliest to latest):

1) dehydration: oliguria (no urine for more than 5 hours/dark urine) except among diabetic patients who suffer polyuria associated with hyperglycaemia, violent sweats after drinking a glass of water/cramps, fatigue/intense thirst accompanied by dryness of the skin and mucous membranes, skinfolds and/or weight loss and/or extreme fatigue, dizziness, tachypnoea and/or somnolence, loss of consciousness;

2) heatstroke: Feeling of general wellbeing when water is trickled onto the forearms/fatigue/headache, nausea, the skin is usually red, hot, dry and (very occasionally) clammy (in contrast to the moist buccal mucosa); rapid pulse / temperature over 39°C and/or violent headache and/or nausea and vomiting and/or incoherent speech and/or loss of consciousness, convulsions. Impaired breathing with polypnoea, possibly manifesting in the form of acute respiratory distress syndrome (ARDS). There is high risk of coronary or cerebral thrombosis, in particular among elderly patients.

It is important to ascertain whether the main problem is dehydration or heatstroke (even though the two conditions may coexist). Before obtainment of biological test results showing whether or not the underlying condition is dehydration, absence of dryness of the buccal mucosa and presence of high fever > 40°C normally suggests heatstroke with no major associated dehydration. If this is the case, any intensive rehydration is to be avoided as it would be pointless and potentially harmful, above all for elderly patients (risk of dilutional hyponatraemia or fluid overload).

Both conditions can be avoided by simple preventive measures (protection from heat, in particular through body misting/ventilation and protection of housing / hydratation [4] implemented in the national Heatwave Plan, targeted organisation that has proved to be effective [5].

1-2 Reminder of the clinical aspects of and risks connected with Covid-19 as well as of barrier measures

- **Modalities of SARS-CoV-2 transmission** (recap of the HCSP's statement [6, 7])

Like most microorganisms, SARS-CoV-2 has more than one transmission channel. The virus' main transmission modalities are as follows:

- direct transmission by droplets emitted when an infected individual (symptomatic or otherwise) coughs, sneezes or simply speaks in the direction of a healthy person a short distance away (1 metre), mainly risking infection via the respiratory mucosa;
- transmission by contact with the mouth, nose or mucous membranes of the eyes.

The WHO has stressed that SARS-CoV-2 is mainly transmitted by droplets [8].

There are no studies proving human-to-human transmission of the virus by aerosols, over long distances. This mode of transmission does not seem to be the major transmission mode. As yet, there is no specific data enabling description of dissemination of aerosols of fine particles carrying viable viruses in such environments as shops or public transport. Nonetheless, the risk cannot be excluded:

- In an infected, emitting patient's bedroom or in enclosed, confined indoor environments that are poorly aired or inadequately ventilated.
- In enclosed spaces some distance away from emitting patients, in particular when such spaces are small and when there are several patients in the same space [statement of 8 April 2020].

The droplets emitted by an infected person may also settle on surfaces or on fixed or moving objects and can be transferred to another person who comes into contact with them. Such transmission from contaminated surfaces to hands has not been proved to lead to confirmed

infection. However, it cannot be excluded when surfaces newly contaminated by droplets are concerned. Hence, transmission via the hands is deemed plausible[1].

Two points for attention: first of all, the viral load varies considerably from one person to another (it would appear that asymptomatic individuals shed less virus), and secondly, the viral load decreases rapidly over time.

"Standard" precautions, hand hygiene in particular, by washing hands in soap and water or using an alcohol-based handrub, are the first line of defence against transmission of any microorganism and should therefore be applied whatever the environment [9].

Cleaning and disinfecting are effective in reducing contamination of surfaces, and are all the more important when it comes to areas where contact is most likely to occur [10].

- **Clinical and diagnostic aspects of Covid-19** (recap of an HCSP statement [11])

The classical signs of infection (fever and shivering) or respiratory illness (coughing and, dyspnoea) are most frequently described as suggestive of Covid-19 and consequently as indications that the SARS-CoV-2 virus should be tested for.

In addition to these signs, other symptoms may help guide diagnosis. For example, the sudden unexplained occurrence of asthenia, myalgia, headaches (except in known migraine sufferers), throat soreness, anosmia (without associated rhinitis) or ageusia are all suggestive of Covid-19 during an epidemic. Headaches and loss of the sense of smell are the two most frequent signs in light to moderate forms of Covid-19 [12].

Among children, diagnosis may be guided by the sudden occurrence of any of the symptoms described above, as well as diarrhoea or change in general condition; isolated fever in infants under 3 months old is also a sign.

Among the elderly, a change in general condition, repeated falls, occurrence or sudden worsening of cognitive disorders, delirium, diarrhoea or decompensation of an earlier medical condition should suggest diagnosis.

Finally, cardiovascular signs have occasionally been described (rhythm disorders, myocardial damage and pulmonary embolism), and even neurological impairment (polyradiculoneuritis, etc.), which are complications rather than early signs of SARS-CoV-2 infection.

At present, definitive diagnosis of infection is based on RT-PCR testing for the SARS-CoV-2 virus' RNA, on nasopharyngeal or lower respiratory tract swabs (saliva-based tests are currently being evaluated by the CNRS). The test's sensitivity varies depending on the quality of the swab and how early on it is taken in the disease's natural history (viral excretion is at its maximum in the early stages of the disease).

When they become available, serological tests may also be useful in identification of people who are or have been in contact with the virus (as a complement to the RT-PCR, which is still the first-line test for diagnosis of the acute phase of Covid-19).

A thoracic scan may also be useful (although its results in cases of Covid-19 infection are not specific to this infection):

- in cases of confirmed respiratory symptoms requiring hospitalisation, in an RT-PCR+ patient or suspect, in order to evaluate how serious pulmonary damage is and have a "gold standard".
- in cases of confirmed respiratory symptoms requiring hospitalisation, in order to direct patients to Covid-19 or non-Covid-19 units while awaiting RT-PCR results, which are not immediate and may only be positive secondarily.

[1] See the "indoor environment" section of the HCSP's statement of 8 April 2020 on the residual risk of SARS-CoV-2 transmission in aerosol form [6]. When emitted from nose or mouth, most droplets are between 1 µm and 1 mm in diameter with maximum emission (in number) of between 10 and 20 µm. The dry residues or "droplet nuclei", which result from rapid evaporation of the smallest droplets, have an average size of between 0.7 and 1.25 µm. These particles stay in suspension in the air and are carried along by airflow. The coronavirus' power to infect at a distance from the person emitting it through breathing, speaking, coughing or sneezing has not been proved. But it was shown, by the presence of viral RNA – which does not however determine the virus' infectiousness – that viral particles could be disseminated at a distance.

- for prognostic purposes in cases of secondary aggravation of symptoms

Finally, among adults, where rapid biological tests are unavailable, a thoracic scan to screen for silent pulmonary lesions in patients of unknown Covid-19 status may be admissible in emergency cases (too urgent to await the arrival of PCR results) for other medical conditions, such as:

- emergency surgical procedures, (ENT, oncology, etc.) ;
- emergency treatment situations (strokes, haemorrhagic situations, etc.) [13].

- **Barrier measures**

Rules of hygiene and SARS-CoV-2 transmission prevention aim to protect professionals and limit human-to-human transmission in the population as far as possible in the context of the lockdown. The population and professionals alike must be taught or reminded of them **over the long term, in particular during periods of extreme heat.** They are scalable and adaptive as the virus is further studied and becomes better understood.

1. Physical distancing (complementary to lockdown or easing of lockdown) must enable people to stay at least 1 metre apart from each other, or more in special situations: it should be extended to 2 metres between a person standing up and another in a wheelchair; during sporting activities, etc.
2. Hand hygiene (HH) must be scrupulously complied with, either by washing in soap and water (facilitated by availability of single-use towels) or use of an alcohol-based handrub.
3. These basic measures are complemented by "general public" masks worn by the population. Clear rules must be complied with if maximum effectiveness is to be ensured:
    a. masks must be worn systematically by everyone when physical distancing rules cannot be guaranteed. When two people may come into contact, the fact that they are both wearing masks ensures better protection;
    b. masks must be maintained in accordance with the instructions provided by their manufacturers (number of washes, temperature, etc.);
    c. masks must be worn correctly, covering mouth and nose;
    d. hands must not touch the mask when it is worn;
    e. they must be worn the right way round: mouth and nose must never come into contact with the mask's external surface. Hand hygiene is essential after taking the mask off;
    f. wearing a mask does not mean there is no need to comply as far as possible with physical distancing, or, whatever the case, with hand hygiene.

Citizens must apply this health doctrine on a daily basis, even when there are no clinical signs of infection, and in all the various everyday-life situations they encounter.

2. Diagnostic, therapeutic, preventive (barrier measures and air-cooling systems), organisational and human resources aspects to anticipate in a dual Covid-19 epidemic + heatwave context

2-1 Diagnostic aspect: In this dual context, people may suffer from infection by Covid-19 and/or a heat-related medical condition. Dehydration, which is already frequently associated with Covid-19 infection (via fever and digestive losses), cannot but be aggravated by a heatwave context. Heatstroke may come on top of Covid-19 infection among individuals with failing sudoriferous systems (the elderly, heart failure patients, individuals suffering from central nervous system pathologies or diabetes and/or who take psychotropic drugs). But it is also possible for somebody to suffer from only one of these three medical conditions.

Making the right diagnosis is essential to avoidance of any loss of opportunity to treat the infection rapidly, due to:

- available therapeutic options for medical conditions connected with heat and which will be all the more effective the earlier they are implemented;
- a different prognosis (potentially affecting the decision whether or not to transfer a patient to the resuscitation unit) depending on the presence or otherwise of Covid-19 infection, in particular in the most vulnerable sectors of the population.

Although dryness of the jugal mucosa along with other biological evidence enables rapid identification of dehydration, differential diagnosis between heatstroke and Covid-19 infection is not so clear, as they have common clinical signs, especially in elderly subjects. Furthermore, in the context of a pollution warning concomitant with a heatwave, differential diagnosis between Covid-19 infection and onset/aggravation of a pollution-related respiratory disease may prove complex. Finally, the injected thoracic CT scan that might be required in diagnosis of a thrombotic complication connected with Covid-19 infection (pulmonary embolism in particular) may be complicated by acute renal failure in cases of not previously diagnosed and corrected dehydration.

2-2 Therapeutic aspect: paracetamol, which is frequently used to relieve Covid-19 symptoms, is contraindicated for heatstroke as it is ineffective and potentially harmful (aggravation of liver damage/coagulation disorders).

2-3 Preventive aspect: compatibility with barrier measures in the context of a heatwave.

There is no real incompatibility between barrier measures and the Heatwave Plan's health recommendations.
In both cases, it should be stressed that upkeep of social ties, whether physically or virtually, is good for the health, and that implementation of recommendations must take full account of the need to reduce social and territorial inequalities in health.

- **Encouraging access to cool or air-conditioned locations during the gradual lifting of the lockdown**

Green spaces, cool places and air-conditioned locations may be difficult or even impossible to access by people whose housing is not adapted to heat (people in situations of precarity in particular) and who are confined to or living in areas where such spaces may not be open to the public.

- **Ensuring that rooms are ventilated, which provides protection against heat and virus alike**

Whatever the context, the HCSP stresses the importance of air renewal in all living areas of whatever kind, by natural or mechanical ventilation.
The regulations currently in force – the *Règlement Sanitaire Départemental Type* (RSDT – Standard *Départemental* Health Regulations) and the Labour Code – make it mandatory.

Doing so is all the more important in the context of the Covid-19 epidemic. One possibility is to ventilate by opening a room's windows wide but keeping it separate from the rest of the housing unit by closing its door and ensuring it is sealed off as much as possible (caulking along the bottom of the door) when an individual infected with Covid-19 is being looked after at home, in order to protect his/her family. The aim of this natural ventilation is to keep air and surfaces dry.

Furthermore, when there is a heatwave, ventilation of rooms is recommended not only in order renew indoor air but also to cool it (when outdoor air has become cooler than indoor air) and create airflows contributing to body cooling. This last point may possibly be inconsistent with the instruction to ensure the room is sealed off from the rest of the housing unit when a person infected with Covid-19 is being looked after at home [14].

- **Ensuring body cooling by ventilation /misting and cooling of rooms / housing units / establishments by air-conditioning without contributing to dissemination of the virus and consequent infection**

In periods of extreme heat, it is recommended that housing units be protected by cooling rooms by means of ventilation and air-conditioning systems wherever possible. Likewise, mist fans are recommended for individual protection.

Checks should be made to ensure that such provisions do not contribute to Covid-19 infection.

In all instances, an individual with Covid-19 symptoms must avoid entering communal establishments. If he/she lives in shared accommodation, a symptomatic individual must be isolated in a separate room while awaiting medical advice.

In individual cases (i.e. a person alone in a room without external intervention), fans, air-conditioning and mist fans pose no problem as far as exposure to the risk of SARS-CoV-2 infection is concerned, although regular air renewal must still be ensured.

In cases where people are grouped together in a shared room, a good many hypotheses and questions are based on the principle that there is a risk of infected individuals associating with healthy individuals due to possible asymptomatic Covid-19 infection. The fear in such cases is that they foster infection via aerosolization of viral particles.

- **Reminder on air-conditioning systems**

Air-conditioning systems differ depending on their design (collective with or without partial air recycling, or individual terminal units and air-conditioners moving the air in a room).

a) Individual air-conditioners

Individual air-conditioners do not ventilate the premises. The indoor unit takes in the air in the room and returns it at the desired temperature. Ventilation may be natural or forced, using a controlled mechanical ventilation (CMV) system. Occupants should also air the room by periodically opening its windows. An air-conditioner (with split system and heat pump) in premises that already have a normally functioning CMV system (a care home for the dependent elderly (EHPAD) for example), as long as it is equipped with efficient, properly maintained filters, will not cause any problems connected with Covid-19

Filters must be efficient, properly installed and regularly maintained, and changed if necessary in line with manufacturers' recommendations[2] (see Appendix 4 – Classification of filters).

Hence, if ventilation is in compliance with regulations, and as long as they are properly maintained, appropriately sized individual air-conditioners equipped with efficient filters enable obtainment of "filtered" air that significantly reduces the room's viral load and is therefore less infectious if one or more infected individuals are in the room.

b) Collective air-conditioning systems

For collective systems with air-handling units, it is recommended that users check that there is no mixture between and effective separation of air drawn from the premises and new air in air-handing units (check of type of heat exchange: mixing chamber or heat exchangers) in order to prevent any eventual recirculation of viral particles throughout the premises by blown air. You can also disconnect such heat exchanges and end up with a so-called "all new air" system, i.e. separation between blown air network and network of air extracted directly from outside.

Systems equipped with terminal units (fan coil-type units) located between floor and windowsill or in a plenum (such as a false ceiling) and which move the air in a room or open space may pose problems.

If air-handling units and terminal units are provided with efficient filters and are properly maintained, they will not cause any Covid-19-related problems.

c) The risk connected with airflows

Terminal units (fan-coil units) and individual air-conditioners produce "airflows" of greater or lesser intensity (air speed is lower at a collective system's air outlets). Even if the air jet is filtered properly and is therefore less infectious, it may nonetheless "increase the projection distance of a droplet emitted by the oropharynx".

Wearing a "general public" cloth mask (70% effectiveness for 3µm particles) in an enclosed space limits infectious droplet emissions when absence of virus carriers is uncertain.

[2] HEPA filters, and even some slightly less efficient products such as E12 EPA filters, perform significantly better (even very much better than filters used by the medical profession with FFP2 masks, with reduction of at least 2 logs) and all the air passing through the filter is filtered.

- **Reminder on regular fans and mist fans**

a) Indoor use of regular fans/mist fans

So-called "collective" fans are no replacement for air-conditioning but can nonetheless keep people cool in a shared room during a heatwave. A fan spreads the viral load evenly across a room and its average level will depend on the ventilation system (in general, the CMV system). But by creating major air movement, it projects respiratory droplets emitted by individuals some distance away in the room, so making the safety distance between people inoperable.

An individual fan used by the sole occupant of a room poses no problems.

b) Outdoor misting

Misting, in particular by high-speed spraying of fine water droplets, brings comfort in periods of extreme heat. Relative humidity increases and the air is indirectly cleared of small particles that attach themselves to mist droplets. The mist tends to fix such particles, causing them to fall to the ground, and the air is consequently cleaner. Out of doors and in large open spaces, respiratory droplets emitted by individuals when they speak, cough or sneeze will be diluted.

There is therefore little risk of SARS-CoV-2 infection.

Such systems must be of the right size for their location, the water used must not endanger health (use freshly tapped drinking water or newly opened mineral water), and care must be taken to ensure that water does not stagnate in the mist fan (which could cause other medical conditions such as Legionnaires' disease).

2-4 Organisational and human resources problems

The Covid-19 health crisis has put a severe strain on the health and medicosocial systems, with:

- problems of access to protective equipment (masks and personal protective equipment or PPE) for health professionals at hospitals, in private practice and in the medicosocial sector, as well as professionals involved in provision of assistance to the most vulnerable (home helps, carers, etc.);
- workforce problems, connected in particular with absences from work (child care for non-health professionals due to schools being closed) and sick leave (due in particular to Covid-19 infections). Such staff losses have only added to a pre-existing understaffing problem in a number of organisations, and have resulted in increased work for the professionals' still present and consequent exhaustion among many of them.

Summer is the traditional holiday period, with its usual staff problems. Heat makes everyone more prone to fatigue, professionals included.

Yet combating isolation and monitoring the most fragile members of society, both of which are key to reduction of the morbidity and mortality rates connected with heat, necessitate human presence. A heatwave would increase needs in terms of healthcare and social resources alike, professionals in the home care sector in particular – all of whom need to be trained in measures relating to heatwaves as well as those connected with the Covid-19 epidemic.

An increase in numbers home carers automatically leads to a need for extra equipment (surgical masks when the individual cared for is not suspected of being infected with Covid-19, PPE when he/she is infected with Covid-19). This is all the more true when the number of masks required per professional increases due to sweating induced by heat and consequent earlier mask replacement (a damp mask must be changed).

Professionals' need for protective equipment may also be an obstacle to appropriately timed application of preventive measures against heat as well as to the monitoring of warning signs among dependent patients, above all when they are infected with Covid-19.

Conversely, wearing masks and gowns may be problematic during a heatwave, given what we have noted in other professional contexts in which PPE is worn less when temperatures are high.

Finally, if there is a pollution warning (as often happens during heatwaves), restrictions on transport may impact such professionals.

3. Triggering of the Heatwave Plan's warning levels depending on health data

With a view to ensuring that the supply of hospital care (resuscitation units in particular) meets the population's future needs, circumstances in which the Heatwave Plan's various warning levels are triggered by *département* are currently under study by *Santé Publique France* and *Météo France* in a model that regards the Covid-19 epidemic as an aggravating parameter.

The HCSP's recommendations

Preamble

The HCSP is concerned by the probability of there being one or more heatwaves this summer, which could well occur in the context of an ongoing Covid-19 epidemic.

The HCSP stresses the serious impact that heatwaves have on health and wishes above all to avoid their being overlooked or underestimated due to predominance of fears regarding Covid-19.

A great many people will be exposed to heatwaves, which have a major impact on morbidity and mortality rates.

There may also be a concurrence of Covid-19 epidemic risk and heatwave situations, along with the pollution peaks classically associated with heatwaves.

Before going into its recommendations in detail, **the HCSP would like to start out by emphasising that fear of contracting Covid-19 while in a care setting must not delay treatment of medical conditions caused by heatwaves (heatstroke and dehydration),** and that preventive measures (keeping collective premises cool in particular) are to be strongly encouraged.

The following recommendations will need to be adapted to the scale of any heatwaves that occur and the prevalence of Covid-19 infection.

The barrier measures recommended for controlling the spread of SARS-CoV-2 [3] and the actions recommended in the Heatwave Plan are fully compatible. None of them can be invalidated but a number of them will need to be adapted to the changing Covid-19 context.

The HCSP recommends

1) <u>Regarding local management and support:</u>
    a. Ensure effective coordination of heatwave and Covid-19 measures, with identification of a contact person for each of the two themes in all organisations, who will have to work in close collaboration with each other.
    b. Make absolutely sure of the consistency of all information and recommendations disseminated for prevention of the Covid-19 epidemic and on the heatwave and any pollution peaks that may occur. Communication of multiple and possibly contradictory pieces of information would be likely to lead to lesser compliance with the various recommendations.
    c. If a context arises combining a heatwave with the Covid-19 epidemic and high atmospheric pollution, implement all regulatory measures provided for (alternating traffic, reducing speed, reducing industrial emissions, etc.) that aim to reduce pollution levels.

2) <u>Regarding ventilation of living areas:</u>
    a. Ensure compliance with and strict application of the regulations making air renewal mandatory in all living areas of whatever kind, by natural or mechanical ventilation, and the best practices resulting from them.
    b. In periods of extreme heat, ventilation of enclosed environments and rooms, in the Covid-19 context, for 15 minutes and at regular intervals, must be ensured when the outdoor temperature is lower than the indoor temperature.
    c. In the event of a resulting pollution peak, the current recommendations on what to do in a heatwave (in terms of ventilation) remain valid including during the Covid-19) epidemic[4]: even if the air is polluted, ventilation is required.

[3] HCSP Recommendations of 24 April 2020, on adaptation of barrier and physical distancing measures among the general population, outside the health and medicosocial fields, in order to control the spread of SARS-CoV-2 when the lockdown is lifted [15].

3) Regarding use of air-conditioning
   a. Ensure that systems are properly maintained and equipped with the most efficient filters healthwise, in line with their technical compatibility. At local level, in periods of hot weather, the "health" goal takes priority over the "energy saving" goal in places where vulnerable people live. However, the HCSP emphasises how useless and even counterproductive poorly adapted, excessive air-conditioning is, whether in private settings or those open to the public. It is of no help to health and compromises energy balances at national level.
   b. Encourage availability of cool communal areas, as long as users are reminded of and comply with barrier measures, including the wearing of "general public" masks.
4) Regarding use of regular fans and mist fans
   a. In small enclosed or not completely open communal areas, use of fans to move/cool the air if there is no air-conditioning is contraindicated when several people are present in them (e.g. classrooms, care homes for the elderly, etc.), even if they are wearing masks.
   b. Use of regular fans is recommended, including alongside mist fans, in rooms with single occupants. The fan must be switched off when another person comes into the room.
   c. In open areas, use of collective misting systems is possible provided that the recommended physical distance is maintained.
5) Regarding public access to water (public showers and drinking fountains)
   a. Maintain access to public showers as long as the hygiene protocols recommended in the context of Covid-19 are applied.
   b. Maintain access to drinking water fountains as long as barrier measures are complied with (advise users to use their elbows to activate the push buttons or use an alcohol-based handrub before and after use; individual use only).
6) Regarding access to cool/cooled communal areas:
   a. They must continue to be identified and made available, while ensuring that barrier measures are applied in them.
   b. Their availability must above all target those sectors of the population most at risk from the heat (urban heat islands, housing units poorly adapted to heat, isolated individuals, etc.). Appropriate communication on and transport to such areas must be planned for such sectors.
7) Regarding home visits by professionals and/or volunteers in order to monitor the most vulnerable individuals:
   a. Any increase in their frequency must not be called into question and must be combined with strict compliance with the instructions on management of such visits in the context of the Covid-19 epidemic [16].
   b. Use of eHealth systems may complement such visits but is no substitute for them.
8) Regarding treatment of symptomatic individuals
   a. Diagnostic procedures for Covid-19 must not delay treatment of heat-related medical conditions, whose diagnosis must be prioritised. Treatment must be carried out in full compliance with barrier measures. Hence, the Covid-19 context must not delay clinical testing to differentiate heatstroke and dehydration (using the finger to assess the moistness of the buccal mucosa) while ensuring that barrier measures are applied in doing so (wearing surgical masks and washing hands before and after).
   b. Systems for assistance in diagnosis and treatment of vulnerable individuals (geriatric hotlines, rare disease resource centres, disability platforms, etc.) created or reinforced

[4] See the Ministry for Solidarity and Health's website: https://solidarites-sante.gouv.fr/sante-et-environnement/risques-climatiques/article/recommandations-en-cas-de-canicule

since the onset of the Covid-19 crisis must be maintained and the support they provide extended to treatment of heat-related medical conditions.

c. Outlaw all self-medication for fever using paracetamol if a heatwave occurs. Taking paracetamol must be approved by a health professional.

d. As far as possible, ensure that Covid-19 patients are treated in air-conditioned rooms in order to facilitate professionals' compliance with PPE regulations. In this respect, accommodation for people infected with Covid-19 must be chosen for its ability to provide protection in the event of a heatwave.

e. In cases of Covid-19 infection, recommendations on preventive measures vis-à-vis heat continue to apply, as do barrier measures in cases of heat-related medical conditions.

9) <u>On the subject of professionals</u>

a. Anticipate and ensure increased availability of equipment (masks and PPE), in particular for actors (professional or otherwise) involved in the monitoring of isolated individuals.

b. Provide for reinforcement of healthcare/social/medicosocial staffing via the health and social reserves along with the Civil Defence Service/ Red Cross/ volunteers. Authorising (by derogation) an increase in medical presence and supervision times in medicosocial facilities would help ensure rapid decision-making 7 days a week.

c. Maintain all measures designed to improve the working conditions and quality of life of professionals active among the most vulnerable sectors of the population:
   - transport
   - meals
   - childcare /priority regarding school places, etc.

d. Classify such professionals in the category of priority individuals authorised to travel following possible activation of the Transport Emergency Plan (after an air pollution warning).

The HCSP stresses that these recommendations were drawn up in line with the current state of knowledge and available resources, and that they are likely to evolve, in particular in the following circumstances:
- greater accessibility to and reliability of diagnostic tests;
- greater availability of personal protective equipment;
- substantial modification of the preventive and therapeutic arsenal.

Statement drafted by a group of experts from inside and outside the High Council for Public Health.

Approved on 6 May 2020 by the President of the High Council for Public Health.

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Appendix1 – The Directorate-General of Health's referral, 16 April 2020

MINISTRY
FOR SOLIDARITY
AND HEALTH

DIRECTORATE-GENERAL OF HEALTH
Sub-Directorate of Health Monitoring and Security
Crisis Preparation Office
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Paris, 16 APRIL 2020

The Director-General of Health

TO

The President of the High Council for
Public Health

SUBJECT: Referral to the High Council for Public Health (HCSP) relating to management of the COVID epidemic in the event of the population's exposure to heatwaves

In a context in which the COVID-19 epidemic could continue over the coming months, it cannot be excluded that it may be concurrent with the onset of heatwaves.

Following on from 2019, which was marked by two major heatwaves that led to activation of a red weather warning in late June and from 22 to 27 July and impacted all exposed citizens, the upcoming summer season might also see hotter than usual conditions.

In this context, the French population, which is already exposed to COVID-19, could find itself subjected to high temperatures at a time when the lockdown might well be extended.

I should like you to provide my departments with details:

- Concerning clinical, diagnostic and therapeutic aspects:
  - clinical and biological diagnostic information enabling adaptation of treatment of patients with COVID-19 and heat-related medical conditions, the elderly, the disabled and persons at risk due to comorbidities in particular;
  - Modalities for treating such patients in health facilities, medicosocial facilities and at home;
  - Recommendations on adaptation of treatment.

- Concerning the organisational aspects to be adapted to the context of a heatwave and the COVID-19 epidemic with lockdown:
    - Recommendations for the elderly, disabled people, and people at risk monitored at home;
    - Recommendations on the elderly, disabled people, and people at risk treated in health and medicosocial facilities;
    - Recommendations for the various categories of professionals and volunteers working in such facilities and in people's homes.

Finally, you will need to provide recommendations for the general population, *a fortiori* in the event of the continuation of the lockdown during a heatwave.

I should like you to provide me with this information by 4 May 2020, taking account of the proximity of the summer season.

My departments are at your disposal should you require any further information.

Jérôme SALOMON

Appendix 2

Composition of the "Covid-19 and Heatwave" Working Group

Qualified members of the "*Health System and Patients' Safety*" Specialist Committee*:*

- Dominique BONNET-ZAMPONI, Co-Chair of the Working Group
- Frédérique CLAUDOT
- Claude ECOFFEY
- Philippe MICHEL, Chair of the "*Organisation of Care and Covid*" subgroup
- Rémy COLLOMP
- Matthieu SIBÉ

Qualified members of the "*Risks Connected with the Environment*" Specialist Committee:

- Daniel BLEY
- Didier FEBVREL, Co-Chair of the Working Group
- Laurent MADEC

Qualified members of the "*Chronic Diseases*" Specialist Committee:

- Agathe BILLETTE de VILLEMEUR
- François EISINGER
- Marcel JAEGER

Qualified members of the "*Infectious Diseases and Emerging Diseases*" Specialist Committee:

- Eric BILLAUD
- Daniel CAMUS
- Christian CHIDIAC, Chair of the "*Flu, Coronavirus and Emerging Respiratory Infections*" Permanent Working Group
- Emmanuel DEBOST

Expert external to the HCSP

- Dominique CHANAUD, Department for Public Health and Disabled Persons, City of Marseille

Other HCSP experts who contributed to the preparation of the statement

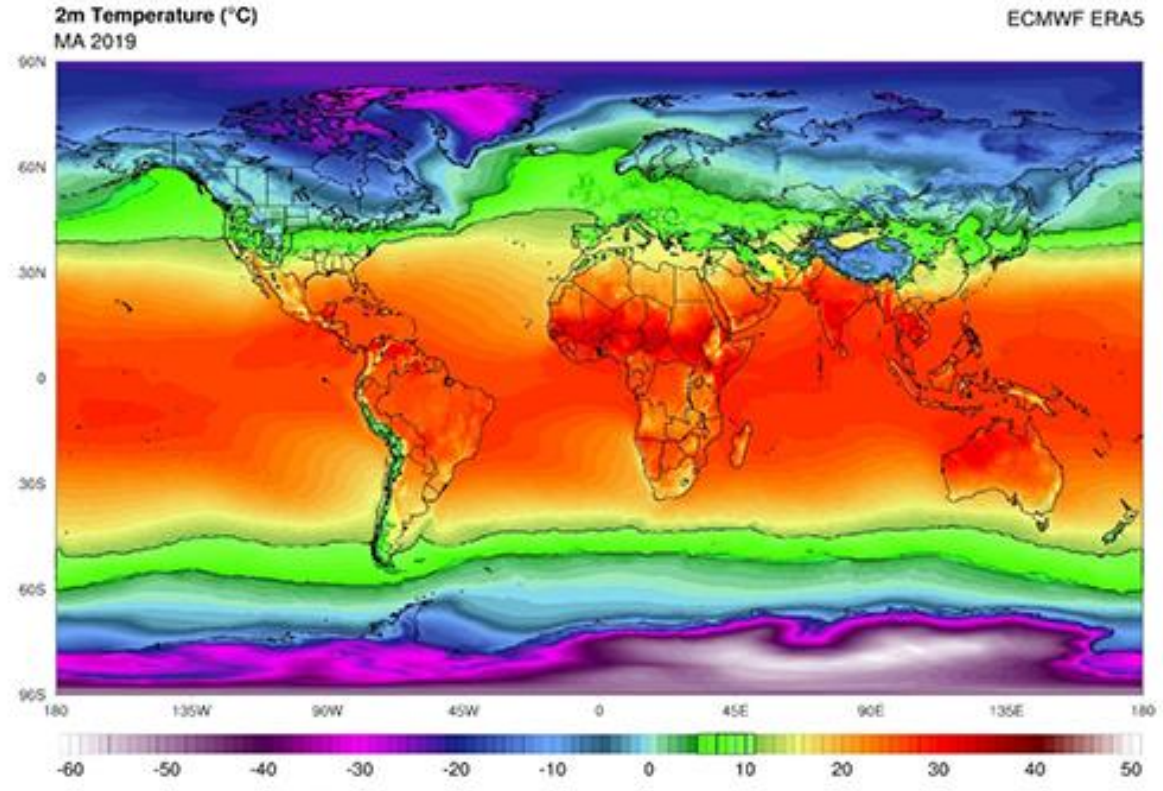
- Didier LEPELLETIER, Vice-Chair of the "*Flu, Coronavirus and Emerging Respiratory Infections*" Permanent Working Group
- Jean-Louis ROUBATY, HCSP, "*Risks Connected with the Environment*" SC
- Fabien SQUINAZI, HCSP, "*Risks Connected with the Environment*" SC

The HCSP's General Secretariat:

- Camille BRUAT
- Annette COLONNIER
- Soizic URBAN-BOUDJELAB

Appendix 3 – Covid 19 and climate

The first data attempting to link intensity of community Covid-19 infections with local climate conditions seems to suggest that SARS-CoV-2, like common cold coronaviruses, is to some degree sensitive to the environment, with a preference for cool temperate regions. Nonetheless, due to low herd immunity to the virus, it is likely that, even though it may be seasonal, Covid-19 will show little sign of losing its grip during summer 2020. Its possible seasonality will be hard to quantify if social distancing measures are maintained throughout the summer.



The green zone would be the zone most conducive to transmission of Covid-19 in March (source: Sajadi MM et al., 2020)

There have long been studies highlighting the seasonality of infections in our planet's temperate regions. For example, a review of 68 infections published in 2018 underlines the fact that a great many infections are seasonal, for example (data for California since the 1930s):

- spring peaks for chickenpox, German measles, mumps, etc.
- autumn peaks for poliomyelitis and hepatitis A ;
- winter peaks for flu, colds, infant bronchiolitis, etc.

The study of seasonality of infections is a demanding field, given the need to work for several years before publication and increasing numbers of possible confounding factors (almost everything is seasonal in our temperate countries, etc.): constraints that go to explain why there are so few studies on the subject.

Factors that influence seasonality of infections

Among the factors that may testify to the seasonality of infections, studies often refer to the climate's influence on the survival and transmissibility of infectious microorganisms. Other factors are also important, however:

- **the seasonality of our behaviours**: time spent indoors (and its negative impact on our personal space), the school year (common cold epidemics often occur after the end of the summer holidays), exposure to the sun (and its impact on blood levels of vitamin D, which is essential to immunity), etc.;

- **the seasonality of our immunity**: various studies suggest that cold weather (and possibly the shortening of daylight hours, via melatonin) reduces the respiratory tract's defences along with innate immunity;
- **the seasonality of the number of people likely to be infected:** for respiratory infections with short-term immunity, such as colds caused by the 229E coronavirus, the number of people at risk is highest in early winter (people who have lost their immunity, who escaped infection the previous winter, or who were born since the last epidemic, for example).

The example of seasonal flu

The incidence of seasonal flu fluctuates every year in temperate regions, with a peak in winter and the fluctuation's intensity varying according to latitude: for instance, there is a 40% reduction in R0 (viruses' reproduction rate) in New York in the summer, but only a 20% reduction in Florida. Such fluctuation may be explained by summer climate conditions and herd immunity to seasonal flu, which is at its highest in summer. Studies on the climate's influence on the incidence of seasonal flu all highlight the fact that its incidence increases following an unusual period of winter dryness. For example, in the United States, peaks are preceded by an arctic anticyclone migrating south, in particular in the northeast of the country and in States around the Gulf of Mexico. In winter, the absolute humidity rate (amount of water vapour in 1 m^3 of air) enables prediction of peaks in cases of flu, independently of the temperature (or its variations).

Studies carried out in Finland have shown that a decrease in absolute humidity is more predictive than its absolute value: a 0.5 g/m^3 reduction in absolute humidity alongside a 1°C decrease in temperature increases the risk of flu by 11 %. The influence exerted by temperature is more difficult to assess as we spend most of the winter indoors. But in Finland, 74% of new cases of flu occur in temperatures ranging between -10 and +5°C, and 38% between -5 and +5°C.
This epidemiological data might appear counterintuitive: in aerosol form, flu viruses survive longer in humid atmospheres. But studies carried out on guinea pigs clearly confirm that their vulnerability to flu increases when absolute humidity and temperature decreases.

The example of viruses responsible for colds

As regards viruses responsible for colds, seasonality is particularly marked for enveloped viruses such as coronaviruses. Non-enveloped viruses (adenovirus, rhinovirus, etc.) are present all year round.
A study carried out in Sweden showed a 90% reduction in the virus' presence in the respiratory tract in the summer for OC43, HKU1 and 229E, and a little less for NL63. Similar results were observed in the United States. In the United Kingdom, the incidence of colds caused by OC43, HKU1 and NL63 viruses is highest from December to April (229E is present to a greater or lesser extent depending on year).
There have been no studies seeking to associate peaks in coronavirus cold infections with particular weather conditions but, as previously stated, peaks tend to come shortly after the start of the school year.
A Scottish study on other respiratory viruses (RSV, parainfluenza and metapneumovirus) showed that, as is the case with seasonal flu, the incidence of infant bronchiolitis (RSV) is highest in a narrow relative humidity zone ("degree of hygrometry"), provided that the temperature is low.

SARS and MERS: few lessons to be drawn from them

There is little data on seasonality for SARS and MERS.
The former disappeared rapidly thanks to tight control of infected cases. Nevertheless, one study points out that the SARS epidemic in China followed a period of unusually dry weather.

As regards MERS, a magazine article published in 2019 pointed out that most cases occur between April and August and that sporadic epidemics occur after periods of extreme heat and strong sunlight. Drought seems to reduce numbers of cases, even though the first case reported was in Jeddah (Saudi Arabia) after an unusual period of drought.

Studies on the incidence of Covid-19 depending on climate

As analysis of data on prevalence and incidence shows, SARS-CoV-2 can be transmitted in a wide variety of climates (including in cities located on the Equator, such as Singapore). But are there climatic zones where transmission of the virus appears to be more frequent? Two studies sought to correlate Covid-19 with climate, not basing themselves on prevalence (number of cases of a disease in a population at a given time, covering new and old cases alike) but rather on incidence (number of new cases over a given period), and therefore on intensity of local community transmission.
The first, carried out at Oxford University, observed that incidence of Covid-19 seems to be inversely proportional to the average temperature, absolute humidity rate and average wind speed (after adjustments for length of day, atmospheric pressure, precipitation rates and ozone levels), and is therefore higher in cold dry climates, as with season flu.
The second, an Irano-American study, identified a rather narrow "corridor of high transmissibility" (see the article's illustration at the top of the page): between 30 and 50° of latitude, with an average temperature of between 5 and 11°C, absolute humidity of 4 to 7 grams of water per m^3 of air and specific humidity of 3 to 6 grams of water per kg of air. This data enables relative modelling of the next few months of the pandemic, which would tend to escalate in the north of the northern hemisphere (and the south of the southern hemisphere, but these regions are very sparsely populated). The authors of the study stress that their results may be distorted by the fact that many large metropolises are located in this temperate corridor (and that community transmission is higher in them).

The first year, a new seasonal infection may… not be the case!

In order to try and predict what will happen with the Covid-19 pandemic this summer, it is not enough to focus on whether SARS-CoV-2 will behave like its closest seasonal cousins, OC43 and HKU1 (which is nonetheless a possibility to be considered). There is a size difference between Covid-19 and these common colds: many of us have immunity to OC43 and HKU1, which is not the case with SARS-CoV-2.
This being so, an R0 reduced by the summer (its climate, way of life and school holidays) may not be enough to significantly reduce the pandemic's continuation, even if there is a measure of cross-immunity between OC43 or HKU1 and SARS-CoV-2 (which has been described). When it appears for the first time in a "virgin" population, even an intensely seasonal infection can persist out of season.
Data so far collected on SARS-COV-2 and the previously cited hypotheses on climatic preference do not enable any confident pronouncements to be made on how summer 2020 will affect the pandemic, in particular because its effect will also depend on the maintenance of such control measures as physical distancing and restriction of movement.
Nonetheless, a good many epidemiologists and modellers believe that new infections will continue this summer, possibly with an R0 of less than 0.5.

Application of the seasonality factor to models of the Covid-19 pandemic

Seasonality and its effect on R0 are among the parameters taken into account by epidemiologist modellers, along with length of immunity, degree of herd immunity and cross-immunity, whether the epidemic will get going again in autumn or winter, etc.

A Swiss and Swedish team of modellers recently published a study on the impact of seasonality on the evolution of the Covid-19 pandemic. The model's parameters were selected on the basis of data on the seasonality of OC43, HKU1, 229E and NL63 coronaviruses, but with a decrease in numbers of SARS-CoV-2 carriers in summer, of between 25 and 75% according to scenarios for temperate countries (instead of 90% for colds).
To (considerably) simplify their results, a decrease in incidence during the summer (as they incorporate this hypothesis into the model) would nonetheless be followed by a major peak during the winter, not so high but longer lasting if R0 control measures (social distancing) are maintained during the summer and autumn.
According to the authors, Covid-19 would very probably become an endemic seasonal infection after a few years, as was the case with the 2009 A/H1N1 flu epidemic.

Another model, based on data on immunity (including cross-immunity) and seasonality of common colds caused by OC43 and HKU1 viruses, was published in *Science* by a team from Harvard. In all scenarios, their model predicts that the epidemic will put a major strain on health services up until 2022, with the need to implement periods of active reduction of the R0 (social distancing) throughout the period. Such active reduction sequences would be less frequent if SARS-CoV-2 showed signs of seasonality (natural decrease of R0 in the summer).
In their best-case scenario, the study's authors forecast that such active reduction will have to be implemented at least 25% of the time, more often in winter than in summer if SARS-CoV-2 proves to be seasonal. They also forecast that, if the disease disappears after 2022, there will have to be continued close monitoring of the situation, as a resurgence would be possible up until 2025.

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Kissler SM, Tedijanto C, Goldstein E et al. "Projecting the transmission dynamics of SARS-CoV-2 through the postpandemic period." Science, 14 April 2020.

Appendix 4 - Classification of filters

Reminders on FFP filters and surgical masks

This document is largely taken from an INRS document[5]

What is the difference between a surgical mask and an FFP mask?

A surgical mask is a medical device (EN 14683 standard). It is intended to avoid projection of droplets emitted by wearers onto those around them. It also protects wearers against projections of droplets emitted by people facing them. However, it provides no protection against inhalation of very small particles in suspension in the air. There are three types of masks:

- Type I: efficiency of bacterial filtration > 95% of an aerosol with an average size of 3 µm.
- Type II: efficiency of bacterial filtration > 98% of an aerosol with an average size of 3 µm.
- Type IIR: efficiency of bacterial filtration > 98% of an aerosol with an average size of 3 µm and splash-resistant.

An FFP mask is a respiratory protection device (NF EN 149 standard). It is intended to protect wearers against inhalation of droplets **and** of particles in suspension in the air. Wearing this type of mask is more onerous (thermal discomfort and breathing resistance) than wearing a surgical mask. There are three categories of FFP masks, classified according to their efficiency (estimated on the basis of the filter's efficiency and leakage onto the face), as follows:

- FFP1 masks, filtering at least 80% of aerosols with an average size of 0.6 µm (total internal leakage < 22 %).
- FFP2 masks, filtering at least 94% of aerosols with an average size of 0.6 µm (total internal leakage < 8%).
- FFP3 masks, filtering at least 99% of aerosols with an average size of 0.6 µm (total internal leakage < 2%).

Given the current shortage of FFP2 masks, can filtering devices meeting foreign standards be used?

Masks meeting the requirements of certain foreign standards may be used in the specific context of the fight against Covid-19. Rates of efficiency in filtering microorganisms are very similar between FFP2 masks (European standard EN 149), N95 masks (American standard NIOSH 42C-FR84), Korea 1st Class masks (Korean standard KMOEL -2017-64), KN95 masks (Chinese standard GB2626-2006), DS2 masks (Japanese standard JMHLW-2000) and P2 masks (Australian standard AS/NZS 1716:2012).

As regards protection against chemical agents, filtration performances may differ and users should examine manufacturers' inserts before wearing masks meeting foreign standards, in order to make sure that they are suitable for their work situations.

General classification of filters (except FFP filters), used in equipment containing filters, vacuum cleaners, air-conditioners, filters in CMV (continuous mandatory ventilation) and AHUs (Air Handling Units)

Depending on the requirements of their work environments; users can choose from four main families of filters:

- **Medium efficiency:** coarse filters, prefilters for capture of the largest particles (diameter > 5 µm). Inefficient on atmospheric aerosol (particles with diameters < 1 µm);
- **High efficiency:** fine filters, efficient on atmospheric aerosol;
- **Very high efficiency:** EPA (Efficient Particulate Air) filters, HEPA (High Efficiency Particulate Air) filters and ULPA (Ultra-Low Penetration Air) filters;
- **Molecular filtration:** filters for elimination of gases (adsorption, photocatalysis, etc.).

The current European classification for air filters used in air-conditioning and HVAC, EN 779:2012, defines three categories of air filters.

Filters are assigned to categories depending on their average efficiency in retention of 0.4-µm particles:

- coarse filters (G).Their average efficiency is below 40%;

[5] http://www.inrs.fr/risques/biologiques/faq-masque-protection-respiratoire.html. This article details the limitations of these masks' performance.

- medium filters (M). Their average efficiency is between 40 and 80%;
- fine filters (F). Their average efficiency is over 80 %.

Average gravimetric efficiency is then used in order to differentiate Group G filters. This is based on a comparison of the reference quantity of dust generated with the quantity of dust passing through the filter.

Table 1 presents the classification of medium and high efficiency filters according to the EN 779:2012 standard.

Table1: Classification of medium and high efficiency filters (EN 779:2012)

Group	Class	Final pressure loss (Pa)	Average gravimetric efficiency (Am) for synthetic dust (%)	Medium efficiency (Em) for 0.4-µm particles (%)	Minimal efficiency for 0.4-µm particles (%)
Coarse	G1	250	$50 \leq A_m \leq 65$	-	-
	G2	250	$65 \leq A_m \leq 80$	-	-
	G3	250	$80 \leq A_m \leq 90$	-	-
	G4	250	$90 \leq A_m$	-	-
Medium	M5	450	-	$40 \leq E_m \leq 60$	-
	M6	450	-	$60 \leq E_m \leq 80$	-
Fine	F7	450	-	$80 \leq E_m \leq 90$	35
	F8	450	-	$90 \leq E_m \leq 95$	55
	F9	450	-	$95 \leq E_m$	70

Current European classification of “very high” efficiency filters, EN 1822:2009, defines three categories of air filters:

- High efficiency (EPA);
- Very high efficiency (HEPA);
- Ultra-low penetration (ULPA).

Note:

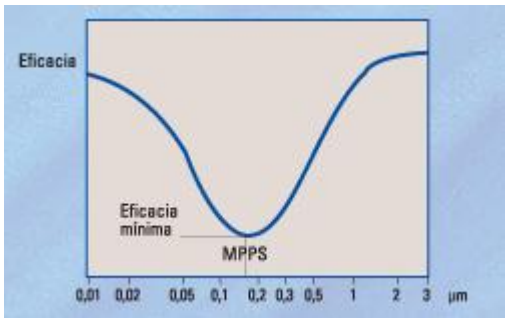
Minimal efficiency is the lowest efficiency among initial efficiency, discharged efficiency and the lowest efficiency during the dedusting procedure.

A filter belongs to one or other category depending on its overall local efficiency in retention of particles with the most penetrating particle size (MPPS[6]).

* Integral efficiency is the average value of all local efficiencies on the filter’s frontal area.

In the first phase of the EN 1822 standard, fractional performance is evaluated for filtration measurements close to the same speed as in the filter. The goal is to establish the particle size whose average gives the lowest retention efficiency, known as the **Most Penetrating Particle Size (MPPS)**

[6] MPPS is between 0.1 and 0.2 µm; DEHS Test.



Particle size is usually between 0.15 and 0.25 µm.

The next phase consists of establishing the filter's capture performance for the MPPS.

Depending on their performance, leaks and porosity, filters are classified into two groups:

- HEPA (High Efficiency Particulate Air) filters: E10, E11, E12, H13 and H14.
- ULPA (Ultra- Low Penetration Air) filters

Table 2 presents the classification of very high efficiency filters according to the EN 1822:2009 standard.

Table 2: Classification of very high efficiency filters (EN 1822:2009)

Group	Class	Overall value		Local Value	
		Efficiency (%)	Penetration (%)	Efficiency (%)	Penetration (%)
EPA	E10	≥ 85	≤ 15	-	-
	E11	≥ 95	≤ 5	-	-
	E12	≥ 99.5	≤ 0.5	-	-
HEPA	H13	≥ 99.95	≤ 0.05	≥ 99.75	≤ 0.25
	H14	≥ 99.995	≤ 0.005	≥ 99.975	≤ 0.025
ULPA	U15	≥ 99.9995	≤ 0.0005	≥ 99.9975	≤ 0.0025
	U16	≥ 99.99995	≤ 0.00005	≥ 99.99975	≤ 0.00025
	U17	≥ 99.999995	≤ 0.000005	≥ 99.9999	≤ 0.0001

Conclusion:

HEPA filters and even certain somewhat less efficient filters such as E12-type EPAs have considerably (and even highly) superior filtration performances to filters used by the medical profession, by at least 2 logs, **and all the air passing through the filter is filtered**, which is not the case with FFP2 masks, which, among other things, tend to leak around the edges.

Appendix 5 – Hearings and written contributions

List of people heard

- ***Nicolas ASSELINE***, Director of Operations and Pricing, LOGEA association
- ***Dr Jean-Pierre AQUINO***, Delegate-General, French Society of Geriatrics and Gerontology (SFGG)
- ***Dr Olivier BERNARD***, Head of the Bouches-du-Rhône MCP Department
- ***Xavier BRIFFAUT***, Researcher in the sociology and epidemiology of mental health at the CNRS, member of CERMES 3, CESAMES team(Centre for Research on Psychotropic Drugs, Mental Health and Society, Paris Descartes University-CNRS-INSERM)
- ***Prof. Denis CHAPIN***, Pulmonologist, President of the Association for Prevention of Atmospheric Pollution (APPA)
- ***Lucienne CLAUSTRES-BONNET***, President of URPS Infirmière PACA
- ***Prof. Damien CUNY***, Pharmacist, Co-Chair of APPA's Scientific Council
- ***Dr Michel DELCEY***, Medical Advisor, APF France Handicap
- ***Sébastien DENYS***, Director of the Health Environment and Work Department, *Santé Publique France*
- ***Philippe DUSSIN***, Director of Multipurpose Homecare and Support Services (SPASAD); AIDOMI – Home Help Association (33)
- ***Félicia FERRERA BIBAS,*** Dispensing Pharmacist, Vice-President of URPS Pharmaciens PACA
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