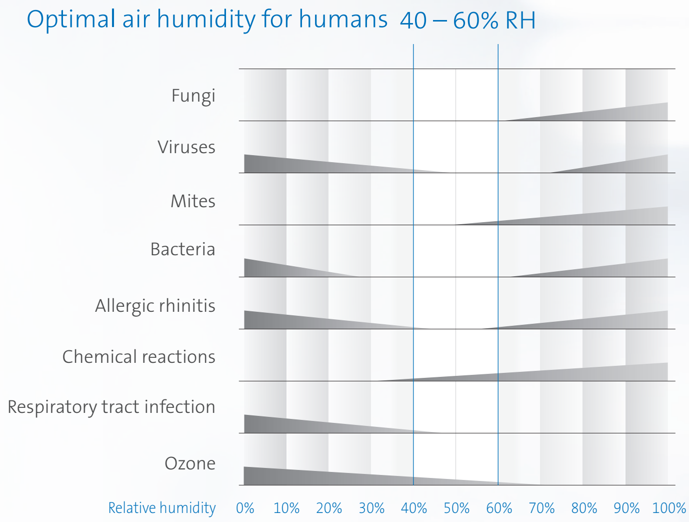
HEALTHY AIR HUMIDITY

The importance of air humidification in hospitals and in outpatient settings

Humidity for a better life

condair



The necessity of humidification in hospitals

People are admitted to hospitals when a serious health disorder occurs. It is therefore essential that patients encounter an environment which is optimally suited to enhance their recovery.

For every emergency, medical treatment, operation, intensive care or rehabilitation measure, the ambient conditions in a hospital have to support healing. Indoor conditions must not be allowed to stand in the way of a full recovery, nor lead to other patients contracting new infection. The quality of the ambient air contributes significantly to patient outcomes.

Healthy, hygienic ambient air
Outdoors, the risk of infection from contact with viral or bacterial pathogenes are extremely low since microbes are quickly diluted in the vast amount of air. Not so in closed spaces!

Indoors, we are faced with a limited volume of air supply which we share amongst each other for our breathing needs. In hospitals, an increased risk of what is known as a nosocomial infection exists in many areas, ie. a disease originating in a hospital. These infections are commonly referred to as HAI's or 'Hospital Acquired Infections'.

In order to keep this risk of infection low, the ambient air has to be treated.

It has to be conditioned in such a way that, in practical terms, pathogens have no chance of survival. Achieving optimal indoor conditions requires the implementation of both the desired temperature along with a relative humidity level of between 40 and 60 percent. Therefore, external air which is sucked in must be humidified or dehumidified in a central air conditioning system regardless of the time of year. Particular attention must be paid to dry ambient air as it favors the survival of viruses and bacteria, and they weaken our immune systems, attack the mucous membranes and leave us with dry skin and eyes.

What is crucial for achieving optimally conditioned ambient conditions, what needs to be kept in mind and what solutions are available?

This brochure provides information on these topics and on healthy air humidity and it`s significance in hospitals and medical facilities.

Hygiene

The aim of hygiene is to maintain or improve the operational capacity and wellbeing of individuals and of society. A main focus is on the prevention of infectious diseases. In this regard, hygiene is setting new challenges on a continuous basis as bacteria becomes more and more resistant.

Hospital hygiene is concerned with the research and prevention and defense against infectious diseases, which are acquired in hospitals, clinics or similar facilities. Thus, it equally serves for the protection of patients and staff and therefore overlaps with occupational health and safety.

The prevention of nosocomial infections in hospitals, is therefore a focal point in hospital hygiene.

In operating theaters and clean rooms in particular, isolation stations, intensive care and delivery rooms, a hygienically flawless ambient air supply is vital.

This is because, when the body's defenses are weakened, the immune system is particularly susceptible to disease-causing agents. Through the skin and essential breathing, the patient comes in direct contact with the ambient air. Its hygiene is therefore of utmost importance for the maintenance, promotion and fortification of a patient's health.

Therefore, a mechanical air supply must be provided at all times by means of a HVAC system, thus, external air must be heated, cooled, filtered and humidified or dehumidified and the supply air must be monitored at all times before entry to the room.


Danger of germs through aerosols

Water aerosols like droplets of mist or steam are tiny particles that are capable of floating, their size determines how many microorganisms they can carry. They get into our bodies via the airways, in this regard, we know the interrelationship of size and depth of penetration into our organism.

Inhalable (0.5 — 18.5 µm)

Nose and throat area	10 — 5 µm
Trachea	5 – 3 µm

Thoracic aerosols that penetrate through the larynx right into the bronchi

Bronchi	3 – 2 µm
Bronchioles	2 – 1 µm

Alveolar duct aerosols that penetrate into the pulmonary alveoli

Alveoli	1 – 0.1 µm

When coughing and sneezing, disease-causing agents such as flu viruses can be literally shot into a room through such droplets via saliva or mucous at speeds of up to 20 m/s and transferred to other people through inhalation. The ambient air humidity plays a decisive role in the capacity to survive and the floating behavior of the tiniest aerosol particles of these pathogenes. But what exactly is the reason for this?

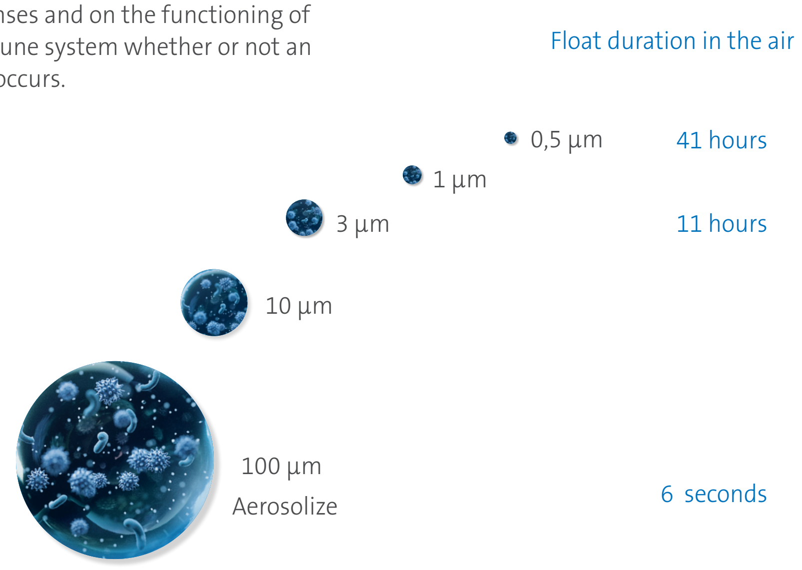
Germs love dry air
Dry ambient air with a relative humidity proportion of under 20% allows tiny droplets that are loaded with flu or cold viruses to dry up. They then shrink to sizes of up to 0.5 µm.

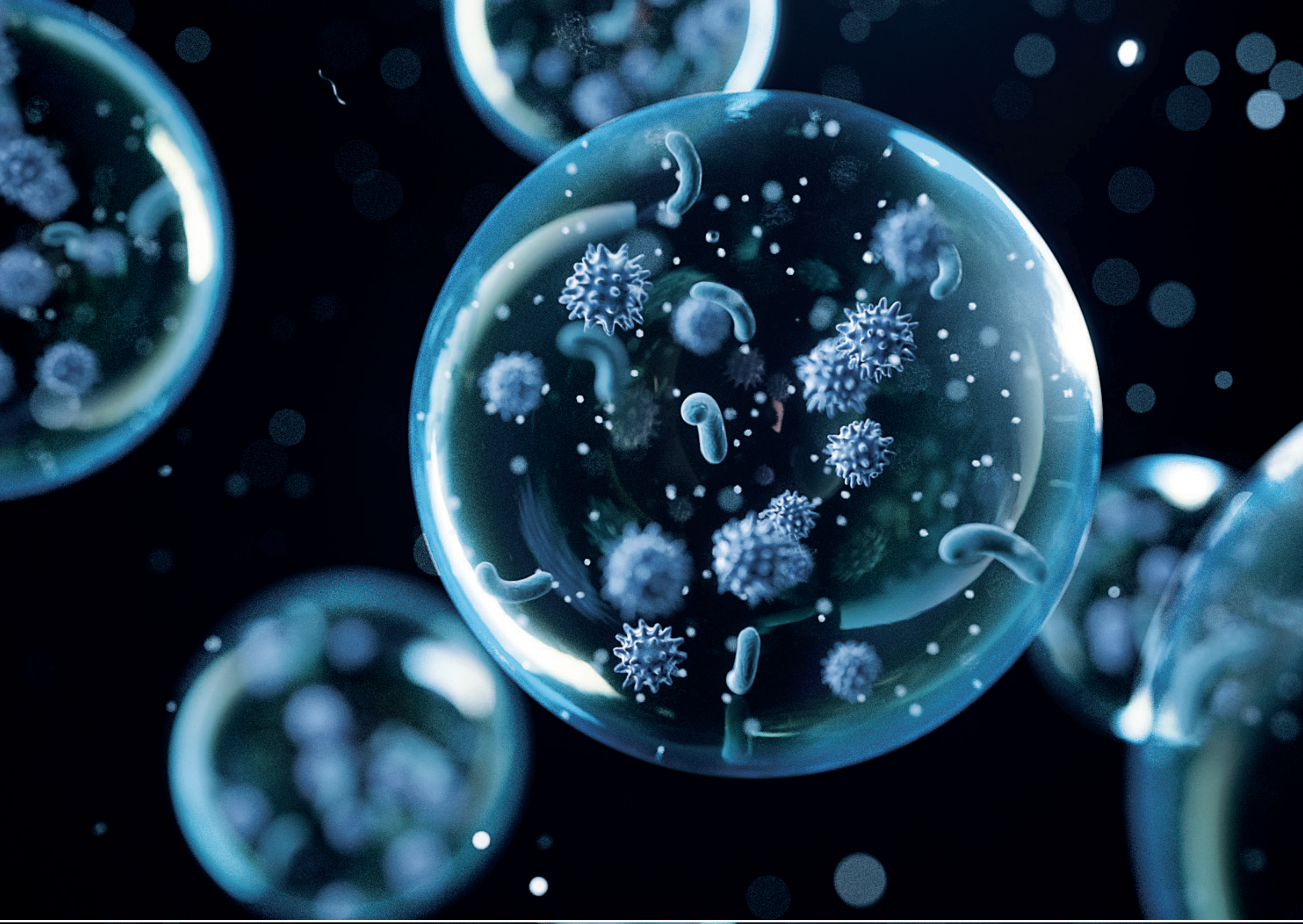
At the same time, their salt concentration increases so much that a veritable crust forms around them in the dry atmosphere. Thus, the capacity of the germs to survive indoors and the ability of the droplets to float are maximized. They can survive for up to 41 hours. So if anyone who has a cold coughs into a room which is too dry, this generates a contaminated atmosphere which can last for nearly 2 days.

The result is a high probability of other people present or people who enter the room breathing in these particles. Then it depends solely on their body's own defenses and on the functioning of their immune system whether or not an infection occurs.

Moist air kills viruses
A constant relative air humidity between 40 and 60 percent, prevents droplets from drying out and forming a salt casing. Viruses and germs are thus deprived of the basis for their survival: in a highly-concentrated saline solution they become inactive within a few minutes.

In addition, droplets with diameters of up to 100 µm remain comparatively large. Their ability to float is thus severely limited. They slowly sink to the floor and can then no longer be inhaled. The size also prevents them from penetrating our organism.







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Stephanie Taylor, MD, MArch, FRSPH(UK)
CEO of Taylor Healthcare Consulting

There is a Silent Killer in our Hospitals!

Scientific literature and patient experiences are making it clear that despite current infection control practices, at least 5 out of every 100 in-patients will contract a new infection or healthcare associated infection (HAI).

These serious and largely preventable HAIs which threaten patient healing and their very survival, globally kill more people than AIDS, breast cancer and auto accidents combined.

This is a horrible situation! The surgeon and patient safety champion, Dr. Atul Gawande, describes victims of HAIs as, “the easiest 100,000 lives we can save”, because no new cure is needed. Instead, hospitals need systems in place that will help to solve this costly and preventable problem.

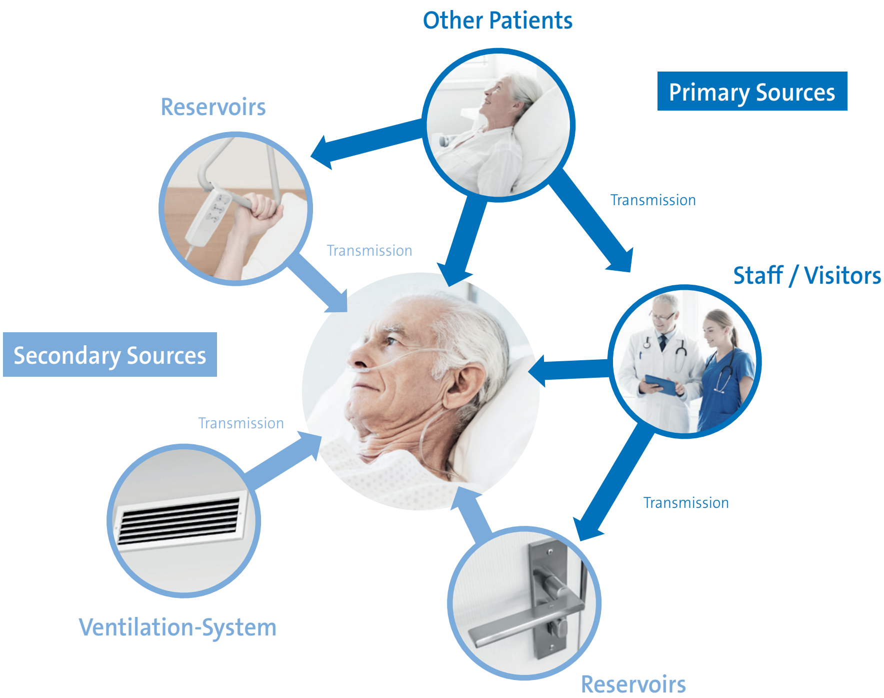
As healthcare leaders struggle to balance hospital budgets and patients stagger under the burden of HAIs, we need to ask if there are facility management strategies which we are missing, ones that would alleviate both of these healthcare crises. A better understanding of how indoor conditions influence both the infectivity of microbes and the ability of patients to fight infections will help identify best practices to decrease HAIs.

Hospitalized patients are exposed to infectious HAI microbes from two main sources: people and building reservoirs. A wide array of pathogens carried into the hospital by sick patients, visitors and staff are expelled into the building through common activities such as talking, coughing, vomiting, skin shedding and toilet-flushing. A single sneeze injects approximately 40,000 infectious aerosols into the room air, so clearly the indoor microbial load can become huge. Vulnerable patients are exposed to virulent microbes that have survived the powerful selection pressures from antimicrobial medications, housekeeping disinfectants and indoor building climates. These infectious microbes, often resistant to antibiotics and other antimicrobial medications, rapidly reproduce and spread through the building via transmission modes keenly adapted to the indoor environment, populating the hospital with microbial communities of pathogens. Not surprisingly, hospitals have unwittingly become reservoirs and vectors for ubiquitous HAI pathogens.

Today’s hospital infection control protocols focus largely on hand, instrument and surface hygiene, as well as on cough etiquette and facial masks. While these strategies target the interruption of transmission through contact and short-distance, large-droplet spray, they do not immobilize the tiny, aerosolized droplets which can spread infectious microorganisms over significant distances and for extended periods through the air.

While the magnitude of airborne droplet transmission continues to generate disagreement, epidemiologists do concur that despite robust surface hygiene interventions to control HAIs, the number of recorded cases has increased by 36% in the last 20 years and continues to grow every year.

Until recently, environmental monitoring for infection control has relied on cell-culture tests which only detect microbes which appear to be alive at the time of collection. This is deceiving!

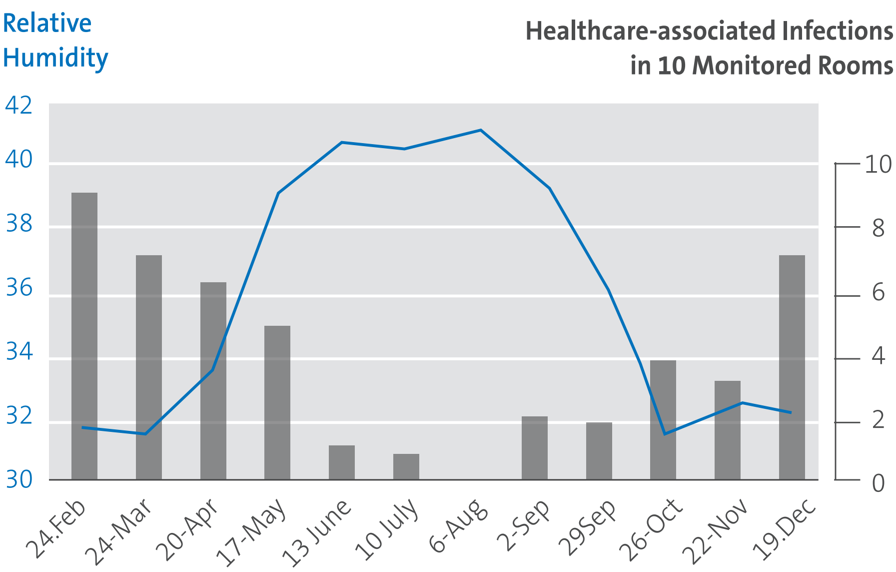


While suspended in tiny airborne aerosols, infectious microbes are often temporarily in “travel mode”, appearing dead and non-infectious when collected during air sampling. But, when re-exposed to physiologic conditions in the next patient, many of these microbes rehydrate and are highly infectious.

Air sampling that mistakenly excludes dormant pathogens in tiny aerosols, and therefore underestimates the infectious load of indoor air, contributes to the infection prevention focus on clinician-behavior and contact transmission which misses the importance of airborne transmission of aerosols. Authors of current, comprehensive review articles conclude that 10% to 33% of all HAI pathogens move through the air at some point between the initial source, the reservoir and the secondary patient. 15 Until airborne transmission of infectious aerosols is controlled, even excellent adherence to existing contact hygiene protocols will not curtail the HAI epidemic.

New data:
The hospital microbiome project

To get a better understanding of the relationship between indoor air parameters in patient rooms and the incidence of HAIs, a study was recently done in a newly constructed, approximately 250 bed academic hospital in the north central US. Over a 13-month period, hourly measurements of room temperature, absolute and relative humidity, lighting levels (lux), room air changes, outdoor ventilation fractions, carbon dioxide levels and room traffic were monitored in ten patient rooms. During this same period, electronic medical records of patients admitted to these rooms were analyzed for the presence of HAIs. Multi-variable statistical analysis was then run on the data to determine if any indoor conditions independently correlated with these patient infections. Of all the environmental measurements tracked and correlated with patient outcomes, indoor RH was found to be the most significantly related to HAI rates. These startling results clearly show that patient room RH was inversely proportional to HAIs ($p < .02$) in other words, as indoor RH increased, the patient HAI rate decreased!



These findings reinforce the need to understand, monitor and manage indoor air hydration, or humidification, to decrease patient HAIs.

Clearly, pathogens fare poorly in properly hydrated air, people are much healthier! What are the reasons for this?

Human lung physiology demands provision of 100 percent saturated air heated to 98.6 degrees Fahrenheit for their essential function: gas exchange. In the lungs, inhaled oxygen is exchanged for the metabolic waste product carbon dioxide across delicate, one cell membranes of the alveoli. Deep in the lung tissue, fragile alveoli sacs are in close proximity to blood vessels. To prevent infectious particles from settling into the alveoli where pneumonia or systemic blood infections could easily result, physiological barriers trap particulate matter in the upper regions of the respiratory system.

Ambient air moisture is necessary for optimal functioning of this defensive mechanism. Respiratory mucosa from the nose to the small bronchial tubes moistens and heats inhaled air before it reaches the alveoli. When ambient air is dried to RH of 20%, patients lose 60 to 80 grams/hour (1½ to 2 liters/day) of water. The water loss by airways alone is 300 to 500 milliliters per day.

In addition to drying the upper respiratory tract mucosa and reducing clearance of infectious droplets, the patient struggles to maintain adequate hydration needed for immune cell functioning and wound healing.

Conclusions

The hospital's physical environment has a significant impact on the health of patients. Unfortunately, too many patients are harmed and hospitals waste money on avoidable HAIs.

The dry air in most hospitals create habitats for microorganisms that are unprecedented in the natural world, and have untold consequences for the selection and transmission of pathogens. By maintaining RH in patient care spaces between 40 to 60%, the transmission and infectivity of airborne pathogens will be reduced, and surface cleaning will be more effective due to less resuspension and redeposition of pathogens. In addition to creating a less infectious environment, indoor air hydration will support patients' physiologic skin and respiratory tract defenses, immune cell functioning, wound healing and total body fluid balance - all natural defenses against HAIs.

Current indoor air guidelines for hospitals do not specify a lower limit RH in patient care areas and are even promoting lowering the minimum acceptable RH level in operating rooms from the current 35% down to 20%. This is a mistake! Management of healthcare facilities must focus on the number one priority - patient healing.

To best protect patient health, optimize clinical outcomes and decrease excess healthcare costs, we must maintain the indoor RH between 40 to 60%. This exciting new data on the influence of hospital indoor air on healthcare-associated infections, and consequently, on patient outcomes, gives hospital engineers and building managers new tools to ensure the best possible outcomes for patient healing.

Projected financial impact of room air humidification for a 250-bed hospital. Cost-reduction analysis if healthcare-associated infections were decreased by 20%

		Q1	Q2	Q3	Q4
BENEFITS - YEAR ONE					
Increase Revenue	Maximize per day bed value by decreasing LOS	1.310.126	1.310.126	1.310.126	1.310.126
	Decrease non-reimbursable HAI costs	764.890	764.890	764.890	764.890
Cost Avoidance	3% CMS penalty for HAI readmissions	91.787	91.787	91.787	91.787
	CMS Quality Index penalty	TBD			
	JCA citations and hospital closure	TBD			
	Employee absenteeism	TBD			
	Quarterly total	2.166.803	2.166.803	2.166.803	2.166.803
	Cumulative value	**2.166.803**	**4.333.606**	**6.500.409**	**8.667.212**
Investments					
	Gas-fired Humidifyer				
	Installation & Integration of New System	1.198.500			
	Maintenance	23.850	23.850	23.850	23.850
	Operating Costs	34.573	34.573	34.573	34.573
	OR & PT Room Down Time	(10.000)	-	-	-
	Quarterly total	1.266.923	58.423	58.423	58.423
	Cumulative Investment	**1.266.923**	**1.325.347**	**1.383.770**	**1.442.194**
NET VALUE					
	Quarterly total	899.880			
	Cumulative total	899.880			

1st year net return	**7.225.018**
Break even point	**1st Quarter**
ROI (1st year)	**500.97%**

The human body consists of **75%** water

The human body mainly consists of water. At birth, our bodies are made up of 80 percent water. This reduces throughout our lives, amounting to about 70 percent in adults and reducing to only 55 percent at age 85.

The majority of it is stored in our bodies' cells, about one third in the extracellular space, the area outside the cells which is filled with fluid, and in the blood.
Water regulates the functioning of the cardiovascular system and digestion, is a solvent for salt and minerals, means of transport for nutrients and degradation products. For our metabolisms to function, the body has to have enough water available at all times.

Our brains also need water all the time to think. In what is surely the most important organ of the body, brain matter is made up of 85 to 90 percent water.

Water fulfills another important function in heat regulation. Two to three liters of water are lost per day through sweating, breathing and our excretions. If this value is higher in sick people, the water balance has to be monitored by a doctor and if necessary liquids introduced intravenously to avoid dehydration. A lack of water can lead to life-threatening states.

Unlike camels in the desert, we are unable to store water for long periods. Therefore, each loss of water must be balanced out on a daily basis through nutrition and the intake of liquids, in illness this can occur by means of infusions if necessary. Otherwise our bodies react with sensitive disruptions. We feel thirsty even at liquid losses of 0.5 percent. At 2 percent, the physical and mental operational capacity is reduced. From 5 percent, our body temperatures increase, and in the event of a loss of water of 10 percent of our body weight, severe symptoms such as blood thickening, confusion or circulatory failure may occur. Through failures of the nervous and circulatory systems, a deficit of over 20 percent leads to death.

Note: We can survive without food for about four weeks depending on fat reserves, but we can only survive without water for a few days. A desert climate significantly accelerates this process. Excessively dry atmospheric air for prolonged periods is similar!

Massive dissemination of germs due to dry air in which germs survive for longer and, as a result of low aerosol size, float for long periods.

Containment of germ dissemination through optimally humidified air (40-60% RH)

The effects of dry air

Dissemination of viruses in dry air
There are three ways in which we can get infected by viruses: The exchange of body fluids, smear infection or droplet infection. Droplet infection occurs through the air, for example through the breathing, speaking, sneezing or coughing of a sick person. When this happens, thousands of small droplets are released into the ambient air. Within split seconds, they shrink by 90 percent of their volume and adapt to the ambient conditions. At this point, it is important the ambient air humidity is right so that the saline solution does not get oversaturated and crystallization does not occur. Thus, the droplet remains moist and disease-causing agents it contains become inactive within a short period of time. Otherwise, a tiny, floatable droplet encased in a salty crust is formed. The saline solution within this crust would be an environment in which viruses and bacteria can survive. These structures are so light that they float around like invisible spaceships in search of another host in order to penetrate its cells. And this happens at home, in the office, in the doctor's practice, or in a hospital. If healthy people inhale infected atmospheric air or come in direct contact with infectious people, the highest alert level is necessary. This is because, whenever anybody inhales these contaminated aerosol droplets via his or her moist airways, the salty crust dissolves immediately on contact with the persons' body fluids. This gives viruses the chances to penetrate cells of the body and cause an infection. However, we now know that especially viruses, which cause many infections especially in winter, cannot withstand moderately moist air of 40 to 60 percent humidity and within a few minutes no longer pose a threat. And when you think that we spend the majority of our lifetimes in buildings, you realize that we also share the air we breathe with all those in the same place. So we can conclude that the air we breathe is our main means of contact, although we don't know what it contains at any point in time.

Lifespan of viruses
Viruses are our constant companions. We come in contact with them on a daily basis without getting sick. They stick to objects and can get into the body through contact with our hands. In most cases, a healthy immune system kills them off - usually without us even noticing. Unlike bacteria, viruses are not living things. In simple terms, they consist of genetic material within a shell. They cannot reproduce themselves. For this reason, they need a host cell in which they implant their genetic information and which they reprogram and can then reproduce themselves. The healthy cell is destroyed in the process. If our immune system is weakened, we get sick. Outside of their host, viruses generally remain effective only for a few seconds. It depends to a large extent on the temperatures and the air humidity. They dislike warmer conditions above 20°C as much as they do a relative air humidity between 40 and 60 percent. On the contrary, low temperatures and particularly a low air humidity offer ideal atmospheric conditions for the viruses themselves or for aerosols occupied by viruses to remain active over the course of several days.

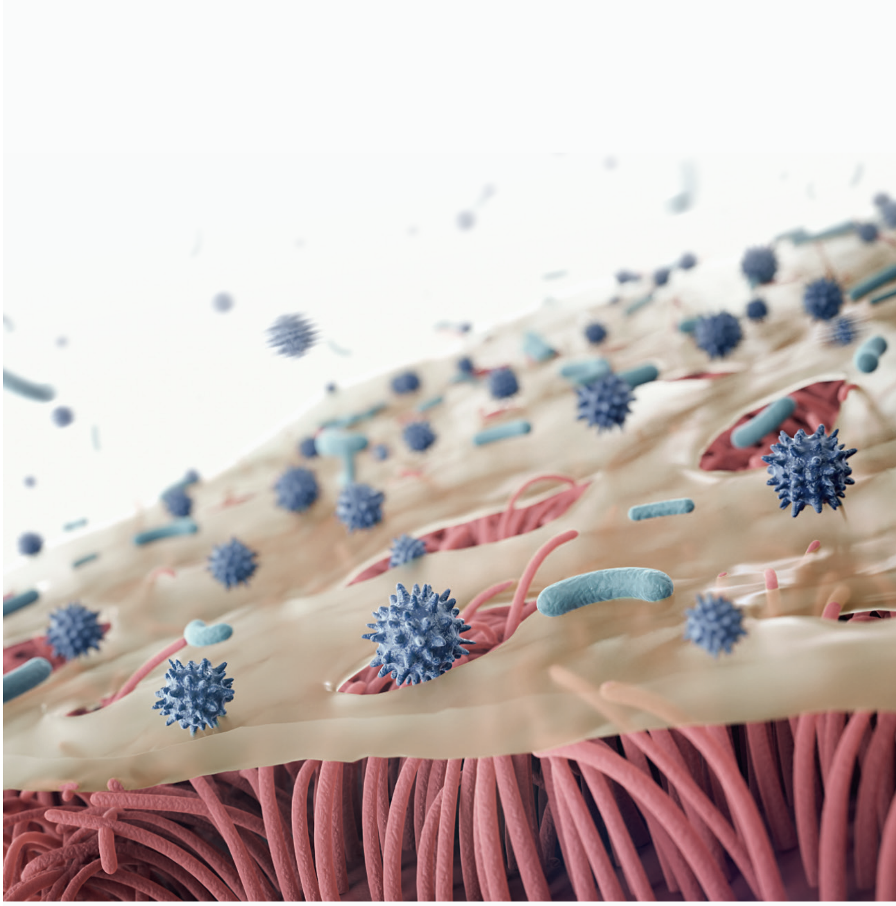
Brain
Our cerebrum and cerebellum make up only 2 percent of the body. Nevertheless, we need 20 percent of our blood for a sufficient oxygen supply alone. Brain cells consist of 85 percent water. The majority of the energy needed for thinking is generated there through a hydroelectric process. This is why, after a certain length of time, a lack of water in the body means that too little energy is available to us. As a result, many vital functions are suppressed. A low energy level in turn means that physical and mental tasks can hardly be completed over longer periods of time.

Eyes
Our eyes are supplied with nutrients and oxygen through the tear film. In addition, bodily substances with disinfectant properties for defense against viruses and bacteria are transported or foreign bodies washed off. To do this, our eyelids wipe the eyes every four to six seconds, before the existing tear film breaks down.
If the formation of tears is impeded however, or their composition is no longer correct, the tear film gets stripped away despite the closing of the lids. Dry patches occur on the eye, which lead to itchiness or even infections. Eye drops provide only short-term relief and are therefore not a long-term solution.

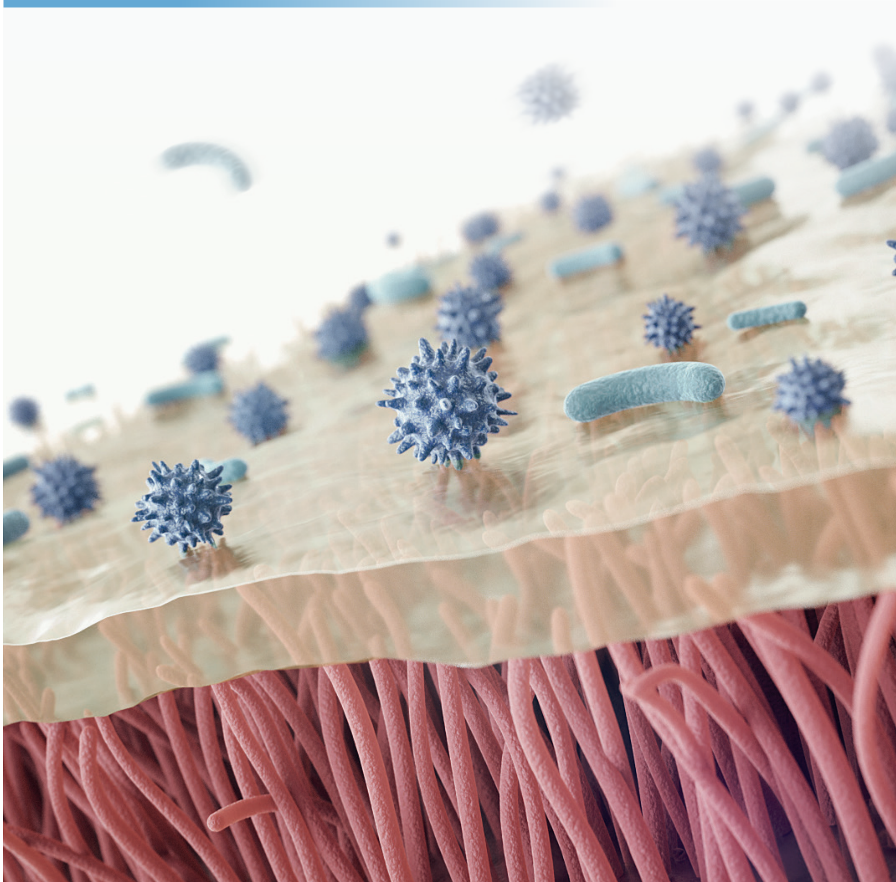
Immune defense
Our immune defense truly is a marvel. It protects a healthy body from the infiltration of viruses, bacteria and other undesirable particles or germs in a natural way. Above all, our noses are called on to do this work. Breathing occurs mainly through our organ of smell. We breathe in mostly through the nose and, especially when talking, out through the mouth. Via the airways, our ambient air sweeps into the lungs and into the tiniest end-organs, the alveoli.
The entire way there is coated with mucous membranes, which excrete a fluid on a continuous basis. Part of it has hairy protrusions. Together with the mucous membranes, these cilia form the respiratory epithelium. It is constantly in motion and is often compared with a field of corn stalks swaying in the wind. This constant motion ensures that impurities and disease-causing agents inhaled in the air we breathe are blended with mucous and then carried away before an infection can occur. Like an air conditioning system, our nose cleans the air, heats it to 37°C and ensures a 100 percent humidification and steam saturation. This is the only way the air can access our alveoli. Otherwise oxygen absorption would not be possible.

Breathing in excessively dry air compromises the functioning of the respiratory epithelium. The mucous no longer obtains enough water and moisture and as a result thickens, no longer runs off and breaks down. The self-cleaning effect only works inadequately. This opens the floodgates for viruses and bacteria. Our immune defense therefore needs optimum moisture conditions for us to stay healthy.

Dry, Immunodeficiency
nasal mucous membrane



Viscous, functional
nasal mucous membrane



Skin
With a surface of about 2 m², the skin is our largest organ. It protects us from cold, heat and radiation, offers resistance to pressure and impact, with its slightly acidic pH value of 5.7 keeps germs and microorganisms at bay, and is our primary item of clothing for heat insulation. Its structure can be seen under the microscope. There are three layers: The epidermis with a corneal layer, the dermis and the subcutaneous layer. The skin is also our largest sensory organ, supports breathing and is cooling when we perspire. All in all, the skin is multi-functional, combines water and fat tissues and provides an external barrier. If the ambient conditions are right, it remains elastic as it does so.

However, if the skin loses moisture and fats, this barrier crumbles. Dry ambient air may favor this process, if the body itself can no longer obtain enough from inside to compensate. This can be the case in sick or older people especially. The same goes for infants whose skin is not yet fully formed. In these cases, the corneal layer becomes increasingly porous and loses its protective function more and more. At the same time, dangerous substances can penetrate more easily which leads to skin irritations and inflammations.

Air humidification with steam

Hygiene is a top priority in hospitals. Electric steam humidifiers generate an absolutely germ-free atmospheric air humidity, as the water used is heated to temperatures of 100°C, which no germ or disease-causing agent can withstand. For this reason, mineral-free or regular tap water can be used, no special processing is required.

Steam air humidifiers can be integrated into any existing central air conditioning system or, in most cases, retrofitted. They are easy to clean and maintain. For the even injection and distribution of the steam in the air flow, it is especially important to implement the humidification distance correctly.

It is made up of the mist zone and the subsequent expansion and mixing zone. When this is measured properly, the occurrence of condensation inside the air pipes is prevented.

In addition, this prevents water aerosols from reaching the filter. The humidification distance is also important for correct humidity control, since control sensors should only be installed where there are balanced humidity values. Due to the quick and homogeneous mixing with the system supply air, in the case of extensive steam injection, significant reductions of the humidification distance are also achieved.


Outside air
Output air
Exhaust air
Input air

Reduction of operating costs with indirect evaporative cooling

Indirect evaporative cooling, also known as adiabatic cooling, is a process in which latent and sensitive evaporative heat from water can be used to cool supply air in a hospital's HVAC system. To do this, the water is firstly evaporated on the exhaust air side of a HVAC system using an evaporative cooler. Heat energy is removed from exhaust air in the process, thus, it cools down. Then the exhaust air is conducted close to the warm external air in the crossflow, without coming in contact with it. From a hygiene point of view, this solution is absolutely harmless, which is very important for hospitals or other medical areas. Through heat recovery from the external air, the added moisture in the exhaust air condenses once again, therefore heating the exhaust air and cooling the supply air at the same time.

Apart from the speed at which air passes through the evaporative cooler, the evaporated water quantity and hence the attained cooling depend on the condition of the output air which enters the evaporative cooler. The theoretical limit of evaporative cooling is reached upon complete saturation of the exhaust air with water, i.e. at a relative humidity of 100 percent. Humidity increases up to values between 92 and 95 percent are realistic in air conditioning systems at economically viable cost, depending on the design of the evaporative cooler used. As mentioned previously, indirect evaporative cooling is suitable for the sensitive cooling of the supply air. Depending on the location, on especially hot days or for redundancy reasons, if additional cooling energy is required, a mechanical cooling system can also be used – but this can be a much smaller size. In a suitable system design, much more electrical driving energy for a cooling system is saved by indirect evaporative cooling than is needed to overcome the additional air-side pressure loss through the extractor fan.

The question of cost-effectiveness
In practical terms, the greatest hurdle when using renewable energy is cost-effectiveness. Efficiency measures such as indirect evaporative cooling have to "pay", additional costs incurred during the investments must be absorbed again through the savings achieved during operation.

A reliable system simulation therefore makes the relationships transparent and allows a realistic comparison with conventional measures for cooling buildings. Since HVAC systems in hospitals work to condition the air all year round and have to meet the highest possible standards for hygiene reasons and for the preservation of health, it has to be taken into account that in many cases a depreciation will set in within an acceptable time frame. From the operating cost viewpoint, the system thus proves economical right from the first day.

Air humidification technologies

ME Evaporative Cooler

Evaporative cooling enables a significant reduction of the operational costs for building cooling, because energy-efficient evaporative cooling allows for smaller cooling batteries to be used or for them to be dispensed with altogether.

DL Evaporative Humidifyer

The Nortec DL Series hybrid humidifier merges two industry-leading high-performance systems into one resulting in a peak of advantages of both humidification methods of atomization and evaporation.

SAMe Steam Distributor

The SAMe multiple steam distribution system ensures a homogeneous, even distribution of steam and thus optimal, hygienic sorption of the steam in the air.

GS Steam Humidifier

Nortec GS units enable high-efficiency humidification with gas.
The exhaust gas can be discharged directly through HVAC exhaust air.
Exhaust gas heat is mostly recovered through heat recovery in the HVAC unit.
And it's easy to add these units to existing systems.

RS Steam Humidifier

Similar to the Nortec EL, the Nortec RS also features a variety of unique design features that enable operational safety with the highest precision and control accuracy. The RS also boasts patented lime scale management which prevents permanent deposition of lime scale on heater rods. A long useful life and extremely short maintenance times are thus guaranteed.

EL Steam Humidifier

These products are the first choice whenever simple but reliable steam/air humidification is required.

Users of such installations look for simple and easy operation, and demand healthy, hygienically humidified breathing air.

SE Series Steam Exchange Humidifier

While the Nortec SE-Series steam exchange humidifiers generate clean, hygienic, and atmospheric steam, all they require to do so is a connection to your facility boiler as power source. By passing through top-quality 316 stainless steel heat exchangers, fresh water is turned into clean boiler steam through a cutting-edge process. This innovative humidification technique prevents any chemical boiler elements from affecting your building's air supply.

USA 1021 6th Street, Racine, WI 53403
Canada 2740 Fenton Road, Ottawa, Ontario K1T 3T7
Tel 1.866.667.8321 **Email** na.info@condair.com