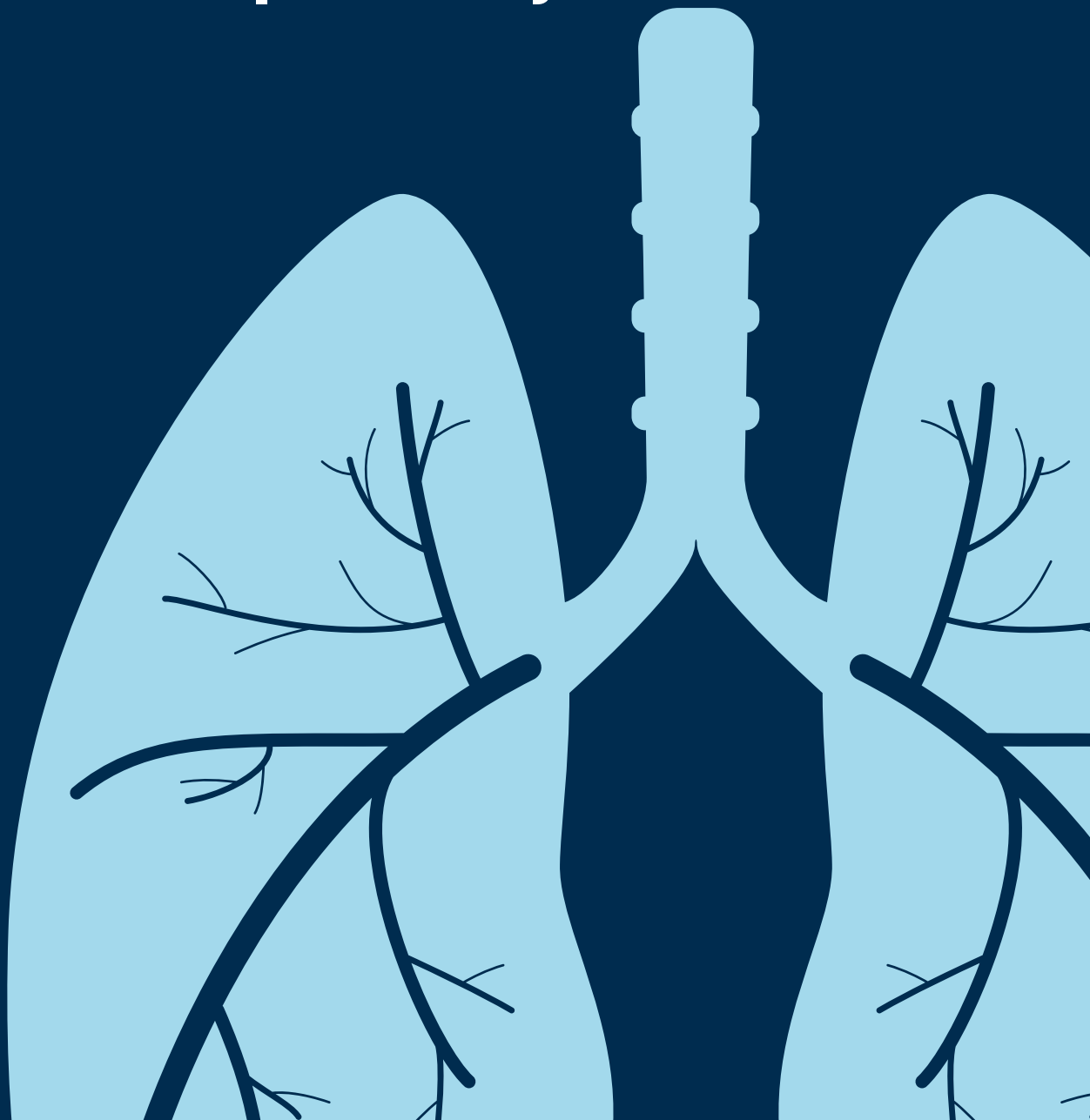
OMRON

# Highlights of clinical research and literature in the field of **Respiratory**

2022





## About OMRON Healthcare

Committed to helping people live a freer and more fulfilling life with zero compromise, OMRON Healthcare is a global leader in the field of clinically proven, innovative medical equipment for health monitoring and therapy.

We offer products that have clinically validated accuracy based on the validation results by the official medical protocols.

For many decades, OMRON's devices have helped people to prevent, treat and manage their medical conditions both at home and in clinical practice in over 110 countries in the world.

OMRON understands the importance of accuracy in a clinical setting and that, oftentimes, a person's road to a healthier life begins in the doctor's office. We work with patients and clinicians alike to understand people's needs. We designed and modified our health devices accordingly. Our three key priorities in the professional field are accuracy, durability, and functionality.

This booklet will share OMRON's acquired knowledge and expertise by providing an overview of the most relevant topics and existing scientific literature in the field of respiratory. Each chapter ends with a short summary with the main takeaways. This booklet is designed to bundle key information, in a clear and concise manner, and make it available for your daily practices.

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# Global Respiratory Diseases

Global Respiratory Diseases 04

Chronic Respiratory Diseases 04

Acute Respiratory Diseases 04

## 01/1 Chronic Respiratory Diseases

Chronic Respiratory Diseases (CRDs) are worldwide among the most common non-communicable diseases. CRDs describe a range of chronic diseases affecting the airways and other structures of the lungs. Some of the most common diseases are asthma and respiratory allergies, chronic obstructive pulmonary disease (COPD) and occupational lung diseases.[1]

**Prevalence and attributable health burden of chronic respiratory diseases[2]**

Chronic respiratory diseases remain a leading cause of disability and death worldwide, with the highest prevalence (10-11% of the population or higher) observed in high-income regions. In 2017 around 550 million people worldwide had a chronic respiratory disease. This shows an increase of 39.8% compared with the year 1990. The lowest prevalence is seen in the sub-Sahara Africa and south Asia. COPD and asthma remain the most prevalent disease-specific chronic respiratory disease worldwide. Chronic respiratory diseases are ranked the third leading cause of death in 2017, with COPD being the most common cause.

**Air pollution and chronic airway diseases: what should people know and do?[3]**

Air pollution and its effects on health remain a public concern worldwide. Around seven million deaths globally were attributable to joint effects of household and ambient air pollution. Air pollution can induce the onset of asthma, acute exacerbation of COPD, and increase the respiratory morbidity and mortality. The effects on health due to air pollution depends largely on the components and sources of pollutants, which is different in countries, seasons, and times. This article provides more information on the components and sources of air pollution, and the impact of it on health.

## 01/2 Acute Respiratory Diseases

Acute respiratory infection (ARI) is a type of infection which causes trouble in breathing function. Usually this occurs in the upper respiratory tract, with symptoms including congestion, runny nose, cough, sore throat, and fatigue. Upper respiratory infections are mostly of viral etiology. They could include common cold, sinusitis and pharyngitis. Lower respiratory infections are either viral or bacterial. Common lower respiratory infections include bronchitis, bronchiolitis, and pneumonia.[4]

**The Global Impact of Respiratory Disease: Acute lower respiratory tract infection[5]**

According to the WHO, lower respiratory tract infection and pneumonia are two of the leading causes of death, accounting for more than 4 million fatalities annually. This occurs particularly in low-and middle-income countries. It is also the leading cause of death in children under 5 years of age, outside the neonatal period. In 2015, pneumonia killed 920,136 children aged under 5. Factors increasing the risk of pneumonia include either the very young or elderly, crowded living conditions, malnutrition, HIV infection, lack of immunisation and lack of breast-feeding in infants. Streptococcus pneumoniae remains the most frequent bacterial cause of pneumonia. Also, HIV infection even increases the risk of getting a pneumonia by twentyfold. In this article of the WHO you can find more information regarding prevention, treatment, control, and elimination of acute lower respiratory tract infection.

**Signs and Symptoms that Differentiate Acute Sinusitis from Viral Upper Respiratory Tract Infection[6]**

Differentiating viral upper respiratory tract infection from acute bacterial sinusitis is quite challenging. About 20 to 40% of children who are diagnosed with acute sinusitis, are likely to have an uncomplicated upper respiratory tract infection. This study shows that severity of symptoms correlates with radiographic diagnosis. Children presenting with mild symptoms are less likely to have bacterial sinusitis, and therefore are less likely to benefit from antibiotics. Also, this paper states that children without green nasal discharge or without disturbed sleep are somewhat more likely to have an uncomplicated upper respiratory tract infection than children with these findings.

**Pediatric Asthma and Viral Infection[7]**

The most important risk factors for the onset of wheezing in infants and small children are respiratory viral infections, particularly respiratory syncytial virus, and rhinovirus. Bronchiolitis is the most common acute respiratory infection and most common cause of hospitalization in children under 1 year of age. Respiratory viruses, particularly rhinovirus, are the most common causes of exacerbations in children: in over 90% of children hospitalized for an episode of wheezing were identified with such a virus. This article aims to review the role of viruses as precipitating factors for asthma, and their role in asthma exacerbations.

# Main takeaways

## Global Respiratory Diseases

- Chronic respiratory diseases remain a leading cause of disability and death worldwide.[2]
- Highest prevalence is seen in high-income countries (10 to 11% of the population or higher).[2]
- Chronic respiratory diseases are ranked the third leading cause of death in 2017. [2]
- Lower respiratory tract infection count for more than 4 million fatalities annually.[5]
- In 2015, pneumonia killed 920,136 children aged under 5.[5]
- In over 90% of children hospitalized for an episode of wheezing, a respiratory infection virus was identified.[7]

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# Asthma


Asthma 06

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## 02/1 Asthma

Asthma is a chronic condition, often long-term, that affects the airways in the lungs. It is a complex disease caused by multiple factors. These factors can be divided into allergen-induced and non-allergen induced, but both often occurring with the same symptoms. The airways can become narrow and inflamed (airway hyperresponsiveness), and symptoms range from mild to severe. With asthma, breathing becomes more difficult and it may trigger coughing, wheezing (a whistling sound), and shortness of breath.

**Global Initiative for Asthma (GINA) Strategy 2021 – Executive summary and rationales for key changes**[1]

The GINA Strategy Report provides healthcare professionals with updated evidence-based strategy for asthma management and prevention. This article summarizes key recommendations from GINA 2021 and its underlying evidence. GINA recommends that patients should not only be treated solely with short-acting-beta2-agonist (SABA), this due to the risk of overusing SABA and undermining the benefits and significance of inhaled corticosteroids (ICS). Trials have shown that as-needed combination ICS-formoterol reduces severe exacerbations by >60% in mild asthma compared with SABA alone, with key similar exacerbations, symptoms, lung function and inflammatory outcomes as daily ICS plus as-needed SABA.

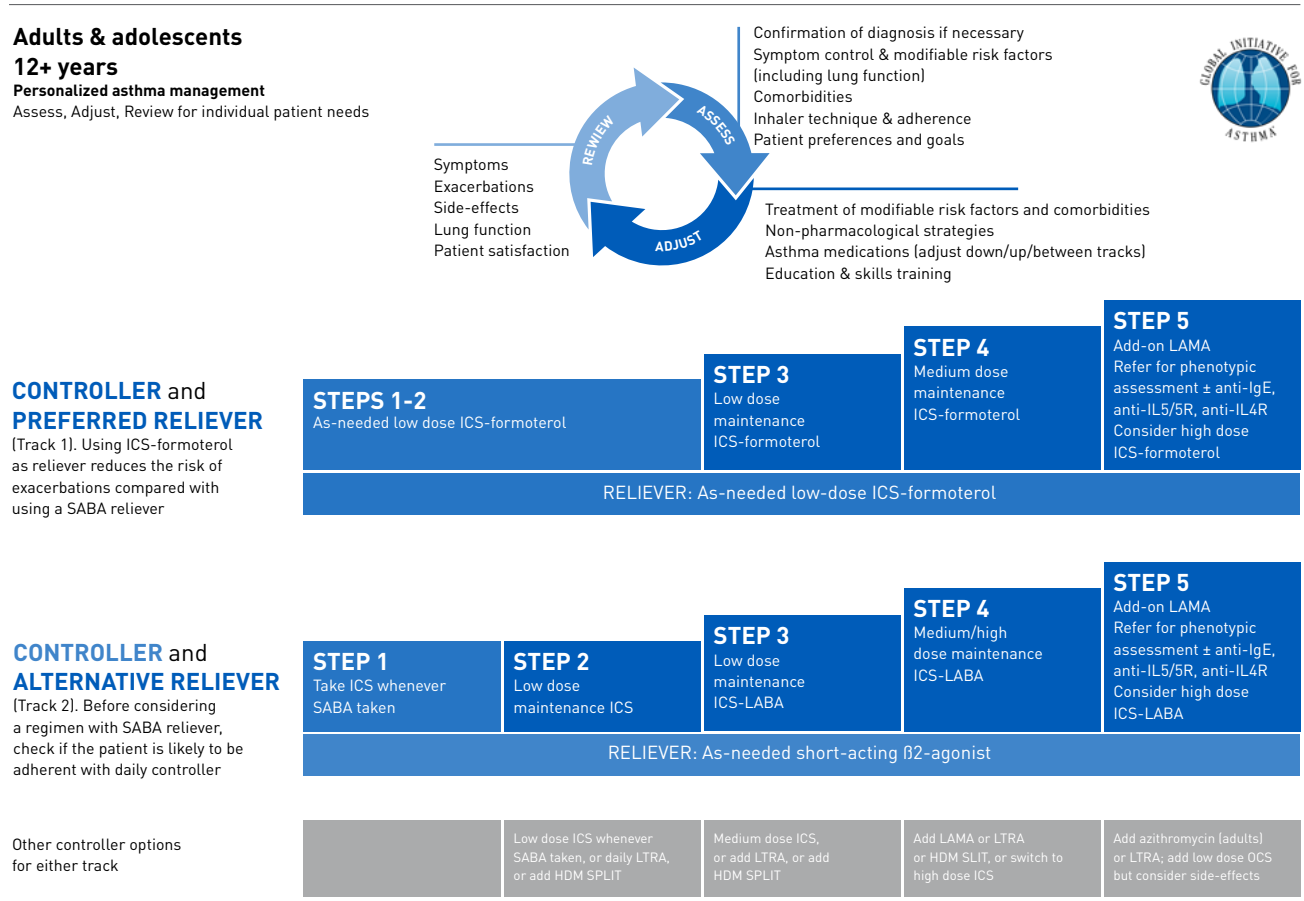



Figure 1: GINA 2021 guidelines Adults & adolescents 12+ years. Personalized asthma management[2]



## MicroAIR U100

The OMRON MicroAIR U100 is a small, portable nebulizer that helps to efficiently treat lower respiratory conditions like asthma, bronchitis and COPD

The unique mesh technology makes it more efficient and more comfortable to use than most traditional nebulizers. It is virtually silent, and the unique design enables usage in any position.

**Epidemiology of Asthma in Children and Adults[3]**

Asthma is one of the most common non-communicable diseases with a substantial impact on quality of life. Although asthma prevalence is higher in high income countries, most asthma-related mortality occurs in low-middle income countries. Current evidence shows that asthma is a complex multifactorial disorder, and its etiology is mostly contributed to genetic factors (asthma susceptibility loci on genes), host factors (obesity, infections, nutritional factors) and environmental factors (air pollution, pollens, mold, and weather). The global epidemic of asthma is continuing, and this paper aims to provide an epidemiological perspective by comparing trends.

**Sex Differences in Severe Asthma: Results from Severe Asthma Network in Italy-SANI[4]**

Early in life, asthma is more common in boys while after adolescence, asthma is more frequent in females. This switch of prevalence in gender is due to different hormonal, immunological, and occupational/environmental factors. The aim of this study is to explore the difference in terms of clinical, functional, and biological characteristics between male and female patients with severe asthma in a real life, registry-based setting.

**Understanding a Patient Perspectives on Medication Adherence in Asthma: A Targeted Review of Qualitative Studies[5]**

Adherence to asthma medications is generally poor and undermines clinical outcomes. This poor adherence is shown by an underuse of inhaled corticosteroids (ICS), often accompanied by an overuse of short-acting B2-agonist (for symptom relief). Many patients undermine their disease and are in denial about the impact of it. Furthermore, poor patient-physician communication contributes to a lack of knowledge about asthma medications, including a lack of understanding the differences between maintenance and reliever inhalers and inhaler technique. This targeted literature elaborates further on the overall key drivers of medical adherence.

**Effective Asthma Management: Is It Time to Let the AIR out of SABA?[6]**

Standard asthma treatment has, for years, been mostly about short-acting beta2-agonists (SABA). Current guidelines no longer recommend SABA monotherapy because of significant safety concerns and poor outcomes. Despite the evidence, SABA over-reliance continues with decreased ICS use because of poor adherence, resulting in increased use of OCS due to exacerbations, as well as increased emergency department visits and hospitalization. Patients who are treated with SABA monotherapy have a greater risk of severe exacerbations than patients treated with ICS. These severe exacerbations are then managed by OCS. However, there are real concerns associated with prescription of OCS and its adverse effects: increased risk of herpes zoster, cardiovascular events, type 2 diabetes, bone related conditions and fractures, cataracts, obesity, and hypertension. This paper discusses the issues and reasons of current SABA over-use, difficulties that can be expected in overcoming SABA over-reliance and importance of anti-inflammatory relievers.

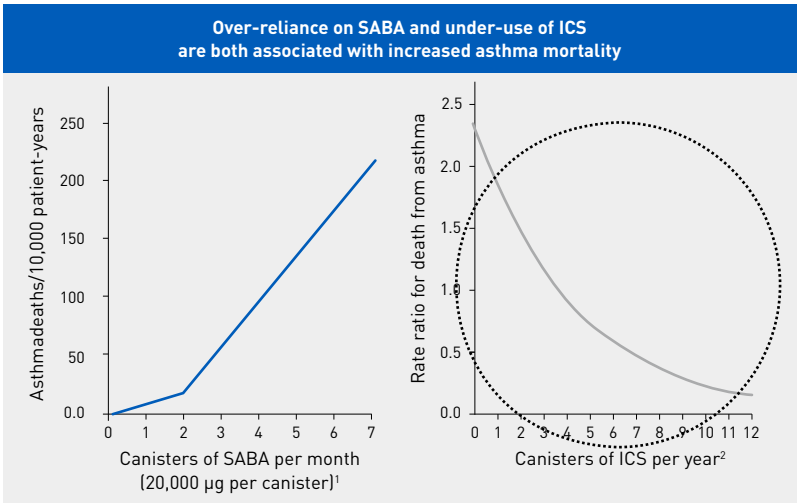



Figure 2: ICS: inhaled corticosteroid; SABA: short-acting $\beta_2$-agonist[7]

**Allergic disorders and susceptibility to and severity of COVID-19: A nationwide cohort study[8]**

This study, done in South Korea, sought to determine the association of allergic disorders with the likelihood of a positive severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) test result and with clinical outcomes of COVID-19 (such as admission to intensive care unit, administration of invasive ventilation and death). The association of SARS-CoV-2 test positivity and allergic diseases in the entire cohort (n=219,959) and the difference in clinical outcomes of COVID-19 were evaluated in patients with allergic diseases and SARS-CoV-2 positivity (n=7,340). It was found that asthma and allergic rhinitis were associated with worse clinical outcomes of COVID-19. Concluding that allergic rhinitis and asthma, especially nonallergic asthma, confers a greater risk of susceptibility to SARS-CoV-2 infection and severe clinical outcomes of COVID-19.

## 02/2 Pediatric Asthma

Asthma is recognized as the most common chronic disease in children. Childhood asthma symptoms include frequent coughing, a whistling or wheezing sound when breathing out, shortness of breath and chest congestion or tightness.

**Global initiative for Asthma. Global Strategy for Asthma Management and Prevention, 2021. Available from: www.ginasthma.org**

According to the Global Initiative for Asthma (GINA) guidelines, Pressurized Metered Dose Inhaler (pMDI) is the preferred device for asthma patients. To use an inhaler properly for the medication to be delivered effectively, continuous training is required. Poor inhaler technique leads to poor asthma control, increased risk of exacerbation and increased adverse effects. However, nebulizers are the only viable alternative delivery system in children that is reserved for children who cannot be taught effective use of a spacer device.

| Choosing an inhaler device for children 5 years and younger | | |
|---|---|---|
| **Age** | **Preferred device** | **Alternate device** |
| **0-3 years** | Pressurized metered dose inhaler plus dedicated spacer | Nebulizer with face mask |
| **4-5 years** | Pressurized metered dose inhaler plus dedicated spacer | Pressurized metered dose inhaler plus dedicated spacer with face mask Or nebulizer with mouthpiece or face mask |

Figure 3: GINA Guidelines Box 6-7: Choosing an inhaler device for children 5 years and younger

**Asthma: Steps in testing and diagnosis - Children (Mayo clinic)[9]**

It can be very difficult to diagnose asthma in very young children, because there are quite many conditions that could cause asthma-like symptoms within this age group. Doctors seldom do lung tests in children under age 5. Therefore, diagnosis is generally based on a child's signs and symptoms, medical history, and physical examination.

**International expert opinion on the use of nebulization for pediatric asthma therapy during the COVID-19 pandemic[10]**

With the current coronavirus disease (COVID-19) pandemic, guidelines are continuously being updated. Even though these updated guidelines broadly agree in their recommendations for asthma medications, guidance on the use of nebulizers for delivery of medication is contradictory. Concerns have been raised that nebulizer-use by COVID-patients could transmit potentially viable infection to bystander hosts. However, existing data are limited and poor. A clear guidance on the safe use of nebulization, both in hospital and at home, especially in pediatric asthma is needed. Therefore, this study provides evidence-based, clinically relevant, and practical recommendations in the use of nebulization during the COVID-19 pandemic. Their overall recommendation suggests that nebulization should remain the choice of treatment for children who require this mode of treatment. The mentioned safety measures in this article will guide physicians on best practice in pediatric asthma during this pandemic.

**Childhood asthma outcomes during the COVID-19 pandemic: Finding from the PeARL multi-national cohort[11]**

This multinational cohort study included 1,054 children with asthma and 505 non-asthmatic children aged between 4 and 18 years from 25 pediatric departments, in 15 countries globally. Their findings evaluated the impact of COVID-19 pandemic on childhood asthma outcomes. They found, among others, that 66% of asthmatic children had improved asthma control and in 33% the improvement exceeded the minimal clinically important difference. Compared to non-asthmatic controls, children with asthma were not at increased risk of LRTIs, emergency visits, episodes of pyrexia and hospitalization during the pandemic.

**Provider demonstration and assessment of child device technique during pediatric asthma visits[12]**

The purpose of this study was to find out the extent to which children use metered dose inhalers, turbohalers, diskuses and peak flow meters correctly during pediatric asthma visits. Results show that only 8.1% of children perform all the metered dose inhaler steps correctly, 22% performed all of the diskus steps correctly, 15.6% performed all of the turbohaler steps correctly and 24% performed all of the peak flow meter steps correctly. This study shows shocking results regarding current child device technique and highlights the importance of training children and parents well to manage asthma symptoms successfully.

**Inhaler counselling, the real deal or just fresh air?[13]**

The aim of this study was to find out whether healthcare professionals within the local community were able to counsel pediatric patients on the right steps with multi-dose inhalers (MDI), MDIs with a spacer and turbohalers. Within this audit 92 healthcare professionals, 43 nurses, 9 doctors, 13 hospital pharmacy staff and 27 community pharmacies team members were included. Overall, 13% of all participants counselled on all the necessary criteria for an MDI inhaler. The pharmacy teams in the hospital and community had the highest competency levels with 31% and 30%. No doctors or nurses were able to identify all steps. Regarding the essential steps needed for MDI with a spacer device, only 10% of all participants were able to competently counsel, again with no doctors or nurses achieving all steps. Concluding that more needs to be done to improve inhaler literacy within the local healthcare community.

**Nebulized Inhaler Corticosteroids in Asthma Treatment in Children 5 Years or Younger: A Systematic Review and Global Expert Analysis[14]**

Nebulized corticosteroids (NebCSs) are a key treatment option for young children with asthma or viral-induced wheezing (VIW), however there are no constant recommendations on their best use. This systematic review aimed to create a consistent clarification of the role of NebCSs in children 5 years or younger, for the management of asthma maintenance therapy, acute asthma exacerbations, and the treatment of viral-induced wheeze. Results showed that NebCSs are at least as successful as oral corticosteroids in the emergency room when it comes to the management of mild to moderate asthma exacerbations. Furthermore, intermittent NebCS treatment of viral-induced wheeze was as effective as continuous daily treatment. Concluding that NebCSs are effective and well-tolerated in patients 5 years or younger, for their management of acute or chronic asthma.

| Patient | Nebulizer | pMDI plus spacer | Dry powder inhaler |
|---|---|---|---|
| **Infant (<2 y)** | Reliable | Unpredictable | Never appropriate |
| | Easy to use | Requires training | |
| | Mask, tight seal not required | Mask, tight seal required | |
| **Preschool (2-5 y)** | Effective | Effective | Not appropriate |
| | Easy to use | Requires training | |
| | Mask, tight seal not required | Mask, tight seal required | |
| | Breath-enhanced mouthpiece | Mouthpiece | |
| **School age (>5 y)** | Effective | Effective | Effective |
| | Breath-enhanced mouthpiece | Mouthpiece | Easy to use |
| | | Requires training and practice | Deposition varies by device |

Figure 4: Recommendations for delivery of ICS in infants and children[15]



## C28P

### Highly efficient nebulizer for frequent use

This powerful nebulizer was developed in conjunction with respiratory therapists for the successful treatment of respiratory disorders such as asthma, chronic bronchitis and allergies.

**Are wheezing, asthma and eczema in children associated with mother's health during pregnancy? Evidence from an Australian birth cohort[16]**

This study investigated the prevalence of wheezing, asthma and eczema among Australian children using longitudinal data from birth to 15 years of age. Furthermore, this study examined the association between maternal health factors (such as asthma, smoking, medical use, and pre-pregnancy obesity) during pregnancy, and respiratory and allergic morbidities on their offspring. Asthma prevalence among 0-1 year aged children was 11.7%, with an increase to 15.4% when the children were 10-11 years old. Wheezing and eczema were more common when the children were 2-3 years old. Furthermore, maternal asthma, smoking during pregnancy, and pre-pregnancy obesity significantly increased risk of wheezing and asthma in children.

# Main takeaways

## Asthma

- Global Initiative for Asthma (GINA) Strategy 2021 provides healthcare professionals with updated evidence-based strategy for asthma management and prevention.[1]
- Trials have shown that as-needed combination of ICS-formoterol reduces severe exacerbations by >60% in mild asthma compared with SABA alone.[1]
- Asthma prevalence is higher in high income countries, but asthma-related mortality occurs in low-middle income countries.[3]
- Early in life, asthma is more common in boys while after adolescence asthma is more frequent in females.[4]
- Despite the evidence and current guidelines, SABA over-reliance and ICS under-reliance still occurs, resulting in increased exacerbations and hospitalization.[6]
- Asthma and allergic rhinitis were associated with worse clinical outcomes of COVID-19.[8]
- Only 8.1% of children perform all metered dose inhaler steps correctly.[12]
- Only around 10% of healthcare professionals are capable of teaching patients how to use inhaler devices correctly, including spacer.[13]
- Maternal asthma, smoking during pregnancy, and pre-pregnancy obesity significantly increases risk of wheezing and asthma in children.[16]

# 02/3 Comorbidities of Asthma

## 02/3/1 Hay fever (allergic rhinitis)

Hay fever is caused by an allergic response to outdoor and indoor allergens, such as pollen, dust mites, and animals with fur or feathers. It is a type of inflammation that occurs when the immune system overreacts to these allergens in the air, causing symptoms such as runny nose, sneezing, swelling around the eyes and itchiness.

**Allergic rhinitis: the "Ghost Diagnosis" in patients with asthma[17]**

A common comorbidity of asthma is allergic rhinitis (AR), which contributes to asthma severity. Over 80% of asthmatics have AR, while AR itself also affects 10-30% of adults and up to 40% of children. AR has been associated with an increased risk of asthma severity and development. Even though the exact mechanisms underlying these relationships still need to be determined, evidence does support the role of allergen sensitization. Immunotherapy for AR has shown to improve both asthma and rhinitis symptoms, in addition to preventing future allergen sensitizations and asthma development. Therefore, recognizing, diagnosing, and treating AR can significantly improve quality of life and reduce asthma morbidity.

**Meta-analysis of the comorbidity rate of allergic rhinitis and asthma in Chinese children[18]**

Allergic rhinitis (AR) and asthma often occur simultaneously. They are both the two most common inflammatory conditions of the airway in children. The comorbidity of AR and asthma in Chinese children is high. Statistically, the prevalence of AR was higher in children with asthma, as opposed to the prevalence of asthma in children with AR. Therefore, these study results signify the importance of improving the recognition and treatment under both conditions.

## 02/3/2 Allergic bronchopulmonary aspergillosis

Allergic bronchopulmonary aspergillosis (ABPA) is a fungal infection of the lung due to a hypersensitivity reaction to antigens of Aspergillus Fumigatus after colonization into the airways. Aspergillus species are molds. There are over 100 specifies worldwide, but most illnesses are caused by Aspergillus fumigatus, Aspergillus Niger, Aspergillus Flavus and Aspergillus Clavatus.[19]

**Allergic bronchopulmonary aspergillosis in asthma and cystic fibrosis[20]**

ABPA, a Th2 hypersensitivity lung disease, affects asthmatic and cystic fibrosis patients. Sensitization to Aspergillus Fumigatus is common in atopic asthmatic patients (about 25% are sensitized), yet only 1-2% of asthmatic patients develop ABPA. This infection is characterized by wheezing and pulmonary infiltrates, which may lead to pulmonary fibrosis and/or bronchiectasis.

## 02/3/3 Obesity

According to the World Health Organisation (2016), there are around 2 billion adults overweight, of which 650 million are affected by obesity (BMI≥30 kg/m$^2$). Obesity increases the risk for asthma. Epidemiological data indicate that asthma is more common in obese than lean patients.[21]

**Obesity and Asthma: Physiological Perspective[22]**

Obesity causes physiological changes which are conducive to either development of asthma or cause of poorly controlled asthma state. Abdominal and thoracic fat generate stiffening of the lungs and diaphragmatic movements, which leads to reduction of resting lung volumes such as functional residual capacity. This causes decreased expiratory reserve volume, which results in expiratory flow limitation during normal breathing in obesity. Obesity has effects on lung function that can cause respiratory distress similar to asthma and may also stimulate the effects of pre-existing asthma even more.




## VIVA

### Smart body composition monitor

OMRON VIVA is a medical device with key parameters that indicates the visceral fat, fat and skeletal muscle, using Bio-electric Impedance Analysis (BIA) Technology to assess your body's composition.

**Overweight/Obesity and Risk of Seasonal Asthma Exacerbations[23]**

Obesity is associated with an increased risk for asthma exacerbations. Whether this risk is also related to the season is not known. This study is done to determine the relationship of increased body mass index (BMI) to the season of asthma exacerbation. Higher BMI values show an increase of risk for asthma exacerbations in adults and children with persistent asthma, particularly for adults during fall-winter. Possible mechanisms for above results include vitamin D status, viral infections, and corticosteroid responsiveness.

# Main takeaways

## Comorbidities of Asthma

- A common comorbidity of asthma is allergic rhinitis (80%> of asthmatics have AR).[17]
- Allergic rhinitis affects 10-30% of adults and up to 40% of children.[17]
- Allergic rhinitis has been associated with an increased risk of asthma severity and development.[17]
- Allergic bronchopulmonary aspergillosis affects asthmatic patients. About 25% of patients are sensitized to Aspergillus Fumigatus, yet only 1-2% develop ABPA.[20]
- Obesity causes physiological changes which are conducive to the development of asthma or cause of poorly controlled asthma state.[22]
- Obesity is associated with an increased risk of asthma exacerbations (particularly for adults during fall-winter).[23]

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03

# Chronic Obstructive Pulmonary Disease (COPD)


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## 03/1 Chronic bronchitis & Emphysema

COPD includes chronic bronchitis and emphysema and is a common, progressive disease. It is marked by persistent respiratory symptoms and airflow limitations due to airway and/or alveolar abnormalities. All of this is mainly caused by significant exposure to noxious particles or gases. It is the third leading cause of death worldwide, with 3.23 million deaths in 2019. Over 80% of these deaths occurred in low-and middle-income countries. There is no cure for COPD, but early diagnosis and early treatment are critical for slowing down the progression.[1]

**Summarizing the 2021 Updated GOLD Guidelines for COPD[2]**

Early detection and appropriate treatment and management of COPD can lower morbidity and perhaps even mortality. The Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines summarize and evaluate available evidence with the aim of assisting healthcare professionals in selecting the best strategy. This review provides an overview of the GOLD 2021 report – Diagnoses, Assessment and Classification.

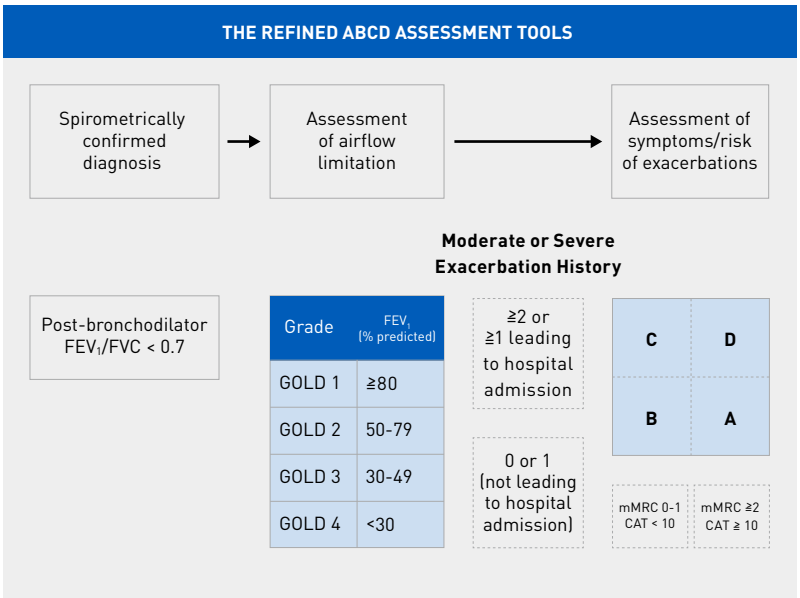



Figure 1: Assessment tool of COPD – GOLD group classification

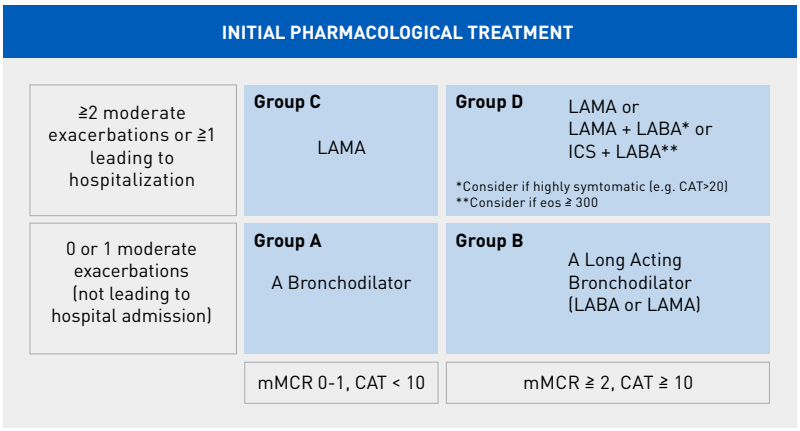



Figure 2: Initial Treatment of COPD

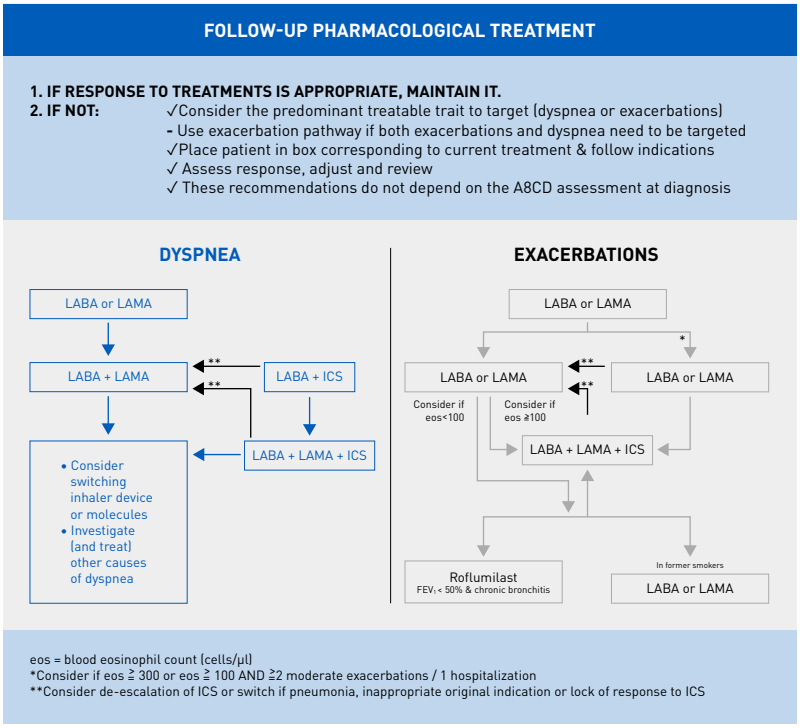



Figure 3: Follow-up recommendations

**Pulmonary Disease[3]**

Around 300 million people worldwide are affected by COPD, which results in approximately 64 million disability-adjusted life years. Occupational exposures account for 14% of the overall COPD burden. Populations living in rural areas have a higher risk for COPD than populations living in urban areas. Further analysis of the epidemiology of COPD can be read in this paper.

**Air pollution, lung function and COPD: results from the population – based UK Biobank study[4]**

Ambient air pollution increases the risk of respiratory mortality. The aim of this study was to evaluate whether ambient air pollution is associated with lung function and COPD. Effect modification was investigated for sex, age, obesity, smoking status, household income, asthma status and occupations previously linked to COPD. Higher exposures to each pollutant were significantly associated with lower lung function. Stronger lung function associations were seen for males, lower income households, "at risk" occupations. Higher COPD associations were seen for obese, lower income and non-asthmatic participants. Furthermore, ambient air pollution was associated with lower lung function and increased COPD prevalence.

**Exercise Capacity in Chronic Obstructive Pulmonary Disease: Mechanisms of Limitation[5]**

Patients with COPD are often caught in a downward spiral, going from expiratory flow limitation to poor quality of life and invalidity. Within this spiral, exercise tolerance represents an important intermediate outcome. As stated by the GOLD initiative, improvement in exercise tolerance is a key goal of COPD treatment. However, this objective can only be achieved by a comprehensive understanding of the mechanism of exercise limitation in COPD patients. This paper reviews the mechanisms and discusses their relative contribution to exercise intolerance.

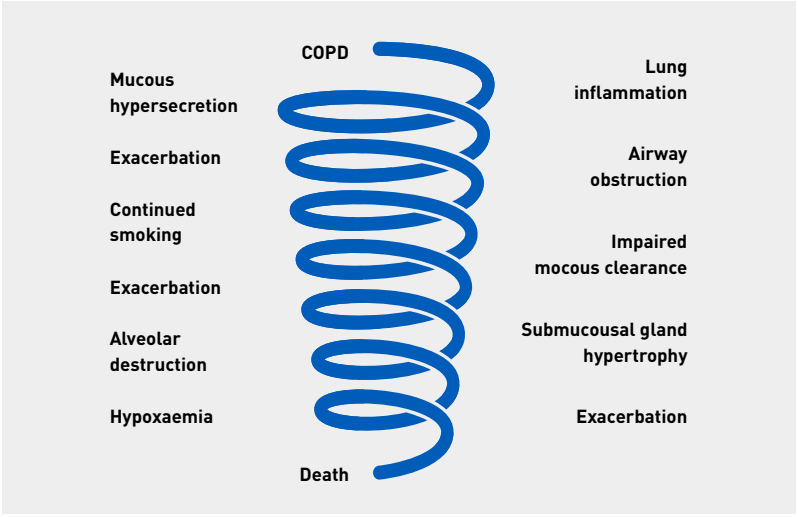



Figure 4: The downward spiral in COPD

## 03/2 Exacerbation

Many COPD patients live with the constant threat of an exacerbation. An exacerbation or lung attack is an acute worsening of symptoms which can lead to permanent loss of lung function and increased risk of mortality. Patients often experience it, but do not always report it. Consequently, they are left under-treated.

**Patient's perception of exacerbation of COPD – the PERCEIVE study[6]**

This study evaluated the perceptions of patients with COPD, their exacerbations, and expectations of treatment. From 83.592 households screened, 1100 subjects with symptoms compatible with COPD were identified. The most frequent symptom was shortness of breath (78%) and the most frequent complaint was that due to their COPD, they could not complete their activities (54%). Of the individuals, 17% were afraid that their COPD would cripple or kill them. Exacerbations generated a mean of 5.1 medical visits/year, with around 10.5 days as the duration of having exacerbation symptoms. 55% of patients said that quicker symptom relief was the most desired requirement for treatment.

**Negative impacts of unreported COPD exacerbations on health-related quality of life at 1 year[7]**

An exacerbation is the most important adverse event in the progression of COPD. It is a common cause of death, hospital admission, increased healthcare costs and decreased lung function. Consequently, it also has a negative impact on health-related quality of life (HRQoL). At least half of all COPD exacerbations, identified as symptom worsening, were not medically reported. More than one unreported exacerbation was already associated with a significantly (statistically and clinically) worse HRQoL. This suggests that unreported exacerbations, even though being associated with less symptom worsening than reported exacerbations, may have an important long-term impact of patients' physical activities.

**Elevated blood eosinophils in acute COPD exacerbations: better short-and long-term prognosis[8]**

Elevated blood eosinophils in COPD is recognized as a potential risk factor for exacerbations. However, the prognostic role of these elevated blood eosinophils during exacerbations of COPD is unclear. Within this study, short-term and long-term outcomes have been investigated in patients with exacerbations of eosinophilic phenotype compared with patients with low blood eosinophils. COPD exacerbations in patients with high blood eosinophil have a better short-term prognosis without higher risk of subsequent exacerbation. These eosinophilic exacerbations also show a lower three-year mortality.




## P300 Intelli IT

Connected Pulse Oximeter for professional and home use

OMRON P300 Intelli IT is a smart fingertip pulse oximeter for use at home or by professional healthcare practitioners. It accurately monitors blood oxygen saturation (SpO2) levels as well as taking a pulse rate.

**The role of nebulised budesonide in the treatment of exacerbations of COPD[9]**

This study was done to evaluate the hypothesis that nebulised budesonide (NB) might be an alternative method to systemic corticosteroids (SC) in the treatment of COPD patients with exacerbations (ECOB). Patients hospitalized due to ECOB (n=159) were randomised into three groups: group 1 received standard bronchodilator treatment (SBDT), group 2 received SC (40 mg prednisolone) plus SBDT, and group 3 received NB (1,500 µg q.i.d.). During the upcoming 10-day hospitalization, improvements were compared with exacerbation and rehospitalisation rates after discharge. The study demonstrates that nebulised budesonide may be an effective and safe alternative to systemic corticosteroids in the treatment of exacerbations of chronic obstructive pulmonary disease.

**The role of nebulized therapy in the management of COPD: evidence and recommendation[10]**

In routine clinical practice, critical errors in using handheld inhalers are highly common and therefore frequently results in inadequate symptom relief. Current evidence concerning using nebulizer use for maintenance therapy in patients with moderate-to-severe COPD (including use during exacerbations), suggests that the efficacy of long-term nebulizer therapy is similar, and in some ways superior to that with pMDI/DPIs. Therefore, maintenance therapy with nebulizers may be well recommended for elderly patients, those with severe disease and frequent exacerbations, and those with physical and/or cognitive limitations.

# Main takeaways

## Chronic Obstructive Pulmonary Disease (COPD)

- Global Initiative for Chronic Obstructive Lung Disease (GOLD) documents the global strategy for the Diagnosis, Management and Prevention of COPD. These guidelines are aimed at assisting healthcare professional in selecting the best strategy.[2]
- 300 million people worldwide are affected by COPD.[3]
- Ambient air pollution increases the risk of respiratory mortality, is associated with lower lung function and increased COPD prevalence.[4]
- COPD patients are often caught in a downward spiral, mainly due to exercise limitations.[5]
- Exacerbations due to COPD generate a mean of 5.1 medical visits/year.[6]
- Exacerbation is a common cause of death, hospital admission, increased healthcare costs and decreased lung function.[7]
- At least half of all COPD exacerbations (identified as symptom worsening), were not medically reported.[7]
- Elevated blood eosinophils in COPD are recognized as a potential risk factor for exacerbations.[8]
- Maintenance therapy with nebulizers may be well recommended for elderly, those with severe diseases and frequent exacerbations, and those with physical and/or cognitive limitations.[10]

# 03/3 Comorbidities of Chronic Obstructive Pulmonary Disease

Common risk factors for COPD are age and smoking, which often lead to COPD patients to demonstrate multiple coexisting comorbidities. Comorbidities in these patients are often responsible for impairing quality of life, increasing mortality in end-stage patients and increasing health costs. COPD comorbidities include diseases that independently coexist with COPD with no other causation, diseases that share common risk factors and pathogenetic pathways with COPD, diseases that are complicated by the interaction with the lung, and systemic manifestations of COPD. Therefore, no universal definition of COPD comorbidities has yet been accepted.[11]

## 03/3/1 Obesity

COPD and obesity are both medical conditions that lead to slowly declining health. Due to the breathing difficulties that come with COPD, body's oxygen supply can reduce which causes fatigue. Fatigue causes exercise intolerance and can therefore lead to a sedentary lifestyle, which further facilitates obesity.

**Overweight in patients with chronic obstructive pulmonary disease needs more attention: a cross-sectional study in general practice.[12]**

Although weight loss is common in patients with COPD, previous studies have shown that about 65% of the COPD population is overweight or obese. Overweight and obesity are highly prevalent in patients with milder stages of COPD. This cross-sectional study examines the association of overweight and obesity with the prevalence of comorbid disorders, in patients with mild to moderate COPD. They found, for example, that in all weight categories hypertension, osteoarthritis and diabetes are the highest prevalent comorbid disorders. Further examination of the results can be found in this article.

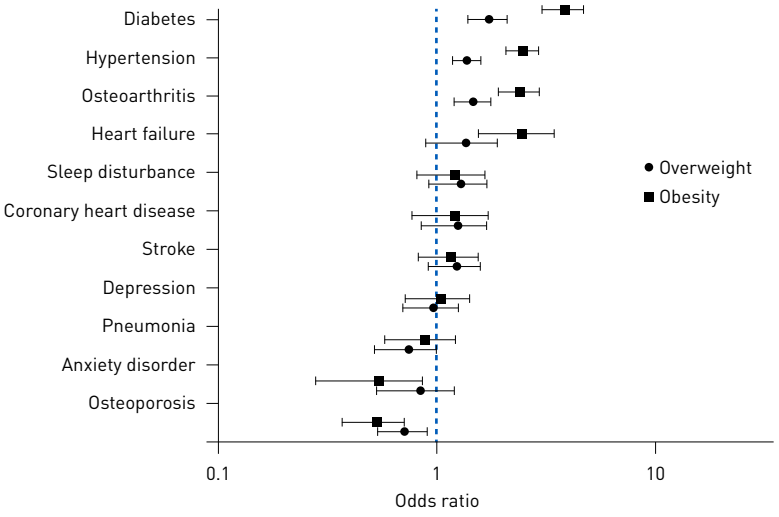



Figure 5: Adjusted odds ratios for the association of weight and comorbid disorders in patients with mild to moderate chronic obstructive pulmonary disease. The black dots represent the odds ratios (ORs) for the prevalence rate of comorbid disorders in overweight and obese patients, using the normal weight patients as reference category. The ORs are adjusted for clustering effect of general practice, gender, age, smoking status, and lung function. The error bars present the 95% confidence intervals around the ORs.

**The impact of Obesity on Nighttime Blood Pressure Dipping[13]**

Obesity not only increases arterial hypertension risk, but also has an impact on the response to antihypertensives. This study aimed to assess blood pressure parameters based on Ambulatory Blood Pressure Measurement in obese patients. They found that patients with extreme morbid obesity frequently exhibit hypertension of the reverse-dipping pattern. Reverse-dippers are characterized by the worst cardiovascular prognosis and outcomes, such as stroke and cardiovascular events. This study therefore highlights the importance of monitoring and managing nocturnal hypertension in obese patients, and thus also obese COPD-patients.




**Night View**
Measuring Blood pressure Night and Day

A comprehensive view of home nighttime and daytime blood pressure for improved treatment decisions

## 03/3/2 Heart Failure

Heart failure (HF) is a clinical syndrome which is caused by functional and structural defects in myocardium. These defects then result in impairment of ventricular filling or the ejection of blood. Most common cause of HF is reduced left ventricular myocardial function. However, dysfunction of the pericardium, myocardium, endocardium, heart valves or great vessels alone or combined is also associated with HF.[14]

**The association between COPD and heart failure risk: a review[15]**

COPD and heart failure frequently coexist in clinical practice. They share the same risk factors, which includes smoking, advanced age, and systemic inflammation. Among patients with HF, the prevalence of COPD ranges from 20 to 32%, and 10% of HF patients being hospitalized also suffer from COPD. On the other side, among COPD patients HF is prevalent in more than 20% of the patients. The risk ratio of developing HF among COPD patients is 4.5 times higher than those without the disease (after adjusting for age and other cardiovascular risk factors). Important to consider when looking at these numbers is that most studies use inappropriate definitions for COPD and HF. Nonetheless, identifying both diseases at an early stage is crucial. This article further reviews the physiopathology, clinical aspects, diagnosis, and treatment of patients with both conditions.

## 03/3/3 Pulmonary Hypertension

Pulmonary hypertension is a condition where blood pressure within the arteries of the lungs is increased. Symptoms that occur can vary from shortness of breath, chest pain, and light-headedness.

**Detection of right sided heart changes and pulmonary hypertension in COPD patients[16]**

Pulmonary hypertension is considered one of the common complications of COPD. Both are pathologically interdependent. COPD-associated pulmonary hypertension is a poor prognostic marker; it is associated with an increased risk of exacerbations, worsened exercise capacity, oxygenation, and mortality. The overall prevalence of pulmonary hypertension in COPD ranges from 20 to 63%. This present study was conducted on COPD patients to assess the function of the right side of the heart along with diagnosing pulmonary hypertension, studying hemodynamic abnormalities and functional limitations. Concluding that pulmonary hypertension in COPD patients is a co-morbidity with right sided changes. These patients had worse prognosis than COPD patients without pulmonary hypertension.

## 03/3/4 Osteoporosis

Osteoporosis is a condition that weakens bones, making them fragile and brittle, causing them to easily break. It is characterized by low bone mass and microarchitectural deterioration of bone tissue.

**Osteoporosis in COPD: Are Bones Brittle in COPD?[17]**

Osteoporosis becomes more prevalent in COPD patients as the disease progresses. The presence of various risk factors causes this, such as low body mass index, immobility due to decrease muscle mass, respiratory dysfunction, smoking and hypogonadism steroid either systemic or inhalational. A significant correlation between BMI and prevalence of osteoporosis was seen, lower body mass index had higher prevalence. Furthermore, an increase in severity of COPD also showed a statistically significant increase in percentage of osteoporosis at whole body level and at right femur.

## 03/3/5 Diabetes-type-2

Diabetes is a chronic condition that occurs when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces. The presence of comorbidity in older diabetes patients is common. Around half of the patients will have three or more comorbid chronic conditions.

**Chronic obstructive pulmonary disease and diabetes mellitus: a systematic review of the literature.[18]**

The relationship between type-2 diabetes mellitus (T2DM) and chronic obstructive pulmonary disease (COPD) remains complex. Recent studies have shown that T2DM can worsen the progression and prognosis of COPD, possibly due to the direct effects of hyperglycaemia on lung physiology, inflammation, or susceptibility to bacterial infection. Conversely, some evidence also show that COPD increases the risk of developing T2DM because of inflammatory processes and/or the therapeutic side effects which are related to the use of high-dose corticosteroids.

## 03/3/6 Anxiety and Depression

According to large population-based surveys, up to 33.7% of the population are affected by an anxiety disorder during their life. Depression currently affects more than 264 million people. About 85% of patients with depression have significant anxiety, and 90% of patients with anxiety disorder have depression. Depression and anxiety cause a high degree of emotional distress and functional impairment.[19 20]

**Overview of the prevalence, impact, and management of depression and anxiety in chronic obstructively pulmonary disease[21]**

More than one third of individuals with COPD experience comorbid symptoms of depression and anxiety. Most common symptoms of depression include depressed mood and loss of interest and pleasure in daily activities. Anxiety is associated with physical and psychological discomfort, with symptoms such as fear, anxiety, and avoidance. Meta-analysis found that one in four COPD patients experience clinically significant depressive symptoms (compared with less than one in eight of the controls). Clinical anxiety in COPD patients has an estimated prevalence of up to 40%.

**The Impact of Depression and Anxiety on Chronic Obstructive Pulmonary Disease Acute Exacerbations: A prospective cohort study.[22]**

This study explores the impact of anxiety and depression in COPD patients on the risk of acute exacerbation. An acute exacerbation is usually triggered by respiratory infection, air pollution and so on. An exacerbation results in a reduced health-related quality of life, pulmonary function and sustained worse health status. Within this study they discovered that there was a higher risk of acute exacerbation in COPD patients with anxiety (54.1%) compared to patients with no anxiety (39.8%). This is the same for patients with depression (52.1%) and patients without (40.4%). The COPD patients with anxiety and/or depression suffered higher risk of one acute exacerbation averagely during the one year.

# Main takeaways

## Comorbidities of Chronic Obstructive Pulmonary Disease

- About 65% of the COPD population is overweight or obese.[12]
- Patients with extreme morbid obesity frequently exhibit hypertension of the reverse-dipping pattern.[13]
- COPD and heart failure frequently coexist, among COPD patients HF is prevalent in more than 20%.[15]
- Pulmonary hypertension is considered one of the common complications of COPD.[16]
- COPD-associated pulmonary hypertension is associated with increased risk of exacerbations, worsened exercise capacity, oxygenation, and mortality.[16]
- An increase in severity of COPD also showed a statistically significant increase in percentage of osteoporosis at whole body level and at right femur.[17]
- Studies have shown that COPD increases the risk of developing T2DM.[18]
- More than one third of individuals with COPD experience comorbid symptoms of depression and anxiety.[21]
- Patients with COPD and anxiety and/or depression suffered higher risk of one acute exacerbation averagely in one year.[22]

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# Common cold

The common cold, an upper respiratory trait infection, is one of the most common infectious diseases of humankind. At least 200 identified viruses can cause the common cold. Some of these viruses include rhinoviruses, coronaviruses, parainfluenza viruses, and such. Common symptoms to all these infections are nasal congestion, throat clearing, sneezing and cough.

**The Common Cold**[1]

Despite the available sophisticated diagnostic methods, about 20-30% of colds remain without a proven viral cause. The occurrence of the common cold shows clear seasonality. In northern hemisphere regions, the frequency of respiratory infections increases rapidly in the autumn and decreases again in spring. In tropical areas, most colds start during rainy season. When looking at age, the incidence of upper respiratory infections is inversely proportional to age. The youngest children have on average 6-8 colds per year, while adults have 2-4. Also, during the first years of life boys seem to have more respiratory infections than girls, while this difference is reversed later in life. Further analysis of the epidemiology of the common cold, its pathogenesis and clinical manifestations can be read in this article.

| Virus | Estimated annual proportion of cases |
|---|---|
| Rhinoviruses | 30-50% |
| Coronaviruses | 10-15% |
| Influenza viruses | 5-15% |
| Respiratory syncytial virus | 5% |
| Parainfluenza viruses | 5% |
| Adenoviruses | <5% |
| Enteroviruses | <5% |
| Metapneumovirus | Unknown |
| Unknown | 20-30% |

Figure 1: Viral causes of the common cold

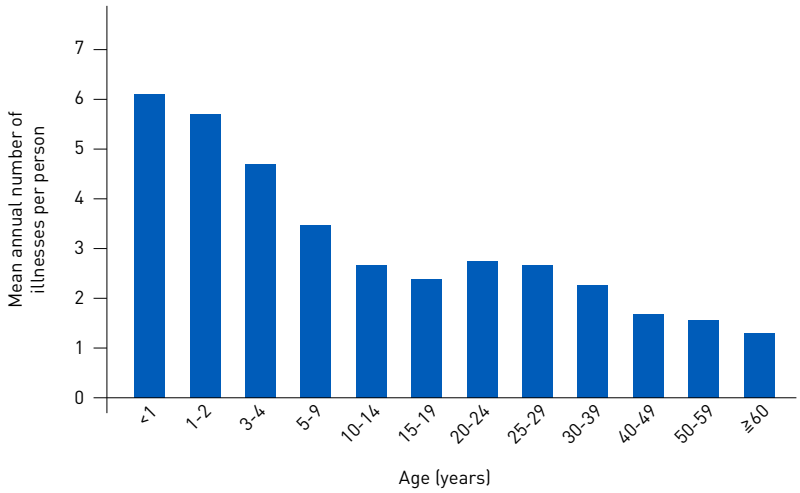



Figure 2: Mean annual incidence of respiratory illnesses per person per age group



## A3 Complete

### Unique 3-in-1 adjustable nebulizer

The OMRON A3 Complete provides the complete nebulization solution for most respiratory conditions, from regular infections like common cold and rhinitis to chronic diseases like asthma or COPD.



## DuoBaby

### 2-in-1 Nebulizer with nasal aspirator

The OMRON DuoBaby is a unique 2-in-1 compressor nebulizer with an integrated, patented, nasal aspirator that can help treat the most common respiratory conditions of babies.

**Prevalence of Human rhinovirus infection in young children with acute wheezing[2]**

Recurrent wheezing is common and one of the leading causes of chronic illness in childhood. Viral infection affects wheezing and asthma in children and adults of all ages. Usually, wheezing illnesses are viral in origin, and children with more severe wheezing episodes are more likely to develop asthma later in their life. Human rhinoviruses (HRV) are the main pathogens responsible for the common cold, but also have a major impact on asthma pathogenesis. The aim of this study was to determine the prevalence of HRV as a cause of acute wheezing in Egyptian children after an acute respiratory illness. The study showed that HRV was the second common viral infection in children with wheezes. The prevalence was more common in winter with higher incidence of recurrence.

**Cold temperature and low humidity are associated with increased occurrence of respiratory tract infections[3]**

Seasonal variation in the outbreaks of viral infection is common. Peaks are mostly observed during the winter months. Clinical evidence supporting an association between cold weather and respiratory tract infection (RTI's) is mainly based on increases of general practitioner consultations during lower temperatures. RTI's also increase wintertime morbidity and even account for at least 20% of excess winter mortality. While examining the association of daily monitored environmental temperatures and humidity with the onset of respiratory infections in a northern population with a high infection rate, the following was observed: daily average temperature was significantly associated with common cold, occurring more often in cold temperatures. Furthermore, lower humidity was associated with an increased amount of URTIs.

**Nasal obstruction in neonates and infants[4]**

The nasal airway contributes to respiration and olfaction. The nose and sinuses condition air before it reaches the lower respiratory tract by providing almost 100% humidification. It also filters and traps foreign particles. The airway epithelium contributes to the host defence system. Any changes to this system can cause significant problems. This happens particularly in neonates who are obligate nasal breathers until they are at least two months old. The following consequences of nasal obstruction in infants can occur; respiratory distress or discomfort, altered sleep cycle, increased risk of obstructive apnoea, and feeding difficulties.

**Nasal congestion in infants and children: a literature review on efficacy and safety of non-pharmacological treatments[5]**

In infants and children, the most common cause of nasal obstruction and runny nose are infections, mainly of viral origins or allergies. Viral upper respiratory tract infections (URTI) are frequently seen in neonates and infants during nasal obstruction. Saline irrigation is believed to eliminate excess mucus and reduce congestion. However, the efficacy and safety of non-pharmacological options for the treatment of such nasal congestion in infants, such as hypertonic and isotonic solutions and other medical devices such as nasal aspirators, is less studied and documented. Nasal aspiration with a medical device, associated with an isotonic saline solution, during viral rhinitis, has been shown to lower risk of developing acute otitis media and rhinosinusitis, in comparison with a group treated with physiological saline solution alone.

**The impact of nasal aspiration with an automatic device on upper and lower respiratory symptoms in wheezing children: a pilot case-control study[6]**

The impact of proper aspiration of nasal secretions during upper respiratory infection in the frequency and severity of symptoms of lower airways has never been investigated. Infections of the upper and lower airways, as well as wheezing, are the first causes of children below 2 years to consult a doctor. This pilot study concludes that the use of automatic nasal aspirator in children with a history of recurrent wheeze was associated with an improved respiratory health during the cold season.

# Main takeaways

## Common Cold

- The common cold is one of the most common infectious diseases.[1]
- On average young children have 6-8 colds per year, while adults have 2-4.[1]
- Respiratory Tract Infections (RTI's) increase wintertime morbidity and account for at least 20% of excess winter mortality.[3]
- Nasal obstruction in infants can cause respiratory distress, altered sleep cycle, increased risk of obstructive apnoea, and feeding difficulties.[4]
- Viral upper respiratory tract infections are frequently seen in neonates and infants during nasal obstruction.[5]
- Nasal aspiration with a medical device, associated with an isotonic saline solution during viral rhinitis, has been shown to lower risk of developing acute otitis media and rhinosinusitis, in comparison with a group treated with physiological saline solution alone.[5]
- The use of an automatic nasal aspirator in children with a history of recurrent wheeze was associated with an improved respiratory health during the cold season.[6]

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# Wheezing

Wheezing is a condition that is very common in paediatric practice. Wheeze is often associated with asthma, but it may also be indicative of something else. It is a continuous musical sound, high-pitched, during breath exhalation due to abnormal narrowed or compressed airway(s). Almost 50% of children experiences wheeze in their first 6 years of life, and 40% of them will eventually report continued wheezing symptoms after childhood.[1]

| Perceptions of wheeze among parents and doctors[5] | % |
|---|---|
| Parents and doctor are in agreement | 45 (37-53) |
| Parents use words other than wheeze / doctor finds wheeze | 39 (31-47) |
| • Cough | 19 |
| • Difficulty in breathing | 11 |
| • Chesty | 1 |
| • Noisy breathing | 1 |
| • Cough, difficulty in breathing and / or noisy breathing | 5 |
| • Other | 1 |
| Parents complain of wheeze or asthma / doctor disagrees | 14 (8-20) |
| • Clinician finds upper airway noise | 8 |
| • Clinician finds problems not related to chest | 2 |
| • Clinicians finds nothing wrong | 4 |
| Doctor's response was unclear | 4 |

Figure 1: Comparisons of parents' and clinicians' reports of wheeze and asthma

**A young child with a history of wheeze[2]**

Wheezing in children under 3 years of age is common. By 30 months, 26% of children in a UK birth cohort (ALSPAC, Avon longitudinal study of parents and children) developed wheezing in the previous 12 months. Data from the latest British Thoracic Society national pediatric audit of wheezing/asthma showed that 24% of all the children admitted to hospital were between 12 and 24 months, boys outnumbering girls in a ratio of nearly 2 to 1. Early onset of wheezing is associated with lower lung function at adolescence and the presentence of atopy is associated with persisting asthma. For some children, early wheezing will translate into long-term asthma, particularly for those with early rhinovirus infections, with sensitisation to aeroallergens and with reduced lung function.

**Infant wheeze, comorbidities and school age asthma[3]**

Many young children wheeze during viral respiratory infections, but there is limited knowledge in which of these infant wheezers will develop asthma in school age. This study aims to identify clinical risk factors for asthma in children aged eight, that wheezed during infancy in a population-based setting.

**Wheeze detection: recordings vs. assessment of physician and parents[4]**

It has been shown that the agreement between parental and professional as to the presence of wheezing in infants and preschool children is poor. This study compared the assessment of a parent, nurse, and physician with the "gold standard" of acoustic analysis for the presence of wheezing in infants and preschool children attending a hospital clinic. In only 10 of 31 (32%) children did the parent and the physician agree on the wheeze severity score. In 13 infants, the parent scored higher than the physician and in 8 the parent scored lower. In 24 of the 31 children (77%) the acoustic wheeze score agreed with the physician wheeze score.

**What do parents of wheezy children understand by "wheeze"?[5]**

Reported wheeze is one of the cornerstones of asthma diagnosis. Epidemiology studies done in the UK report increasing prevalence of childhood wheezing illness and underdiagnosis and undertreatment of asthma. Therefore, wheeze is considered important for diagnosing asthma and measure asthma prevalence. However, finding the real prevalence of wheezing is problematic; perceptions of wheeze oftentimes differ among patients, parents, and healthcare professionals. 55% of parents identified wheeze differently than clinicians.



## WheezeScan

Helps you detect wheeze in children with asthma symptoms

Omron WheezeScan provides an objective assessment of the presence of wheezing. A convenient tool to help parents to manage their children's asthmatic symptoms at home.

**The impact of a digital wheeze detector on parental disease management of pre-school children suffering from wheezing – a pilot study[6]**

Proper treatment of viral airway infections and wheezing in children at pre-school age requires acceptable recognition of airway obstruction. As mentioned in other articles, caretakers are often struggling with this judgement, which consequently leads to insufficient or late treatment and unnecessary discomfort of the patient. Digital technologies may support parental decision taking. Within this pilot study parents were asked to use a digital wheeze detector (WheezeScan, Omron Healthcare), 2x/day for 30 days and record the child's respiratory symptoms, detection of wheezing, and medication intake via an electronic diary (eDiary) app. Results show that parents detected wheezing without digital support in only 22/708 (3.1%) of the recorded events. By contrast, the wheeze detector indicated an airway obstruction in 140/708 (19.8%) of the recordings. The positive outcomes highlight that the WheezeScan may empower parents by increasing their capability of wheeze detection.

**Acute asthma, prognosis, and treatment[7]**

Patients with acute asthma will exhibit increasing shortness of breath, chest tightness, coughing, and/or wheezing. Audible wheezing is usually a sign of moderate asthma, whereas no wheezing can be a sign of severe airflow obstruction. This article is a structured review of the available literature regarding the diagnosis and management of acute asthma.

This study fits well with comments made by Dr. R. Russell in his opinion paper about how an early and accurate identification of Wheeze can improve quality of life. Contributing to the importance of detecting wheeze in disease monitoring he states: "To wait until someone complains of breathlessness takes time. If you could detect that wheeze one or two days earlier, you can intervene and stop it developing into an asthma attack".[8]

**Patient reported outcomes for preschool children with recurrent wheeze[9]**

UK emergency departments are regularly attended by children with preschool wheeze. Toddlers with wheezing disorders count for 1/3rd of the presentations of respiratory disorders in this age group, and is associated with increased healthcare costs, loss of time of work in parents and impaired quality of life. A study looking at exacerbation rates between 2007-2015 in general asthma population showed that the group of children under 5 years old had the most frequent exacerbations. Since there is no international consensus regarding a specific personalised management approach, this paper attempt to co-design patient-centred outcomes with families. Concluding that by systematically using Patient-Reported Outcome Measures, the communication and decision making by doctors and patients will become better, furthermore improving patient satisfaction and outcomes of care.

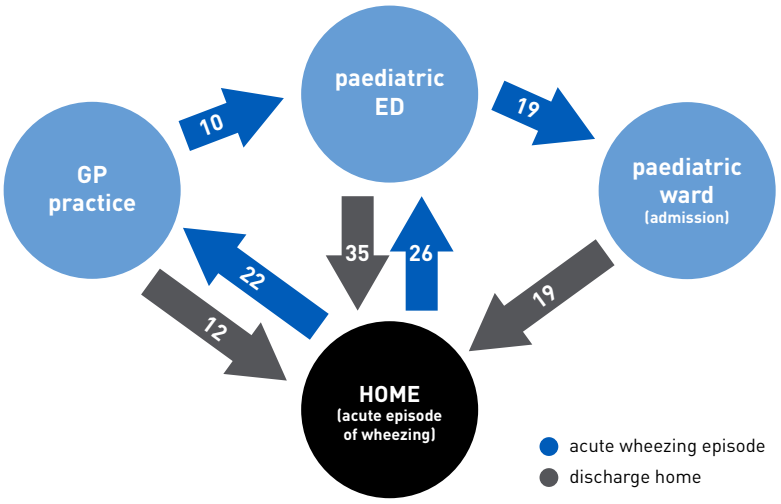



Figure 2: Process map describing patients' journey during the first episode of wheeze they recall needing to seek for medical support – the blue color indicated admission with acute wheeze and the grey color indicates discharge – the number of parents who have described each journey are added next to each arrow.

**Parental understanding of wheeze and its impact on asthma prevalence estimates[10]**

In a questionnaire survey of a random population sample of 4,236 children aged 6-10 years, parent's definition of wheeze was assessed. Current wheeze was reported by 13.2% of children, and 83.5% of parents correctly identified "whistling or squeaking" as the definition of wheeze. Frequent attacks of reported wheeze (adjusted odds ratio (OR) 3.0), maternal history of asthma (OR 1.5) and maternal education (OR 1.5) were significantly associated with a correct answer, while the opposite was found for first language not English (OR 0.6) and living in a deprived neighbourhood (OR 0.6). This study shows how misunderstanding could lead to underestimation within deprived family backgrounds.

**Proximity to Major Roads and Risks of Childhood Recurrent Wheeze and Asthma in a Severe Bronchiolitis Cohort[11]**

A suggested risk factor for childhood respiratory diseases is air pollution exposure. This study investigated proximity to major roads, as an indicator for air pollution exposure, and its associations with childhood recurrent wheeze and asthma. Outcomes were parents-reported recurrent wheeze by age 3 and asthma by age 5. This study confirms that participants who resided close to a major road had the highest risk of recurrent wheeze and asthma, compared to those residing >300 m from a major road.

**Associations of wheezing phenotypes with late asthma outcomes in the Avon Longitudinal Study of Parents and Children: A population-based birth cohort[12]**

The aim of this study was the define extended wheezing phenotypes, this by using repeat measurements of wheeze made regularly during the first 16 ½ years of life. Another part of this study was to investigate associations of these phenotypes with physician-diagnosed asthma, lung function and FENO measures at age 14 to 15 years. After this study six wheezing phenotypes were identified: never/infrequent, preschool-onset remitting, midchildhood-onset remitting, school age-onset persisting, late childhood-onset persisting, and continuous wheeze.

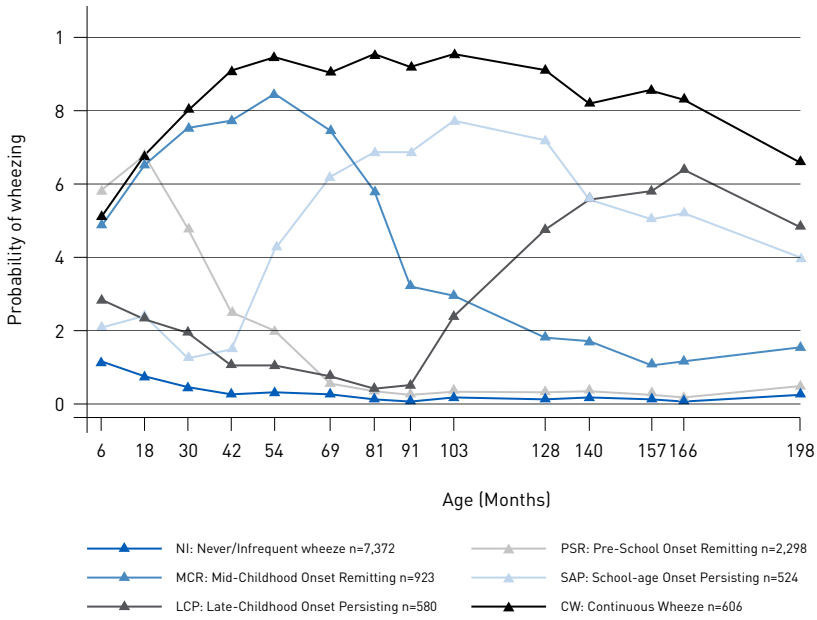



Figure 3: Estimated prevalence of wheezing at each time point from birth to 16½ years for each of the 6 wheezing phenotypes identified by using latent class analysis in 12,303 participants with at least 2 observations of wheeze.

**Prevalence estimates and risk factors for early childhood wheeze across Europe: the EuroPrevall birth cohort[13]**

Genetic factors play an important role in the cause of preschool wheeze and asthma. However, the International Study of Asthma and Allergies in Childhood, as well as the European Community Health Respiratory Survey, recognizes how environmental factors are predominantly responsible for geographic variations in the prevalence of asthma. This study determined the prevalence of wheeze in the first 2 years of life across Europe, demonstrating that it varies considerably across the north-western to south-eastern gradient. Lower respiratory trait infections, day care attendance, postnatal smoke exposure and male gender are important risk factors.

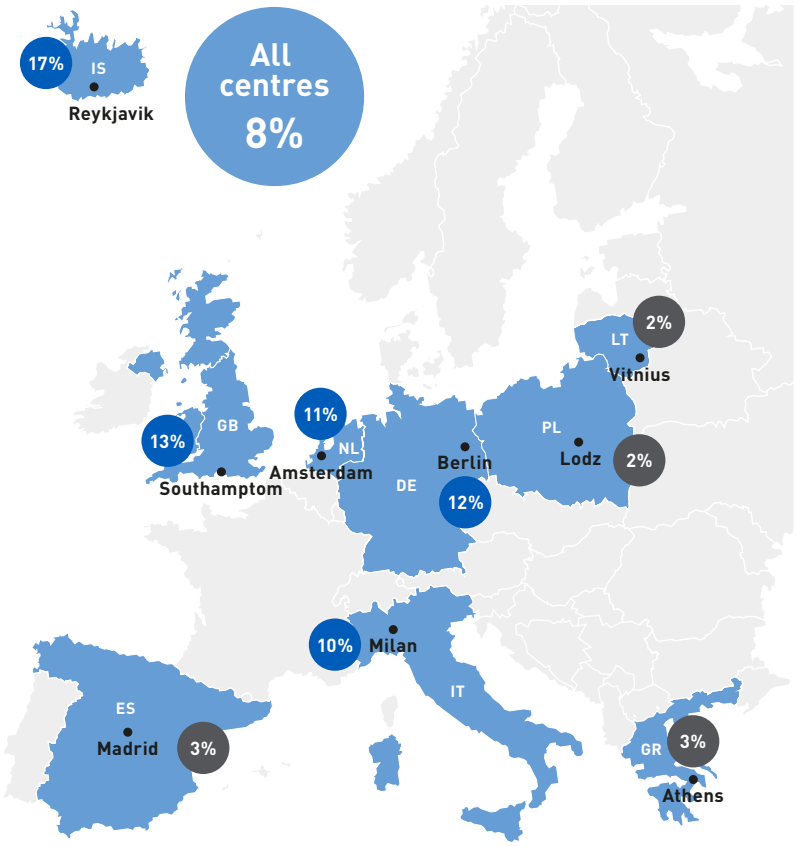



Figure 4: Map showing study centres and the prevalence of wheeze in the second year of life in each centre (adapted from Keil et al.)[13]

# Main takeaways

## Wheezing

- Wheezing is a continuous musical sound, high-pitched, during breath exhalation due to abnormal narrowed or compressed airways.[1]
- Almost 50% of children experiences wheeze in their first 6 years of life.[1]
- Early onset of wheezing is associated with lower lung function at adolescence and the presence of atopy is associated with persisting asthma.[2]
- Perceptions of wheeze can differ among people, resulting in 55% of the parents identifying wheeze differently than clinicians.[5]
- Results of a study show that parents detected wheezing without digital support in only 22/708 (3.1%) of the recorded events. By contrast, the wheeze detector (WheezeScan) indicated an airway obstruction in 140/708 (19.8%) of the recordings.[6]
- The importance of detecting wheeze in disease monitoring: an early and accurate identification of wheeze can improve quality of life.[8]
- Six wheezing phenotypes are identified: never/infrequent, preschool-onset remitting, midchildhood-onset remitting, school age-onset persisting, late childhood-onset persisting, and continuous wheeze.[12]

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# Inhalation Devices

Inhalation drug delivery devices cover many different types: pressurized metered dose inhalers (pMDIs), breath-activated inhalers (such as dry powder inhalers (DPIs)), emerging novel delivery systems and nebulizers.

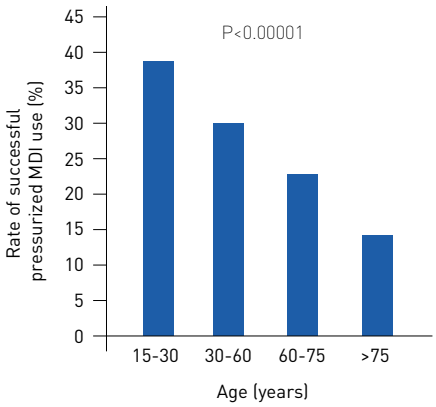



Figure 1: Decrease in frequency of successful use of pressurized MDI with patient age

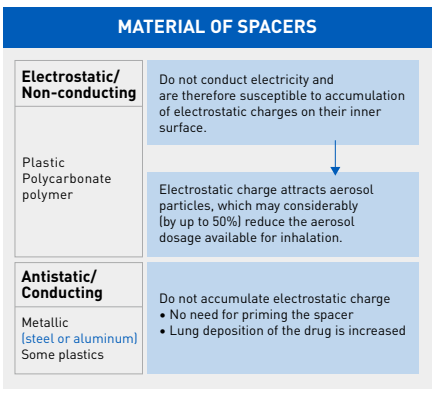



Figure 2: Materials of spacers (Plastic Polycarbonate Polymer and Metalic (Steel or aluminuim) Some Plastics

**Inhalation drug delivery devices: technology update[1]**

The pulmonary route of delivering drugs and biopharmaceuticals has proved to be effective locally and systemically. A successful pulmonary administration requires a harmonic interaction between the drug formulation, the inhaler device, and the patient. One of the biggest problems concerning the lack of desired effect comes due to an incorrect use of the device. This review summarizes the advantages and limitations of the most used inhaler devices.

**Choosing the right inhaler for your asthma or COPD patient[2]**

Not one device suits all patients. Challenges can range from difficulties related to lung disease severity and pulmonary function, to physical considerations, including manual dexterity and comorbidities such as arthritis. Furthermore, patient engagement and satisfaction are also crucial factors to consider. A tailored and personalized approach is highly recommended to achieve improved disease outcomes. This paper discusses the aspects for consideration with nebulizers, pressurized metered-dose inhalers, dry powder inhalers and the soft mist inhaler.

**Considerations for managing chronic obstructive pulmonary disease in the elderly[3]**

Nebulizers should be considered for patients unable to use handheld inhalers properly. Once set up, they are easier for patients to use than handheld devices as they only require normal tidal respiration for effective drug delivery. Most patients in the emergency department, needing inhaler medication, are treated with a nebulizer. They are also effective for maintenance dosing in populations who cannot use other devices, such as patients with cognitive, neuromuscular, or ventilatory impairments. 56% of the patients using nebulizers do so because of physical and cognitive disabilities.

**Systematic Review of Errors in Inhaler Use – Has patient technique improved over time?[4]**

Incorrect inhaler technique occurs frequent and has not improved over the past 40 years. Data from 144 articles show that the most frequent MDI errors were in coordination (45%; 95% CI, 41%-49%), speed and/or depth of inspiration (44%; 40%-47%), and no post inhalation breath-hold (46%; 42%-49%). Frequent DPI errors were incorrect preparation in 29% (26%-33%), no full expiration before inhalation in 46% (42%-50%), and no post inhalation breath-hold in 37% (33%-40%). The overall prevalence of correct technique was 31% (28%-35%); of acceptable, 41% (36%-47%); and of poor, 31% (27%-36%).

**Spacer devices for inhaled therapy: why use them, and how?[5]**

This extensive review of the literature is about the rationale for using a spaced/valved holding chamber (VHC) to deliver inhaled therapy from a pressurized metered-dose inhaler. Discussing on how the properties of individual devices may vary according to their physical characteristics and materials – and the potential risks and benefits. One of the important factors mentioned in this article are the two material types of manufacture (Plastic Polycarbonate Polymer and Metallic (steel or aluminium) Some Plastics) and the consequences of it on the delivery of the aerosol dosage. Patients should know how to properly use it, how to keep it clean and how to keep an eye out for faults.

# Main takeaways

## Inhalation Devices

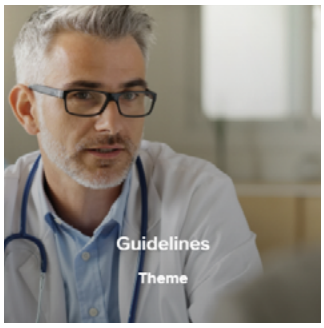
- A successful pulmonary administration requires a harmonic interaction between the drug formulation, the inhaler device, and the patient.[1]
- A tailored and personalized approach is highly recommended to achieve improved disease outcomes.[2]
- Nebulizers should be considered for patients unable to use handheld inhalers properly.[3]
- Incorrect inhaler technique occurs frequent and has not improved. The overall prevalence of correct technique was 31% (28%-35%); of acceptable, 41% (36%-47%); and of poor, 31% (27%-36%).[4]
- The two material types of pMDIs (Plastic Polycarbonate Polymer and Metallic (steel or aluminium) Some plastics) have consequences on the delivery of the aerosol dosage.[5]

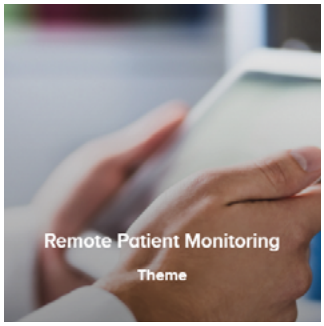
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# OMRON Academy

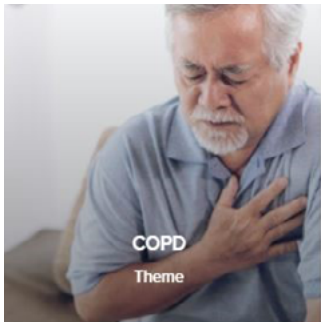
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# Product index


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## 08/1 Products








| Model | NE-U780 | NE-C900 | MicroAIR U100 | C28P | DuoBaby | A3 Complete |
|---|---|---|---|---|---|---|
| **Product Code** | NE-U780-E | NE-C900-E | NE-U100-E | NE-C105E | NE-C301-E | NE-C300-E |
| **Type** | Utrasonic Nebulizer | Compressor Nebulizer | Mesh Nebulizer | Compressor Nebulizer | Compressor Nebulizer with nasal aspirator | Compressor Nebulizer |
| **Where to use** | Professional setting | Professional setting | Portable | Home use | Home use | Home use |
| **Particle size (MMAD)** | 4.6 µm | 3 µm | 4.5 µm | 2.65 µm | Inhalation top Upper airways: 9µm Inhalation top Lower airways: 4 µm | Position 1: 10 µm<br>Position 2: 5 µm<br>Position 3: 3 µm |
| **Aerosol output** | 3.04 ml | 0.57 ml | 0.5 ml | 0.7 ml | Inhalation top Upper airways: 0.54 ml/min Inhalation top Lower airways: 0.50 ml/min | Position 1: 0.45 ml<br>Position 2: 0.53 ml<br>Position 3: 0.36 ml |
| **Aerosol output rate** | 0.14 ml/min | 0.08/min | 0.1 ml/min | 0.12 ml/min | Inhalation top Upper airways: 0.16 ml/min Inhalation top Lower airways: 0.12 ml/min | Position 1: 0.15 ml/min<br>Position 2: 0.12 ml/min<br>Position 3: 0.1 ml/min |
| **Aerosol % < 5 µm** | 57% | 65% | 57% | 70% | Inhalation top 1: 28% Inhalation tap 2: 63% | Position 1: 25%<br>Position 2: 0.5 50%<br>Position 3: 73% |
| **Medication tank capacity** | 150 ml (min 10 ml) | 7 ml | 10 ml | 10 ml | 12 ml | 12 ml |
| **Residual volume** | < 10 ml | < 0.7 ml | 0.5 ml | 0.7 ml | 0.7 ml | 0.7 ml |
| **Noise level** | < 40 dB | 55 dB | 20 dB | 55 dB | 63 dB | 65 dB |
| **Weight** | 2.5 kg (main unit only) | 2.2 kg (compressor only) | 0.12 kg | 1.3 kg | 1.7 kg | 1.3 kg |
| **Batteries** | | | 2 x AA | | | |
| **Main operations** | ● | ● | Optional | ● | ● | ● |

# 08/2 Accessories Sets

| Model | Product Code | Description |
|---|---|---|
| NE-U780 Ultra Air Pro | | |
| **Removable water tank** | NEB-RWT-78E | Includes handle cover. |
| **Silicon packing 5pcs (Washer)** | NEB-SP-78E | |
| **Medication cup** | U12-1-E | For transferring ultrasonic vibrations.<br>(Damage or deformation may prevent nebulization. Handle with care.) |
| **Air Filter set** | NEB-AFS-78E | Keeps dust and other contaminants out of the airflow. |
| **Air Filter 5pcs** | U17-4P2-E | Keeps dust and other contaminants out of the airflow. |
| **Long time Nebulization set** | NEB-LMCC-78E | Used during continuous nebulization. Used with the supply medication set (U10-11-E). |
| **Supply Medication set** | U10-11-E | Supplies medication so as to maintain a constant level in the medication cup.<br>Used during extended humidification and inhalation. |
| **Inhalation mask (S) set 3pcs** | NEB-MSISS-78E | Includes strap. Allows simultaneous inhalation via mouth and nose. |
| **Inhalation mask (L) set 3pcs** | NEB-MSILS-78E | Includes strap. Allows simultaneous inhalation via mouth and nose. |
| **Inhalation hose M** | NEB-HS-L70E | 700 mm |
| **Inhalation hose L** | NEB-HS-L15E | 1500 mm |
| **Mouthpiece set 5pcs** | NEB-MPSS-78E | Is placed in mouth to facilitate inhalation. |
| **Protective Filter Set** | NEB-PFS-78E | Keeps dust and other contaminants out of airflow. |
| **Protective Filter 5pcs** | NEB-PF-78E | Keeps dust and other contaminants out of airflow. |
| NE-C900 Compessor Nebulizer | | |
| **Nebulizer Kit & Mouthpiece Set** | NEB-NSET3-90E | |
| **Adult Mask (PVC)** | NEB-MSLP-E | |
| **Child Mask (PVC)** | NEB-MSLP-E | |
| **Infant Mask (PVC)** | NEB-MSSP-E | |
| **Adult Mask (SEBS)** | NEB-MSLS-E | |
| **Child Mask (SEBS) Set** | NEB-MSSS-E | |
| **Mouthpiece** | NEB-MP-E | |
| **Nosepiece** | NEB-NP-E | |
| **Air Tube (PVC)** | NEB-TP-L20E | 200 cm |
| **Air Filters 5 pcs** | NEB-AFR-30E | |

* For the detailed list of all the available accessories you can check the instruction manual of each product.

| Model | Product Code | Description |
|---|---|---|
| MicroAIR U100 | | |
| **Adult Mast (PVC)** | NEB-MSLP-E | |
| **Child Mask (PVC)** | NEB-MSMP-E | |
| **Infant Mask (PVC)** | NEB-MSSP-E | |
| **Adult Mask (SEBS)** | NEB-MSLS-E | |
| **Child Mask (SEBS) Set** | NEB-MSSS-E | |
| **Mesh Cap** | NEB-MC-10E | |
| **Medication Container** | NEB-BTL-10E | |
| **Mask Adapter** | NEB-MSA-10E | |
| **Mouthpiece** | U22-1-E | |
| **AC Adapter** | NEB-AC-10E, NEB-AC-10UK | |
| C28P | | |
| **Nebulizer kit** | NEB6026 | |
| **Air tube** | NEB6016 | |
| **Mouthpiece Set** | NEB6027 | Contents: mouthpiece with cap, exhalation valve, inhalation valve. |
| **Child Mask (incl. elastic band)** | NEB6028 | |
| **Adult Mask (incl. elastic band)** | NEB6029 | |
| **Support Adapter for Child Mask** | NEB6030 | |
| **Nasal shower** | NEB6014 | |
| **Air Filter Set** | 3AC458 | Contents: 5 pieces. |
| DuoBaby | | |
| **Nebulizer accessory set** | NEB2012 | Contents: nebulizer kit (includes two inhalation tops), baby mask, adult mask, mouthpiece, 3 air filters, air tube. |
| **Aspirator accessory set** | NEB7000 | Contents: nasal aspirator, air tube. |
| **Air Filter set 3 pcs** | 3AC408 | |
| **A3 Complete** | | |
| **Accessory Kit** | NEB6001 | Contents: nebulizer kit, air tube, mouthpiece, nosepiece, adult mask, child mask. |
| **Air Filter set 3 pcs** | 3AC408 | |

* For the detailed list of all the available accessories you can check the instruction manual of each product.

# 08/3 For consumers

## WheezeScan



A tool designed to helps parents detect wheeze in children with asthma symptoms. It analyses your child's breathing to quickly and accurately tell whether your child is wheezing. Helping to remove doubt in the moment of breathing distress and know when and how to follow your doctor's treatment plan.

- Wheeze detector
- For babies and children
- Compatible with Asthma Diary App

## MicroAir U100



A small, portable nebuliser that helps to efficiently treat respiratory conditions from a simple cough to asthma. It is compact, travel-ready and easy to reach. It is virtually silent and the unique design enables usage in any position.

- Use to treat lower airway conditions
- Instant therapy in your pocket
- Get relief from any angle or position

## DuoBaby



A unique 2-in-1 compressor nebuliser with integrated nasal aspirator that can help treat the most common respiratory condition of babies. The nasal aspirator gently cleans the baby's nose, reducing congestion and slowing him to breath freely. The nebuliser enables efficient medication delivery to the upper and lower airways.

- Use to treat both upper and lower airway conditions
- Includes unique nasal aspirator to clear your baby's nose

## C102 Total



The OMRON C102 Total 2-in-1 Nebuliser with Nasal Shower efficiently treat and provide relief for different respiratory symptoms and diseases throughout the year. The nasal shower cleans the nasal cavity and helps to relieve symptoms of conditions such as common cod, allergic rhinitis, or sinusitis. The nebuliser provides efficient medication deposition in the lungs to treat diseases such as bronchitis, bronchiolitis and asthma. It is easy to use and hygienic, suitable for children and adults. This product is intended to be used with medication (prescribed by your GP) or Saline.

- Use to treat both upper and lower airway conditions
- Includes nasal shower to help prevent or treat a blocked nose

## C28P



A nebuliser with Advanced Valve Technology, providing you with the treatment your doctor intended. Advanced Valve Technology has been designed to maximise the flow of medication while inhaling and makes sure there is no wastage of medication as you breathe out. Suitable for use with a range of medications the nebuliser can be used to treat chronic conditions like asthma, COPD, bronchitis, bronchiolitis or can be used with a saline solution to relieve and treat a cough & cold. The versatile device is ideal for multiple users as it comes packed with a comfortable soft-edged mask in adult and child size. A single unit that can be used by the whole family.

- Efficient treatment of lower airway conditions
- Suitable for relief from Cough & Cold as well as chronic conditions
- Durable and easy to clean design

## C28P



OMRON compare NE-C285P has a robust design for intensive use, suitable for the treatment of lower airways respiratory diseases like asthma, COPD, cystic fibrosis or emphysema.

- Use to treat lower airway conditions
- Suitable for children and adults

## C801



OMRON CompAIR NE-C801 is an everyday compressor nebuliser for the treatment of lower airways respiratory diseases like asthma. With a low sound level, the CompAIR NE-C801 allows for a very quiet and comfortable operation, thanks to its Virtual Valve Technology.

- Use to treat lower airway conditions
- Suitable for children and adults

## C801KD



OMRON CompAIR C801KD is a compressor nebuliser for the treatment of lower airways respiratory diseases like asthma in babies and children.

It is specially designed for babies and children, thanks to its silent operation and child-friendly design. CompAIR C801KD comes with a puppet accessory that can be attached to the device to make the inhalation more enjoyable. The device also comes with a child and infant mask for children and babies.

- Use to treat lower airway conditions
- Suitable for babies and children

## C803

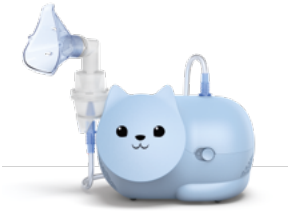


OMRON CompAIR Basic NE-C803 is the lightest and quietest OMRON compressor nebuliser for the treatment of lower airways respiratory diseases like light asthma.

This nebuliser provides an excellent value for money for consumers looking for a basic compressor nebuliser.

- Use to treat lower airway conditions
- Suitable for children and adults

## Nami Cat



A child friendly nebuliser that's been designed for making it easier to get your child using their nebuliser.

When your child has a nasty cough or difficulty breathing, the Nami Cat is a friendly face that can get them breathing easier. Its child friendly design helps you as a parent to get your child using their nebuliser – while its powerful compressor ensures they get the effective treatment they need.

- Compressor nebuliser for whole family
- With cute design for children between 2-6 years of age
- Effective for conditions in the upper airways

## P300 Intelli IT




The clinically tested OMRON P300 Intelli IT is a fingertip pulse oximeter for use at home or by professional healthcare practitioners. The device accurately monitors blood oxygen saturation (SpO2) levels as well as taking a pulse rate. Lightweight and easy to use, the device is also durable passing tests for moisture resistance, operational durability and drop durability.

The device also comes with Bluetooth and automatically syncs to the OMRON connect companion app. Helping a user to store all their health data in one place and making it easy for patients to share their latest readings with their doctor for better quality care conversations.

- For professional or home use
- Highly sensitive for reliable readings
- Track blood oxygen saturation

# 08/4 For Healthcare Professionals

## U780




The NE-U780 was developed in conjunction with respiratory therapists for the successful treatment of asthma, chronic bronchitis, allergies, and other respiratory disorders. This is a medical device.

The OMRON NE-780 is an ultrasonic nebulizer especially designed for professional use in doctor's offices and hospitals.

The removable water tank, which can be completely immersed in disinfecting liquid, makes cleaning the ultrasonic device particularly easy.

The OMRON NE-U780 offers a high aerosol output rate, making it ideal for the treatment of a variety of respiratory diseases. Both the nebulization volume and air-flow volume can be adjusted as required and the backlight on the display simplifies the operation of the device considerably.

- Smooth shape for easy cleaning – The main unit is easy to clean and disinfect by using sheet switches and air pathways that can be easily wiped clean and disinfected.
- Autoclave-safe attachments – The medication cup cover, inhalation hose, mouthpiece, and inhalation mask (optional) can be disinfected using either an autoclave or sterilizing liquid.
- Large, easy-to-see LCD display – The product features a large LCD display that lets you identify timer, air-flow volume, and nebulization volume settings at a glance. A backlight ensures the display is visible in dark locations, too.
- Audible Alarm – The product warns you with an audible alarm when an error has occurred or when the set time has elapsed. Error LEDs indicate where an error has occurred.

## C900



The NE-C900 CompAir Pro nebulizer features OMRON's two-part Smart Structure™ kit making cleaning, assembly, and disassembly easy, granting more time for direct patient care. Because the parts can be easily and effectively sanitized between applications, the NE-C900 CompAir Pro is ideally suited for repeated use in multiple patients.

The NE-C900 CompAir Pro nebulizer features a convenient integrated grip handle, making it safe to transport the nebulizer between treatment rooms and provides a smooth, rigid surface for fast and easy cleaning.

For added flexibility, the parts that contact the patient are composed of either PVC or polypropylene, making the NE-C900 CompAir Pro suitable for use in patients with latex allergies.

The NE-C900 CompAir Pro can deliver virtually any medical solution, giving you a wide range of patient care options. This device has been designed especially for busy medical professionals who expect high quality, easy operation and efficient delivery of medication.

High output of 7L (Airflow L/min) at 100 kPa (pressure) fulfils the requirement for a successful Hospital business. The nebulisation rate of 0.4 ml/min ensures a fast and convenient treatment of asthma, chronic bronchitis, allergies, and other respiratory disorders.

- Portable nebuliser – integrated handle for safely carrying the nebuliser from one patient to another.
- Smart structure kit – two-part kit for easy cleanings.

PM-00364-01-22-OHE

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