

Hephaï - the digital education platform for improved inhaler use

Hephaï is developing an AI-based digital education platform to support patients in correctly using their inhalers prescribed for asthma and COPD (Chronic Obstructive Pulmonary Disease) in order to maximize effectiveness.

This groundbreaking project uses AI motion analysis to ensure that patients are using their inhalers correctly - without human intervention. Within this AI system, a virtual coach swiftly identifies any errors in patients' usage technique. It then interacts with patients showing them how to use their inhaler correctly.

The start-up was created in 2019 by Dr Valéry Trosini-Desert, Serge Kinkingnéhun and Pr Thomas Similowski.

This free app is expected to launch in 2022 - in partnership with pharmaceutical companies. It will be available to download on smartphones, tablets and PCs.

Hephaï - key facts

- A unique digital platform aimed at improving the use of inhalers prescribed for asthma and COPD
- 2019: Start-up founded
- 2021: Development of partnership with Chiesi
- 2021: Patent filed for software technology
- 2022: Free app launch

A unique AI-based digital platform for improved inhaler use

The app:

- Allows the patient to **record themselves on the app** (through their smartphone, tablet or PC) **whilst using their inhaler**
- Uses behavioral recognition AI and algorithms, based around movement and sound
- **Provides the patient with immediate results via the app**, indicating if they are using their inhaler correctly or not
- Encourages the patient if they have used their inhaler correctly
- **Establishes a corrective process** if incorrect inhaler use was recorded, by highlighting errors in technique and providing an educational video - demonstrating proper practice. The app then offers the patient an opportunity to have their inhaler technique re-assessed



“Using artificial intelligence, Hephaï can automatically assess the movements and sounds made by the patient whilst using their inhaler and with the guidance of a virtual coach, help them to correct their technique.”



The app can be recommended by a pulmonologist, family doctor or pharmacist.

Hephai's goals:

- Develop a digital health education platform to support patients in their own homes
- Reduce incorrect inhaler use via an AI virtual coach and help patients independently follow recommended inhaler techniques
- Improve the respiratory health of patients who have been prescribed ready-to-use inhalers for chronic respiratory diseases such as asthma or COPD



Addressing a real medical need: tackling misuse of inhalers prescribed for asthma and COPD

Inhalers are very commonly prescribed for patients with asthma or COPD, who can use them on a daily basis. A wide range of inhalers may be prescribed for these respiratory conditions. There are currently 61 inhalers on the market, across 16 different categories; each one with its unique and potentially complex administration technique.

Effective management of these conditions is largely dependent on patient adherence and correct inhaler technique. Targeted treatment education should therefore be a key aspect of the healthcare provided to people living with these chronic conditions. However, on a day-to-day basis, the complexity of available treatment options and the time-consuming nature of treatment education make it difficult to regularly incorporate this into professional consultations. Family doctors and pulmonologists do not always have the time during consultations to comprehensively explain inhaler use, or even to monitor correct inhaler use by the patient. This is also true in pharmacy settings.

Many patients therefore begin treatment without fully understanding how to use their inhaler effectively and without guidance on the proper techniques. In most cases, patients have to make do with the instructions provided with the inhaler packaging, which are not necessarily easy to follow.

Inhaled drugs can be difficult to take correctly, often requiring a number of potentially complex steps - that are not always intuitive. Usage errors are commonplace: **an estimated 30–40% of patients with COPD do not use their inhalers correctly**.¹, with significant medical and economic consequences, including a negative impact on the clinical efficacy of treatment and wasted expenditure. In France, direct and indirect costs of incorrect use are estimated at €900 million (\$1.05bn).

A total of 299 million people worldwide live with asthma or COPD. Over the past 30 years, there has been unprecedented growth in the market for inhaled therapy², with annual sales having increased from \$7 billion

¹ Critical error: inhalers prescribed for asthma and COPD are used incorrectly, resulting in both lower clinical efficacy of treatment (reduced delivery to the respiratory system) and negative consequences for ongoing adherence. Some 'critical' errors can render the treatment entirely ineffective.

Molimard M, Raheison C, Lignot S, et al. Chronic obstructive pulmonary disease exacerbation and inhaler device handling: real-life assessment of 2935 patients. Eur Respir J 201 - <https://pubmed.ncbi.nlm.nih.gov/28182569/>

2. Omar S. Usmani, Choosing the right inhaler for your asthma or COPD patient. Ther Clin Risk Manag. 2019; 15: 461–472 - <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6422419/>



(€5.9bn) in 1987 to \$36 billion (€30.4bn) in 2014 and with over 90 billion inhaled doses prescribed to patients in a single year.

“Hephaï aims to improve respiratory condition management - by minimizing the medical risks associated with incorrect use”

The platform also facilitates the collection of Real-World Evidence (RWE) on ready-to-use inhaled drugs; this information supports industrial partners in the improvement of their devices.

Hephaï is a multi-device (PC, tablet, smartphone) tool available on IOS, Android and Windows and a Class I Medical Device (MD). Personal data collection and analysis is compliant with medical and GDPR regulations and with European directives on medical devices.

Hephaï builds on 10 years of prior research into inhaled medication prescribed for asthma and COPD, and on the success of the ZEPHIR guide. The ZEPHIR guide, developed by Dr Valéry Trosini-Désert, provides a set of support tools for adults taking inhaled medications for asthma or COPD, in partnership with the French Society of Respiratory Diseases. The guide is a directory of inhaler types, categorized by indication, treatment category and INN (International Nonproprietary Names). It also offers educational videos on techniques for every inhaler available on the market.

The development of Hephaï by Dr Valéry Trosini-Désert, Hephaï co-founder and pulmonologist at the Pitié-Salpêtrière hospital (Paris, France)

I support patients with asthma or COPD in my day-to-day hospital work, and for over ten years have looked into the issues associated with the misuse of inhalers prescribed for these two conditions. Long-term inhaler use is the cornerstone of treatment for these two diseases. Contrary to what you might think, using an inhaler is neither simple nor instinctive: it requires a degree of dexterity and a series of potentially complex movements. Poor inhaler technique poses a real threat to the effective management of a patient's respiratory condition.

It was clear to me that patients with these respiratory diseases urgently needed support and guidance, as patient information and education is still sorely lacking. This led me to the idea of developing a virtual coach, to teach them how to use their inhalers correctly in their own homes. An easy-access, free and intuitive app to provide day-to-day support for patients in using their devices effectively, and thus improve treatment adherence.



The founders

- **Dr Valery Trosini-Désert, co-founder and pulmonologist at the Pitié-Salpêtrière hospital, Paris, France**



Dr Trosini-Désert is a pulmonologist and head of the bronchoscopy unit within the pulmonology department of the Pitié-Salpêtrière public hospital group in Paris. She is the creator of the ZEPHIR guide, established in 2011. This treatment education tool, which is readily available across a number of interfaces, provides the correct administration technique for every ready-to-use inhaler for asthma or COPD management.

Dr Trosini-Désert is the lead author of the ARGOS study on telemedicine- and tablet-based analysis of patient inhaler use at home [A Telemedicine Intervention to Ensure the Correct Usage of Inhaler Devices *Telemed J E Health*.2020 Nov;26(11):1336-1344].

- **Serge Kinkingnéhun, PhD, co-founder and CEO**



Serge Kinkingnéhun founded EyeBrain, his first medical device start-up, in 2008 while working as a neuroimaging and cognitive science research engineer at the Pitié-Salpêtrière hospital (Paris, France). After selling EyeBrain, he worked on identifying innovative solutions and implementing value-creation strategies for medical technologies at the Paris Brain Institute (France). It was during this period that he met Dr Valéry Trosini-Désert. Having supported her initial start-up project, he is now working alongside her at Hephaï in the role of CEO.

Serge Kinkingnéhun is also a start-up mentor, working directly with start-ups or via organizations including Imperial College, EIT Health, Matrice, Wilco and Creative Valley. He also serves as the medtech expert for financing bodies such as Bpifrance,

Wilco and the Institut Curie, and has founded Autonom Innov, his own start-up accelerator.

In 2020, Serge was appointed as an advisor for the promotion and development of research in France by the Prime Minister's General Investment Secretariat.

- **Pr Thomas Similowski, co-founder and Scientific Committee Chair**



Thomas Similowski is a professor of pulmonology at the faculty of medicine at Sorbonne University (Paris, France), and is head of the R3S department at the Pitié-Salpêtrière hospital. He is also the director of the Inserm-Sorbonne University MRSU 1158 research unit. He has held a number of positions within the pulmonology field both nationally (Chair of the French Respiratory Health Research Fund and of the National University Council) and internationally (European Respiratory Society); he has held positions at various university teaching hospitals.

Thomas is a recognized national and international opinion leader in his field. Through his research, he has acquired extensive value-creation experience; including as an inventor or co-inventor on a dozen patents. He has also been involved in several industry collaborations. Alongside Dr Valéry Trosini-Désert, he has been a longstanding contributor to the promotion of treatment education on the use of inhalers for asthma and COPD, which then became the Hephaï project.



Asthma and COPD: key facts and figures

- **Asthma**

Asthma is a chronic condition that affects both children and adults. The airways in the lungs contract as a result of inflammation and tightening of the muscles surrounding the fine respiratory passages. This causes symptoms such as coughing, wheezing, shortness of breath and difficulty breathing. These symptoms are intermittent and are often worse at night or while exercising. Other triggers that may exacerbate asthma symptoms include viral infections (colds), dust, air pollution, seasonal changes, grass or tree pollen and animal hair or feathers.

Asthma is often under-diagnosed and inadequately treated. People with asthma that are not treated correctly may also suffer from poor sleep and can feel fatigued during waking hours and have difficulty concentrating. With severe symptoms, patients may need urgent medical care - requiring hospital admission for treatment and monitoring.

Asthma cannot be cured, but effective inhaler treatment allows people living with asthma to manage their condition and lead an active life.

Various types of inhalers are available, including bronchodilators, which open up the airways and ease symptoms, and/or corticosteroids, which reduce airway inflammation. These improve the asthma symptoms and reduce the likelihood of a serious or fatal asthma attack. People with asthma often need to use their inhalers daily. Treatment is determined based on the frequency of patient symptoms and on the types of inhaler available.

Asthma affected an estimated 262 million people in 2019 and caused 461000 deaths.

Source: [World Health Organization](#)

- **COPD (Chronic Obstructive Pulmonary Disease)**

COPD is a common chronic lung disease. It was the third leading cause of death worldwide in 2019, resulting in 3.23 million deaths. Bronchial lesions limit the exchange of gases and respiratory passages are constricted by several processes. As a result, certain sections of the lungs can be severely damaged, secretions may obstruct the airways and the epithelium of the respiratory passages can become inflamed and edematized.

The following common COPD symptoms develop at around 45 years of age: shortness of breath or dyspnea; chronic cough, often accompanied by sputum; and/or fatigue.

As COPD progresses, normal daily activities become increasingly challenging, often as a result of breathlessness. COPD flare-ups bring a marked worsening of symptoms, which may require additional treatment at home or emergency hospitalization. Severe flare-ups can be life-threatening.

Both asthma and COPD share certain symptoms (coughing, wheezing, dyspnea) and some people live with both conditions. Significant COPD risk factors include exposure to tobacco smoke and indoor air pollution, as well as occupational exposure to dust, smoke and chemical products.

COPD management centers on the prescription of inhaled medications, in combination with respiratory rehabilitation and the elimination of risk factors.

Source: [World Health Organization](#)



Financing and intellectual property

Thanks to its partnerships, Hephai has generated revenue since its creation in 2019.

In 2021, Hephai filed a patent for the software technology used in its digital education tool. This first patent was to protect the digital platform; the first of its kind for respiratory conditions such as asthma and COPD.

Partners



In 2021, Hephai partnered with Chiesi, an international pharmaceutical company, to develop its digital platform. Through this agreement, Chiesi signaled its commitment to respiratory health. This is a flagship treatment area for the laboratory, which offers metered-dose or powdered inhalation system solutions to meet the differing needs of patients and physicians.

Other partners:



Prizes and Awards

- Winner of a 2021 Catalyst Award as part of the US National Academy of Medicine 'Healthy Longevity Global Competition'

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