![eureca - European Respiratory Cluster Antwerp]

Connected health: how Pulmonary Medicine can benefit from the Internet of Things

Workshop Proceedings

Part 1: Unmet medical needs, the parameters and biomarkers to be monitored and the promise of connected health in respiratory

October 14th, 2020

Acknowledgements

The workshop on 'connected health: how pulmonary medicine can benefit from the Internet of things' was held on October 14th, 2020. The workshop was organized by the European Respiratory Cluster Antwerp (eu.reca vzw).

For this meeting eu.reca brought together a group of multidisciplinary experts to discuss the topic 'connected health' within pulmonary medicine. Medical experts elaborated on the doctor's view with regard to the unmet medical need and expectations. A number of technical experts from a variety of industries offered an insight into the technologies that are currently being used or under development. The purpose of the discussion was to explore future opportunities and to see if it would be possible to align the medical expectations with the potential benefits of the new designs.

The eu.reca network acknowledges APTAR for their continued support and in particular for their keen interest into this specific topic.

The eu.reca network also acknowledges AstraZeneca for their support and participation in this session.

Workshop components

The discussion consisted of 3 main parts. First our experts focused on the unmet medical needs, the parameters and biomarkers to be monitored and the promise of connected health in respiratory. In a second part the team explored enabling technologies and how they can be successfully introduced into the market. Last but not least our experts covered the complexity of the regulatory context around connected health in respiratory and the impact on medical liability.

This document summarizes part 1 of our workshop: the unmet medical needs, the parameters and biomarkers to be monitored and the promise of connected health in respiratory.

Welcome

By Frank Pieters, founder of eu.reca vzw

In his welcome address, Frank Pieters, founder of eu.reca vzw, introduced the European Respiratory Cluster Antwerp (eu.reca), a young ecosystem entirely focused on everything that impacts the human lung. To advance respiratory innovation, eu.reca brings scientific and medical experts together with entrepreneurs and other stakeholders. The network stands for a hands-on approach, not only tackling relevant challenges, but always reaching out to present possible solutions.

As eu.reca's approach is based on interaction, initiatives such as round table workshops and webinars are important. In closing, Frank welcomed all participants from different backgrounds stressing that cross-fertilization between industry, academics, clinicians and governments is key to accelerate in the field of respiratory diseases.

▶ Setting the scene: goals of the workstream

In recent years innovative technology created a lot of opportunities in connected health, with a focus on administrative and diagnostic solutions, but also for monitoring and medicine administration technology.

The mission of the project 'connected health' is to gain a clear insight into both expectations and unmet needs as they are perceived in the clinical pulmonary field, in order to identify the potential for new, relevant designs and innovations.

▶ Current medical environment and unmet medical needs

> *"A pneumologist sees a patient no more than once or twice a year and has therefore a limited view on what happens in the patient's life in between the individual consults. There is no continuous monitoring of life quality from the patient's perspective."* **Prof. dr. Guy Joos**

For the specialist to know precisely what has occurred in between consultations, the patient would need to perform daily measurements such as peak flow monitoring, as well as take note of the symptoms. This is not feasible. Therefore, it would be a major improvement to have a digital solution that records in real-time what is happening from the patient's point of view.

Today the specialist is missing a lot of information that could be important to either confirm the diagnosis, or to optimize the treatment and follow-up on the patient's condition. Information about infections, exposure to air pollution, allergens, or occupational agents are very relevant, certainly in the cases of asthma, COPD, respiratory infections, tuberculosis and lung cancer.

Over the past years it has become obvious that the application of connected health in the therapeutic field is vastly different from that in the diagnostic field. In the former the technologies developed within connected health should focus on high-risk or difficult to treat patients, who can really benefit from close monitoring. As stated earlier, without automatic symptom registration, a specialist receives a rather fragmented set of

information, based on a limited number of consultations. In an ideal scenario high risk patients would have their symptoms registered and monitored during a period of 3 to 4 months. Current common practice for asthma patient's follow-up is a control questionnaire of 5 questions. Real-time registration of both circumstances and events, would be infinitely more useful on the condition of data being synthesized and relevant.

With regard to the therapeutic field, another issue is always raised: the misuse of inhalers and the lack of therapy adherence for both asthma and COPD. The introduction of new technologies should enable the Health Care Provider to make the correlation between symptoms and triggers. This in turn can lead to recommendations during monthly conference calls between patient and healthcare teams, triggering a potential adaptation of the medication scheme and providing better education and follow-up of the patient.

In specific cases as for the treatment of severe asthma, the pneumologist wants to understand the adherence of the patient related to medicine administration, inhaler usage and therapeutic guidelines in order to enable the best possible treatment both from a medical and pharmaco-economic point of view.

With regard to diagnosis the potential for connected health is also very real. Undeniably, there is a need for more and better diagnostic possibilities outside of the hospital. The current pandemic has only opened more minds to the necessity of making smart choices as to whom must be administered to the hospital and what for. An excellent example of a condition that would be better diagnosed at home is sleep apnea. It would be truly valuable for a patient to have a diagnostic tool for the detection of sleep apnea in the home environment. There is currently technology existing to do so, but from a clinical perspective, it does not fully satisfy the needs. There is a polysomnography system but there remains a need for a system with more markers that cover the entire diagnostic chain, and that makes sure the patient can monitor his sleep pattern without having to come to the hospital to pick up the instruments.

> "A survey conducted by eu.reca in 2020 shows that over the past 20 years there was no modification on the control of asthma. It seems that over the last 20 years nothing has changed, although the treatment options have substantially been uplifted." **Frank Pieters**

Although technology providers indicate that the technology today is largely in place to unlock the potential of connected health, doctors still identify many unmet needs. Possibly, many health care professionals are simply not aware of the technology that is available in other domains, and could be implemented in their field of expertise.

▶ What kind of parameters do you want to collect?

There was a general agreement among participants that in terms of variables, a good view on fairly simple, straightforward data such as heart rate, oxygen saturation and respiratory rate would already be very useful. Firstly, because even today, little is known about the interrelationship between these variables. Secondly, because these variables are surely to be impacted in any major occurrence. If something substantial were to go wrong with a patient, most likely it would show in either heart rate, oxygen saturation, or respiratory rate.

> "I would like to have daily measurements of high risk patients, as well as signal when the patient feels that something is wrong. There has to be a relationship between the frequency of measuring and the rate of change of variables such as heart rate, oxygen saturation and respiratory rate. In addition, it is absolutely necessary to define the accuracy or precision needed in order to provide real value during the diagnostics and/or therapy." **Prof. dr. Marc Decramer**

The most important parameter to collect is without doubt the evolution of lung function, preferably measured by a non-invasive method. Next to lung function, there is a clear need for more continuous monitoring of a patient's symptoms. In any case it's very important to have a restricted set of parameters and a uniform system. Measuring these parameters only adds value when there is insight into the subjective impression of the patient.

In addition, new technology will allow to measure parameters that are linked to the breathing patterns at the moment of inhaling the medicine, which in turn could deliver important information that could result in patient-specific training algorithms to optimize inhaler therapy. Other projects have demonstrated that checking the voice quality of the patient can provide insights into the progress of COPD.

There is reference made to the experience that was gained by some research groups, in the specific field of lung tumors. These groups quantify information contained in medical images of a tumor, which is not visible for a radiologist. The rate of variability during the day could be indicative of the rate of decline in the long term. But, without further and deeper research, it is difficult to determine whether such minor changes are really relevant. Referring to spirometry, maybe at first sight daily spirometry monitoring seems not relevant either, but possibly if one were to measure it every hour, new patterns could be detected that might predict the long-term outcome. All participants agree that additional research and development activity in this field is required.

> **"Having access to individualized information about infections, exposure to air pollution, allergens, or occupational agents would allow us to advance diagnostic and therapeutic practice."**

▶ The promise of connected health in respiratory

Gathering more information as such, however, should not be what we aim for. Connected health is a tool that will allow easier access to information that today we are getting with other means. In collecting data, it is essential to find critical data and eliminate 'noise'.

Connected health offers the opportunity to gather a lot of data about what really happens outside of the hospital, but the focus should always be on qualitative and relevant information.

> **"Connected health can give us the possibility to assemble the information we currently get via many different ways"**

Based on the above discussion we have been able to identify multiple domains within the clinical pulmonary field that can benefit from connected health:

- Continuous patient monitoring within flexible intervals, eliminating the lack of patient information between different consultations providing relevant insights to the pneumologist
- Measurement and integrated analysis of multiple medical parameters or biomarkers (i.e. heart rate, blood oxygen level, respiratory rate)
- Measurement of patient adherence related to medicine administration and inhaler usage
- Development of patient specific training programs to optimize inhaler therapy and broader therapeutic compliance
- Development of predictive therapeutic models based on the patient's individual information in order to avoid crisis situations or red alerts
- Integration of environmental data (air pollution, allergens a.o.) to optimize the patient's therapy

▶ Participants

Special thanks for all attendees for their active participation in this first part of the workshop.

We are grateful to all participants but in particular to **Prof. Dr. Guy Joos** and **Dr. René Deman** for sharing their insights on the unmet needs in the clinical field of pneumology, as well as **Prof. Marc Decramer** for his expertise concerning the use of internet technology in the hospital setting.

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Darrell Baker (ex-GSK), **Vincent Vanheule** (AZ) and **Guy Lefever** (Startegica) for sharing their experience with digital transformation and industry technology solutions.

Tom Braekeleirs for his practical view on digital transformation.

Wim Vos (Radiomics) for his contribution to how technology can be used in drug/device development and clinical practice.

Pulmonary Specialists

Marc Decramer is a pneumologist, was professor at KU Leuven, Chief of the Respiratory Division and CEO at the University Hospital UZ Leuven.

Guy Joos is Pneumologist and Head of the Dept. of Respiratory Medicine at Ghent University Hospital. He is full Professor at Ghent University and Director of Research at the Faculty of Medicine and Health Sciences of Ghent University.

René Deman is Pneumologist and Head of the Department of Respiratory Medicine at AZ Groeninge (Kortrijk – Belgium). He has a broad interest in the field of asthma, COPD and sleep medicine.

Domain Specialists

Guy Lefever is Managing Director of Startegica, providing Strategic Advisory services to Life Sciences, Manufacturing and Technology companies.

Darrel Baker is Strategic Consulting in Pharmaceuticals and Biotechnology, specialist in Respiratory Medicine Development and Commercialisation.

Tom Braekeleirs is CEO of BlueHealth Innovation Center (BHIC), which supports the digital transformation of healthcare through digital innovation.

Wim Vos is the CEO of Oncoradiomics and has over 10 years of experience in leading a start-up to international success.

Chris Hall, NED and Pharma Devices Consultant

APTAR

APTAR is a global solution provider of innovative drug delivery systems, components and services to pharmaceutical, consumer healthcare and biotech customers worldwide.

Marcus Bates, Director External Partners Connected Development

Sai Shankar, Vice President Global Digital Health Care

AstraZeneca

AstraZeneca is a global, science-led biopharmaceutical company focusing delivering new medicines in 3 therapeutic areas: Respiratory, Oncology and CVRM.

An Herreman, Medical Affairs manager

Vincent Vanheule, Medical Affairs manager

Simon Byrne, Business Unit director Respiratory and Immunology

Lies Raymaekers, Brand manager Repiratory

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Spectricity

Spectricity is a spin-off of imec, a leading R&D center in nano-electronics and digital technologies in Belgium. Spectricity develops low-cost, miniaturized, integrated optical spectral sensing solutions in the visible and near-infrared spectral range.

Jonathan Borremans, CEO

Peter Vanbekbergen, CTO

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Frank Pieters, CEO P&L Projects, chairman of the board at Softhale NV, head of strategy and business development at Aquilon.

Jade Verrept, Coordinator eu.reca network, cluster manager Science Park University of Antwerp.

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