Asthma research in Europe: a transformative agenda for innovation and competitiveness

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Asthma is highly prevalent, often starting in infancy and persisting throughout life, and is associated with high morbidity and burden. It is a major global health challenge with growing impact, affecting more than 300 million people worldwide and at least 10% of all Europeans [1]. Furthermore, it is the most prevalent long-term condition in children [2]. Approximately 5–10% of asthma cases are so severe that current treatments do not work, and over five million people in the European Union (EU) fall into this category.

People with asthma live at risk of life-threatening asthma attacks, leading to at least 500 000 hospitalisations worldwide each year [3]. A European study estimated that unscheduled care and rescue medication accounted for 47% of the total cost-per-patient in infants, 45% in children and 56% in adults [4]. This results in high socio-economic impact, estimated at more than €70 billion annually [1]. This includes the costs of direct primary and hospital healthcare (estimated to be close to €20 billion per annum), costs due to lost productivity (€14 billion) [1], and the monetised value of disability-adjusted life-years (DALYs) lost (over €38 billion) [1]. Close to 1 million DALYs are lost due to asthma in Europe every year [5].

Despite the fact that the direct and indirect costs of asthma are substantial and continue to rise, asthma remains under-prioritised in the EU research agenda. Only 0.5% of the Seventh Framework Programme

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(FP7) health research budget was devoted to asthma and chronic obstructive pulmonary disease (COPD) (€30 million) [5]. In comparison, some 5.4 times this amount (over €163 million) was spent on cardiovascular conditions and some 20.6 times (over €618 million) on brain research.

Asthma, with its high global prevalence and an associated multi-billion global market for treatments, plus its historical underfunding and the demand for new treatments and diagnostics, represents an enormous opportunity to drive substantial economic growth. This paper sets out how the EU may capitalise on this *via* investment in research with high commercial potential that can radically improve the EUs research agenda and public health.

Europe at the forefront of a medical research revolution: an opportunity for change

Demonstrable success in European asthma research has been achieved over the past two decades but there is still much more to do. Research priorities have been identified and opportunities lie ahead to fulfil them [6]. The digital revolution can become an aid for the self-management of long-term conditions. Advances in genomics and disease stratification can provide a radical approach to current challenges, offering life-changing benefits for people who do not respond to existing treatments. So-called "big-data" can be harnessed to assist healthcare professionals and policy makers in making efficient judgements about how and when to treat people and improve healthcare systems. Electronic and mobile systems (e-health and m-health) can now provide personalised medicine, offering new devices and programmes with more penetration into younger age groups.

The EUs "Europe 2020" strategy for jobs and growth sets out to address societal challenges through research and innovation whilst recognising the role that research has in promoting economic competitiveness. The "Innovation Union" initiative recognises the need to promote research in areas of high commercial potential, whilst bridging the gap between research breakthroughs and the market. Both express the need for a more collaborative research framework, linking public and private stakeholders around common goals, including small and medium enterprises (SMEs).

A key EU initiative in collaboration with the European pharmaceutical industry is the Innovative Medicines Initiative (IMI), which is working to improve health by speeding up the development of, and patient access to, innovative medicines, particularly where there is an unmet medical or social need. It does this by facilitating collaboration between universities, the pharmaceutical and other industries, SMEs, patient organisations, and regulators.

One major achievement of the IMI is the Unbiased Biomarkers for the Prediction of Respiratory Disease Outcomes (U-BIOPRED) project (2009–2015) [7]. U-BIOPRED received much praise from the IMI as one of its most effective collaborative efforts, since it delivered a significant enhancement in the understanding of asthma and an impact on decision making within the pharmaceutical industry (which actively uses U-BIOPRED data).

The EU has put forward European Innovation Partnerships (EIPs) as initiatives to address societal challenges though private and public involvement in innovation. These have set the basis for further improvement and realisation of the full potential of public–private partnerships.

Asthma: an unmet need and an economic opportunity

Asthma is arguably the best example of the opportunities associated with personalised-medicine, bioinformatics and e-health. Advances in personalised medicine will depend on access to large patient cohorts and core phenotype information [8]. Asthma is variable and much of the difficulty in understanding its mechanisms and developing new therapies comes from the multiplicity of phenotypes. The treatment pipeline for severe asthma is now exciting as it takes significant advantage of stratification, thus having the potential for breakthroughs in personalised medicine.

Asthma has one of the best cases for effective self-management and improved outcomes, as approximately 80% of people with asthma could effectively self-manage, primarily through improved medication adherence. The size of the problem and it socioeconomic impact, the potential for improvement and eventual solution, the wide implications in the economic process, and the wide interactions at various levels of the innovation chain should establish asthma as a European priority to be resolved through innovation.

The European Asthma Research and Innovation Partnership: a transformative agenda for research and innovation

The European Asthma Research and Innovation Partnership (EARIP) is an EU-funded initiative designed to inform EU research and innovation priorities by bringing together key stakeholders across a wide range of disciplines. Partners have worked over the past 3 years to develop a coordinated agenda for asthma research and innovation that will position Europe as the front-runner to address this major health and

societal challenge [9]. EARIP proposes that research should focus on areas with high potential for commercial breakthroughs, such as diagnostics and e-health, and where stakeholders are linked around a common goal. Platforms streamlining communication and closer links between innovators, policy makers and regulators, crucially involving the EU member states, will speed up market uptake.

A stakeholder mapping exercise initiated through EARIP has revealed the width and potential of the area and forms a basis for reference and for expansion into a prospective registry (figure 1). EARIP firmly believes that patients and the public should be at the core of any initiative, to ensure that policy makers, healthcare professionals and industry understand their perspective and design research and innovation around their needs. The European Federation for Allergy and Airways Diseases Patients' Associations (EFA) is driving this by engaging patients and facilitating their communication with various bodies. This is being supported by the European Lung Foundation (ELF) which coordinated an asthma research roadmap as part of EARIP [10]. Organisations including the European Respiratory Society (ERS) and the European Academy of Allergy and Clinical Immunology (EAACI) are already promoting this agenda to their members, producing guidelines and supporting their implementation to increase the quality of asthma care throughout Europe.

Call to action: a demand-driven research agenda

Europe is ideally placed to capitalise on the research potential of the EARIP agenda. Radical improvements in asthma outcomes and the related impact on the overall European economy are only achievable through a coordinated and concerted approach at international level. Our calls/recommendations include: 1) A strategic research framework for asthma (a demand-driven agenda developed in consultation with stakeholders, to ensure public and private resources are focused on research priority areas); 2) A commitment to addressing asthma at the European level; 3) Adoption and dissemination of the research priorities, roadmap and

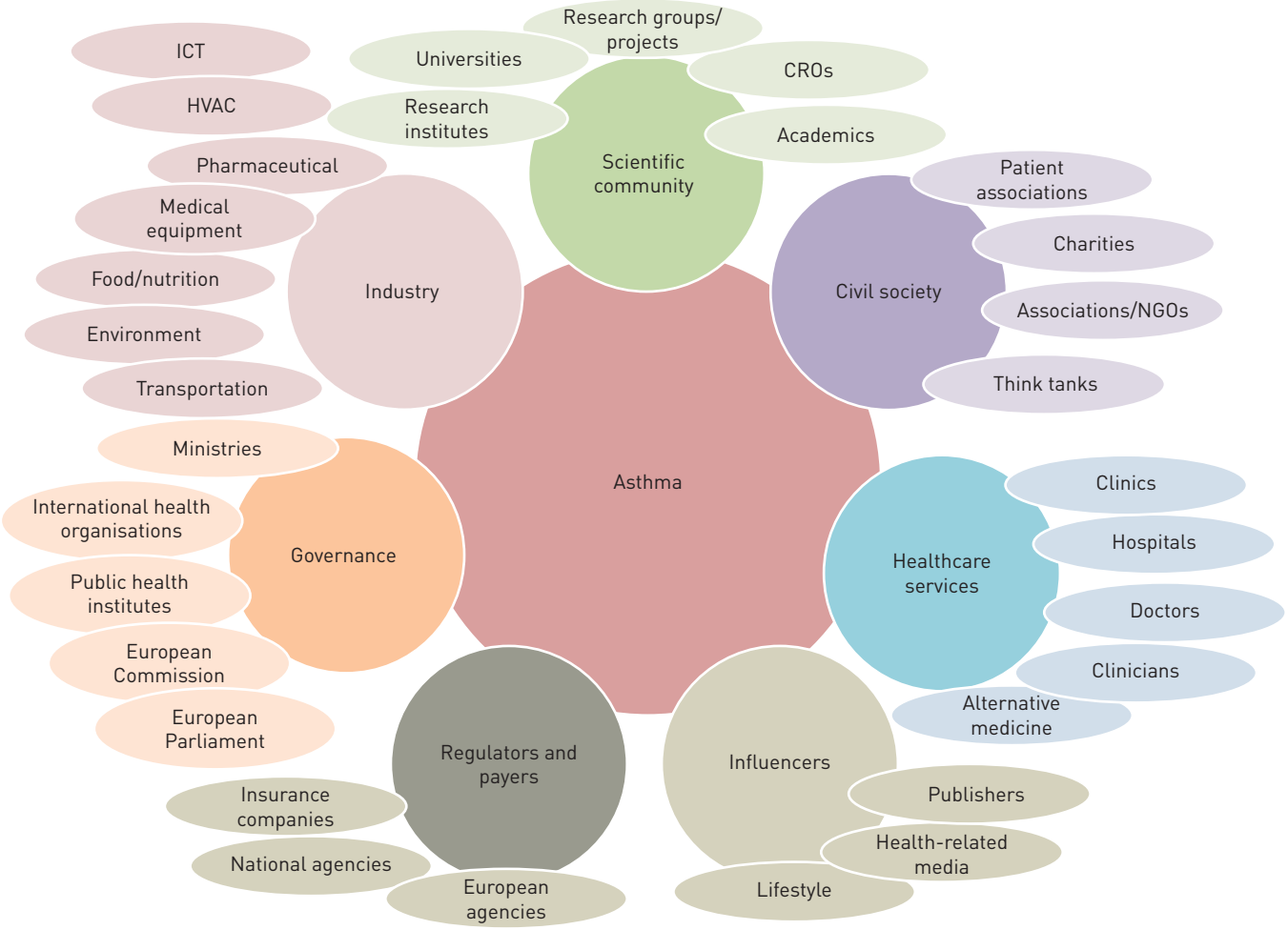

FIGURE 1 Map of stakeholders in the asthma domain. CRO: contract research organisation; NGO: non-governmental organisation; HVAC: heating ventilation and air-conditioning; ICT: information and communication technology.

recommendations established by EARIP; 4) An Innovative Medicines Initiative (IMI) project addressing the full spectrum and various subgroups of asthma.

Existing multi-stakeholder hubs and consortia with proven innovative capacity can act as catalysts for expansion. A successful example is the Global Allergy and Asthma European Network (GA^2LEN), a flagship Sixth Framework Programme (FP6) Network of Excellence, which remains sustainable and has served as an innovation forum for a large number of academic, civil society and industrial partners [11]. Following a number of workshops with various stakeholders at the European Respiratory Society International Congresses in 2014 and 2015, and the European Academy of Allergy and Clinical Immunology Congress in 2015, EARIP proposes that, if there is commitment that enables proper action to be taken, it would be possible to reduce the asthma burden in Europe by 40% within the next 10 years. A number of indices, such as hospitalisations, deaths, prevalence and cost can be utilised as further milestones reflecting the societal impact. To achieve this, research results should be rapidly incorporated into commercial applications and impactful public health programmes.

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