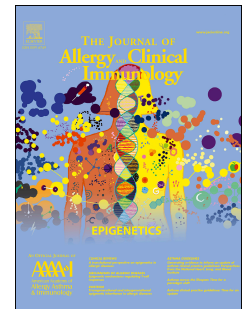


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Jean Bousquet, MD, Peter W. Hellings, MD, Ioana Agache, MD, Flore Amat, MD, Isabella Annesi-Maesano, MD, Ignacio J. Ansotegui, MD, Josep M. Anto, PhD, Claus Bachert, MD, Eric D. Bateman, MD, Anna Bedbrook, BSc, Kazi Bennoor, MD, Mickael Bewick, MD, Carsten Bindslev-Jensen, MD, Sinthia Bosnic-Anticevich, PhD, Isabelle Bosse, MD, Jan Brozek, MD, Luisa Brussino, MD, Giorgio W. Canonica, MD, Victoria Cardona, MD, Thomas Casale, MD, Alfonso M. Cepeda Sarabia, MD, Niels H. Chavannes, MD, Lorenzo Cecchi, MD, Jaime Correia de Sousa, MD, Elisio Costa, PhD, Alvaro A. Cruz, MD, Wienczyslawa Czarlewski, MD, Giuseppe De Carlo, MD, Giulia De Feo, MD, Pascal Demoly, MD, Philippe Devillier, MD, Mark S. Dykewicz, MD, Yehia El-Gamal, MD, Esben Eller, MD, Joao A. Fonseca, MD, Jean-François Fontaine, MD, Wytske J. Fokkens, MD, Maria-Antonieta Guzmán, MD, Tari Haahtela, MD, Magdalena Illario, MD, Juan-Carlos Ivancevich, MD, Jocelyne Just, MD, Igor Kaidashev, MD, Musa Khaitov, PhD, Omer Kalayci, MD, Thomas Keil, MD, Ludger Klimek, MD, Marek L. Kowalski, MD, Piotr Kuna, MD, Violeta Kvedariene, MD, Desiree Larenas-Linnemann, MD, Daniel Laune, PhD, Lan TT. Le, MD, Kai-Hakon Carlsen, MD, Olga Lourenço, PhD, Bassam Mahboub, MD, Alpana Mair, PhD, Enrica Menditto, PhD, Branislava Milenkovic, MD, Mario Morais-Almeida, MD, Ralph Mösges, MD, Joaquim Mullol, MD, Ruth Murray, PhD, Robert Naclerio, MD, Leyla Namazova-Baranova, MD, Ettore Novellino, PhD, Robyn E. O'Hehir, MD, Ken Ohta, MD, Yoshitaka Okamoto, MD, Ken Okubo, MD, Gabrielle L. Onorato, MSc, Susanna Palkonen, MD, Petr Panzner, MD, Nikos G. Papadopoulos, MD, Hae-Sim Park, MD, Ema Paulino, PhD, Ruby Pawankar, MD, Oliver Pfaar, MD, Davor Plavec, MD, Ted A. Popov, MD, Paul Potter, MD, Emmanuel P. Prokopakis, MD, Menachem Rottem, MD, Dermot Ryan, MD, Johanna Salimäki, MSc, Boleslaw Samolinski, MD, Mario Sanchez-Borges, MD, Holger J. Schunemann, MD, Aziz Sheikh, MD, Juan-Carlos Sisul, MD, Rojin Rajabian-Söderlund, PhD, Talant Sooronbaev, MD, Cristiana Stellato, MD, Teresa To, PhD, Ana-Maria Todo-Bom, MD, Peter-Valentin Tomazic, MD, Sanna Toppila-Salmi, MD, Antonio Valero, MD, Arunas Valiulis, MD, Erkka Valovirta, MD, Maria-Teresa Ventura, MD, Martin Wagenmann, MD, De Yun Wang, MD, Dana Wallace, MD, Susan Wasserman, MD, Magnus Wickman, MD, Arzu Yorgancioglu, MD, Luo Zhang, MD, Nanshan Zhong, MD, Mihaela Zidarn, MD, Torsten Zuberbier, MD

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ARIA Phase 4 (2018): Change management in allergic rhinitis and asthma multimorbidity using mobile technology

Jean Bousquet MD ¹⁻³, Peter W Hellings MD ⁴, Ioana Agache MD ⁵, Flore Amat MD ⁴⁴, Isabella Annesi-Maesano MD ⁶, Ignacio J Ansotegui MD ⁷, Josep M Anto PhD ⁸⁻¹¹, Claus Bachert MD ¹², Eric D Bateman MD ¹³, Anna Bedbrook BSc ², Kazi Bennoor MD ¹⁴, Mickael Bewick MD ¹⁵, Carsten Bindslev-Jensen MD ¹⁶, Sinthia Bosnic-Anticevich PhD ¹⁷, Isabelle Bosse MD ¹⁸, Jan Brozek MD ¹⁹, Luisa Brussino MD ²⁰, Giorgio W Canonica MD ²¹, Victoria Cardona MD ²², Thomas Casale MD ²³, Alfonso M Cepeda Sarabia MD ²⁴, Niels H Chavannes MD ²⁵, Lorenzo Cecchi MD ²⁶, Jaime Correia de Sousa MD ²⁷, Elisio Costa PhD ²⁸, Alvaro A Cruz MD ²⁹, Wienczyslawa Czarlewski MD ³⁰, Giuseppe De Carlo MD ³¹, Giulia De Feo MD ³², Pascal Demoly MD ^{6,33}, Philippe Devillier MD ³⁴, Mark S Dykewicz MD ³⁵, Yehia El-Gamal MD ³⁶, Esben Eller MD ¹⁶, Joao A Fonseca MD ³⁷, Jean-François Fontaine MD ³⁸, Wytske J Fokkens MD ³⁹, Maria-Antonieta Guzmán MD ⁴⁰, Tari Haahtela MD ⁴¹, Magdalena Illario MD ⁴², Juan-Carlos Ivancevich MD ⁴³, Jocelyne Just MD ⁴⁴, Igor Kaidashev MD ⁴⁵, Musa Khaitov PhD ⁴⁶, Omer Kalayci MD ⁴⁷, Thomas Keil MD ⁴⁸, Ludger Klimek MD ⁴⁹, Marek L Kowalski MD ⁵⁰, Piotr Kuna MD ⁵¹, Violeta Kvedariene MD ⁵², Desiree Larenas-Linnemann MD ⁵³, Daniel Laune PhD ⁵⁴, Lan TT Le MD ⁵⁵, Kai-Hakon Carlsen MD ⁵⁶, Olga Lourenço PhD ⁵⁷, Bassam Mahboub MD ⁵⁸, Alpina Mair PhD ⁵⁹, Enrica Menditto PhD ⁶⁰, Branislava Milenkovic MD ⁶¹, Mario Morais-Almeida MD ⁶², Ralph Mösges MD ⁶³, Joaquim Mullol MD ⁶⁴, Ruth Murray PhD ⁶⁵, Robert Naclerio MD ⁶⁶, Leyla Namazova-Baranova MD ⁶⁷, Ettore Novellino PhD ⁶⁸, Robyn E O'Hehir MD ⁶⁹, Ken Ohta MD ⁷⁰, Yoshitaka Okamoto MD ⁷¹, Ken Okubo MD ⁷², Gabrielle L Onorato MSc ², Susanna Palkonen MD ³¹, Petr Panzner MD ⁷³, Nikos G Papadopoulos MD ⁷⁴, Hae-Sim Park MD ⁷⁵, Ema Paulino PhD ⁷⁶, Ruby Pawankar MD ⁷⁷, Oliver Pfaar MD ^{78,79}, Davor Plavec MD ⁸⁰, Ted A Popov MD ⁸¹, Paul Potter MD ⁸², Emmanuel P Prokopakis MD ⁸³, Menachem Rottem MD ⁸⁴, Dermot Ryan MD ⁸⁵, Johanna Salimäki MSc ⁸⁶, Boleslaw Samolinski MD ⁸⁷, Mario Sanchez-Borges MD ⁸⁸, Holger J Schunemann MD ¹⁹, Aziz Sheikh MD ⁸⁹, Juan-Carlos Sisul MD ⁹⁰, Rojin Rajabian-Söderlund PhD ⁹¹, Talant Sooronbaev MD ⁹², Cristiana Stellato MD ³², Teresa To PhD ⁹³, Ana-Maria Todo-Bom MD ⁹⁴, Peter-Valentin Tomazic MD ⁹⁵, Sanna Toppila-Salmi MD ⁴¹, Antonio Valero MD ⁹⁶, Arunas Valiulis MD ⁹⁷, Erkka Valovirta MD ⁹⁸, Maria-Teresa Ventura MD ⁹⁹, Martin Wagenmann MD ¹⁰⁰, De Yun Wang MD ¹⁰¹, Dana Wallace MD ¹⁰², Susan Wasserman MD ¹⁰³, Magnus Wickman MD ¹⁰⁴, Arzu Yorgancioglu MD ¹⁰⁵, Luo Zhang MD ¹⁰⁶, Nanshan Zhong MD ¹⁰⁷, Mihaela Zidarn MD ¹⁰⁸, Torsten Zuberbier MD ¹⁰⁹, MASK study group

1. University Hospital, Montpellier, France.
2. MACVIA-France, Fondation partenariale FMC VIA-LR, Montpellier, France.
3. VIMA. INSERM U 1168, VIMA : Ageing and chronic diseases Epidemiological and public health approaches, Villejuif, Université Versailles St-Quentin-en-Yvelines, UMR-S 1168, Montigny le Bretonneux, France and Euforea, Brussels, Belgium.
4. Laboratory of Clinical Immunology, Department of Microbiology and Immunology, KU Leuven, Leuven, Belgium.
5. Transylvania University Brasov, Brasov, Romania.
6. Epidemiology of Allergic and Respiratory Diseases, Department Institute Pierre Louis of Epidemiology and Public Health, INSERM and UPMC Sorbonne Université, Medical School Saint Antoine, Paris, France
7. Department of Allergy and Immunology, Hospital Quirón Bizkaia, Erandio, Spain.
8. ISGlobal, Centre for Research in Environmental Epidemiology (CREAL), Barcelona, Spain.
9. IMIM (Hospital del Mar Research Institute), Barcelona, Spain.
10. CIBER Epidemiología y Salud Pública (CIBERESP), Barcelona, Spain.
11. Universitat Pompeu Fabra (UPF), Barcelona, Spain.
12. Upper Airways Research Laboratory, ENT Dept, Ghent University Hospital, Ghent, Belgium.
13. Department of Medicine, University of Cape Town, Cape Town, South Africa.
14. Dept of Respiratory Medicine, National Institute of Diseases of the Chest and Hospital, Dhaka, Bangladesh.

- 53 15. iQ4U Consultants Ltd, London, UK.
- 54 16. Department of Dermatology and Allergy Centre, Odense University Hospital, Odense Research
- 55 Center for Anaphylaxis (ORCA), Odense, Denmark.
- 56 17. Woolcock Institute of Medical Research, University of Sydney and Woolcock Emphysema Centre
- 57 and Local Health District, Glebe, NSW, Australia.
- 58 18. Allergist, La Rochelle, France.
- 59 19. Department of Health Research Methods, Evidence, and Impact, Division of Immunology and
- 60 Allergy, Department of Medicine, McMaster University, Hamilton, ON, Canada.
- 61 20. Department of Medical Sciences, Allergy and Clinical Immunology Unit, University of Torino &
- 62 Mauriziano Hospital, Torino, Italy.
- 63 21. Personalized Medicine Clinic Asthma & Allergy, Humanitas University, Humanitas Research
- 64 Hospital, Rozzano, Milan, Italy.
- 65 22. Allergy Section, Department of Internal Medicine, Hospital Vall d'Hebron, Barcelona, Spain and
- 66 ARADyAL Spanish Research Network, Barcelona, Spain.
- 67 23. Division of Allergy/Immunology, University of South Florida, Tampa, Fla.
- 68 24. Allergy and Immunology Laboratory, Metropolitan University, Simon Bolívar University,
- 69 Barranquilla, Colombia and SLaa, Sociedad Latinoamericana de Alergia, Asma e Immunologia,
- 70 Branquilla, Columbia.
- 71 25. Department of Public Health and Primary Care, Leiden University Medical Center, Leiden, The
- 72 Netherlands
- 73 26. SOS Allergology and Clinical Immunology, USL Toscana Centro, Prato, Italy.
- 74 27. Life and Health Sciences Research Institute (ICVS), School of Medicine, University of Minho, Braga,
- 75 Portugal; ICVS/3B's, PT Government Associate Laboratory, Braga/Guimarães, Portugal.
- 76 28. UCIBIO, REQUINTE, Faculty of Pharmacy and Competence Center on Active and Healthy Ageing of
- 77 University of Porto (Porto4Ageing), Porto, Portugal.
- 78 29. ProAR – Nucleo de Excelencia em Asma, Federal University of Bahia, Brasil and WHO GARD
- 79 Planning Group, Brazil.
- 80 30. Medical Consulting Czarlewski, Levallois, France.
- 81 EFA European Federation of Allergy and Airways Diseases Patients' Associations, Brussels,
- 82 Belgium
- 83 32. Department of Medicine, Surgery and Dentistry "Scuola Medica Salernitana", University of
- 84 Salerno, Salerno, Italy.
- 85 33. Department of Respiratory Diseases, Montpellier University Hospital, France.
- 86 34. Laboratoire de Pharmacologie Respiratoire UPRES EA220, Hôpital Foch, Suresnes, Université
- 87 Versailles Saint-Quentin, Université Paris Saclay, France
- 88 35. Section of Allergy and Immunology, Saint Louis University School of Medicine, Saint Louis,
- 89 Missouri, USA.
- 90 36. Pediatric Allergy and Immunology Unit, Children's hospital, Ain Shams University, Cairo, Egypt.
- 91 37. CINTESIS, Center for research in health technologies and information systems, Faculdade de
- 92 Medicina da Universidade do Porto, Porto, Portugal and MEDIDA, Lda, Porto, Portugal.
- 93 38. Allergist, Reims, France.
- 94 39. Department of Otorhinolaryngology, Academic Medical Centres, AMC, Amsterdam, the
- 95 Netherlands.
- 96 40. Immunology and Allergy Division, Clinical Hospital, University of Chile, Santiago, Chile.
- 97 41. Skin and Allergy Hospital, Helsinki University Hospital and University of Helsinki, Helsinki,
- 98 Finland.
- 99 42. Division for Health Innovation, Campania Region and Federico II University and Hospital Naples
- 100 (DISMET and R1D Unit) Naples, Italy
- 101 43. Servicio de Alergia e Immunologia, Clinica Santa Isabel, Buenos Aires, Argentina.
- 102 44. Allergology department, Centre de l'Asthme et des Allergies Hôpital d'Enfants Armand-Trousseau
- 103 (APHP); Sorbonne Université, UPMC Univ Paris 06, UMR_S 1136, Institut Pierre Louis
- 104 d'Epidémiologie et de Santé Publique, Equipe EPAR, Paris, France.
- 105 45. Ukrainina Medical Stomatological Academy, Poltava, Ukraine.
- 106 46. National Research Center, Institute of Immunology, Federal Medicobiological Agency, Laboratory
- 107 of Molecular immunology, Moscow, Russian Federation.
- 108 47. Pediatric Allergy and Asthma Unit, Hacettepe University School of Medicine, Ankara, Turkey.
- 109 48. Institute of Social Medicine, Epidemiology and Health Economics, Charité - Universitätsmedizin
- 110 Berlin, Berlin, and Institute for Clinical Epidemiology and Biometry, University of Wuerzburg,
- 111 Germany

- 112 49. Center for Rhinology and Allergology, Wiesbaden, Germany.
- 113 50. Department of Immunology and Allergy, Healthy Ageing Research Center, Medical University of
- 114 Lodz, Poland.
- 115 51. Division of Internal Medicine, Asthma and Allergy, Barlicki University Hospital, Medical University
- 116 of Lodz, Poland.
- 117 52. Faculty of Medicine, Vilnius University, Vilnius, Lithuania.
- 118 53. Center of Excellence in Asthma and Allergy, Médica Sur Clinical Foundation and Hospital, México
- 119 City, Mexico.
- 120 54. Kyomed, Montpellier, France.
- 121 55. University of Medicine and Pharmacy, Hochiminh City, Vietnam.
- 122 56. Oslo University Hospital, Department of Paediatrics, Oslo, and University of Oslo, Faculty of
- 123 Medicine, Institute of Clinical Medicine, Oslo, Norway.
- 124 57. Faculty of Health Sciences and CICS – UBI, Health Sciences Research Centre, University of Beira
- 125 Interior, Covilhã, Portugal.
- 126 58. Department of Pulmonary Medicine, Rashid Hospital, Dubai, UAE.
- 127 59. DG for Health & Social Care, Scottish Government, Edinburgh, UK.
- 128 60. CIRFF, Federico II University, Naples, Italy.
- 129 61. Clinic for Pulmonary Diseases, Clinical Center of Serbia, Faculty of Medicine, University of
- 130 Belgrade, Serbian Association for Asthma and COPD, Belgrade, Serbia.
- 131 62. Allergy Center, CUF Descobertas Hospital, Lisbon, Portugal
- 132 63. Institute of Medical Statistics, and Computational Biology, Medical Faculty, University of Cologne,
- 133 Germany and CRI-Clinical Research International-Ltd, Hamburg, Germany.
- 134 64. Rhinology Unit & Smell Clinic, ENT Department, Hospital Clínic; Clinical & Experimental
- 135 Respiratory Immunoallergy, IDIBAPS, CIBERES, University of Barcelona, Spain.
- 136 65. Director, Medical Communications Consultant, MedScript Ltd, Dundalk, Co Louth, Ireland.
- 137 66. Johns Hopkins School of Medicine, Baltimore, Maryland, USA.
- 138 67. Scientific Centre of Children's Health under the MoH, Moscow, Russia
- 139 68. Director of Department of Pharmacy of University of Naples Federico II, Naples, Italy.
- 140 69. OHEHIR. Department of Allergy, Immunology and Respiratory Medicine, Alfred Hospital and
- 141 Central Clinical School, Monash University, Melbourne, Victoria, Australia; Department of
- 142 Immunology, Monash University, Melbourne, Victoria, Australia.
- 143 70. National Hospital Organization, Tokyo National Hospital, Tokyo, Japan.
- 144 71. Dept of Otorhinolaryngology, Chiba University Hospital, Chiba, Japan.
- 145 72. Dept of Otolaryngology, Nippon Medical School, Tokyo, Japan.
- 146 73. Department of Immunology and Allergology, Faculty of Medicine in Pilsen, Charles University
- 147 Prague, Czech Republic.
- 148 74. Center for Pediatrics and Child Health, Institute of Human Development, Royal Manchester
- 149 Children's Hospital, University of Manchester, Manchester, UK and Allergy Department, 2nd
- 150 Pediatric Clinic, Athens General Children's Hospital "P&A Kyriakou," University of Athens, Athens,
- 151 Greece
- 152 75. Department of Allergy and Clinical Immunology, Ajou University School of Medicine, Suwon,
- 153 South Korea.
- 154 76. Farmacias Holon, Lisbon, Portugal.
- 155 77. Department of Pediatrics, Nippon Medical School, Tokyo, Japan.
- 156 78. Center for Rhinology and Allergology, Wiesbaden, Germany.
- 157 79. Department of Otorhinolaryngology, Head and Neck Surgery, Universitätsmedizin Mannheim,
- 158 Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany.
- 159 80. Children's Hospital Srebrnjak, Zagreb, School of Medicine, University J.J. Strossmayer, Osijek,
- 160 Croatia.
- 161 81. University Hospital 'Sv Ivan Rilski', Sofia, Bulgaria.
- 162 82. Allergy Diagnostic and Clinical Research Unit, University of Cape Town Lung Institute, Cape Town,
- 163 South Africa.
- 164 83. Department of Otorhinolaryngology University of Crete School of Medicine, Heraklion, Greece.
- 165 84. Division of Allergy Asthma and Clinical Immunology, Emek Medical Center, Afula, Israel.
- 166 85. Honorary Clinical Research Fellow, Allergy and Respiratory Research Group, The University of
- 167 Edinburgh, Edinburgh, Past President SLAAI, FACAII, UK.
- 168 86. Association of Finnish Pharmacies, Finland.
- 169 87. Department of Prevention of Environmental Hazards and Allergology, Medical University of
- 170 Warsaw, Poland.

88. Allergy and Clinical Immunology Department, Centro Médico-Docente la, Trinidad and Clínica El Avila, Caracas, Venezuela.
89. The Usher Institute of Population Health Sciences and Informatics, The University of Edinburgh, Edinburgh, UK.
90. Sociedad Paraguaya de Alergia Asma e Inmunología, Paraguay.
91. Department of Nephrology and Endocrinology, Karolinska University Hospital, Stockholm, Sweden.
92. Kyrgyzstan National Centre of Cardiology and Internal medicine, Euro-Asian respiratory Society, Bishkek, Kyrgyzstan.
93. Sidkkids hospitala and Institute of Health Policy, Management and Evaluation, Toronto, Canada.
94. Imunoalergologia, Centro Hospitalar Universitário de Coimbra and Faculty of Medicine, University of Coimbra, Portugal.
95. Department of ENT, Medical University of Graz, Austria.
96. Pneumology and Allergy Department CIBERES and Clinical & Experimental Respiratory Immunoallergy, IDIBAPS, University of Barcelona, Spain.
97. Vilnius University Institute of Clinical Medicine, Clinic of Children's Diseases, and Institute of Health Sciences, Department of Public Health, Vilnius, Lithuania; European Academy of Paediatrics (EAP/UEMS-SP), Brussels, Belgium.
98. Department of Lung Diseases and Clinical Immunology Allergology, University of Turku and Terveystalo allergy clinic, Turku, Finland.
99. University of Bari Medical School, Unit of Geriatric Immunoallergology, Bari, Italy.
100. Dept of Otorhinolaryngology, Universitätsklinikum Düsseldorf, Germany
101. Department of Otolaryngology, Yong Loo Lin School of Medicine, National University of Singapore, Singapore, Singapore.
102. Nova Southeastern University, Fort Lauderdale, Florida, USA.
103. Department of Medicine, Clinical Immunology and Allergy, McMaster University, Hamilton, Ontario, Canada.
104. Centre for Clinical Research Sörmland, Uppsala University, Eskilstuna, Sweden.
105. Celal Bayar University Department of Pulmonology, Manisa, Turkey.
106. Department of Otolaryngology Head and Neck Surgery, Beijing TongRen Hospital and Beijing Institute of Otolaryngology, Beijing, China.
107. State Key Laboratory of Respiratory Diseases, Guangzhou Institute of Respiratory Disease, the First Affiliated Hospital of Guangzhou Medical University, Guangzhou, China.
108. University Clinic of Respiratory and Allergic Diseases, Golnik, Slovenia.
109. Comprehensive Allergy Center Charité, Department of Dermatology and Allergy, Charité - Universitätsmedizin Berlin; Global Allergy and Asthma European Network (GA²LEN), Berlin, Germany.

MASK Study group

J Bousquet ¹⁻³, PW Hellings ⁴, W Aberer ⁵, I Agache ⁶, CA Akdis ⁷, M Akdis ⁷, MR Alberti ⁸, R Almeida⁹, F Amat ¹⁰, R Angles ¹¹, I Annesi-Maesano ¹², IJ Ansotegui ¹³, JM Anto ¹⁴⁻¹⁷, S Arnavielle ¹⁸, E Asayag ¹⁹, A Asarnoj ²⁰, H Arshad ²¹, F Avolio ²², E Bacci ²³, C Bachert ²⁴, I Baiardini ²⁵, C Barbara ²⁶, M Barbagallo ²⁷, I Baroni ²⁸, BA Barreto ²⁹, X Basagana ¹⁴, ED Bateman ³⁰, M Bedolla-Barajas ³¹, A Bedbrook ², M Bewick ³², B Begh  ³³, EH Bel ³⁴, KC Bergmann ³⁵, KS Bennoor ³⁶, M Benson ³⁷, L Bertorello ²³, AZ Bia oszewski ³⁸, T Bieber ³⁹, S Bialek ⁴⁰, C Bindeslev-Jensen ⁴¹, L Bjermer ⁴², H Blain ^{43,44}, F Blasi ⁴⁵, A Blua ⁴⁶, M Bochenska Marciniak ⁴⁷, I Bogus-Buczynska ⁴⁷, AL Boner ⁴⁸, M Bonini ⁴⁹, S Bonini ⁵⁰, CS Bosnic-Anticevich ⁵¹, I Bosse ⁵², J Bouchard ⁵³, LP Boulet ⁵⁴, R Bourret ⁵⁵, PJ Bousquet ¹², F Braid  ²⁵, V Briedis ⁵⁶, CE Brightling ⁵⁷, J Brozek ⁵⁸, C Bucca ⁵⁹, R Buhl ⁶⁰, R Buonaiuto ⁶¹, C Panaitescu ⁶², MT Burguete Caba as ⁶³, E Burte ³, A Bush ⁶⁴, F Caballero-Fonseca ⁶⁵, D Caillot ⁶⁷, D Caimmi ⁶⁸, MA Calderon ⁶⁹, PAM Camargos ⁷⁰, T Camuzat ⁷¹, G Canfora ⁷², GW Canonica ²⁵, V Cardona ⁷³, KH Carlsen ⁷⁴, P Carreiro-Martins ⁷⁵, AM Carriazo ⁷⁶, W Carr ⁷⁷, C Cartier ⁷⁸, T Casale ⁷⁹, G Castellano ⁸⁰, L Cecchi ⁸¹, AM Cepeda Sarabia ⁸², NH Chavannes ⁸³, Y Chen ⁸⁴, R Chiron ⁶⁸, T Chivato ⁸⁵, E Chkhartishvili ⁸⁶, AG Chuchalin ⁸⁷, KF Chung ⁸⁸, MM Ciaravolo ⁸⁹, A Cicceran ⁹⁰, C Cingi ⁹¹, G Ciprandi ⁹², AC Carvalho Coelho ⁹³, L Colas ⁹⁴, E Colgan ⁹⁵, J Coll ⁹⁶, D Conforti ⁹⁷, J Correia de Sousa ⁹⁸, RM Cort s-Grimaldo ⁹⁹, F Corti ¹⁰⁰, E Costa ¹⁰¹, MC Costa-Dominguez ¹⁰², AL Courbis ¹⁰³, L Cox ¹⁰⁴, M Crescenzo ¹⁰⁵, AA Cruz ¹⁰⁶, A Custovic ¹⁰⁷, W Czarlewski ¹⁰⁸, SE Dahlen ¹⁰⁹, C Dario ¹¹⁰, J da Silva ¹¹¹, Y Dauvilliers ¹¹², U Darsow ¹¹³, F De Blay ¹¹⁴, G De Carlo ¹¹⁵, T Dedeu ¹¹⁶, M de F tima Emerson ¹¹⁷, G De Feo ¹¹⁸, G De Vries ¹¹⁹, B De Martino, ¹²⁰ N de Paula Motta Rubini ¹²¹, D Deleanu ¹²², P Demoly ^{12,68}, JA Denburg ¹²³, P Devillier ¹²⁴, S Di Capua Ercolano ¹²⁵, N Di Carluccio ⁶⁶, A Didier ¹²⁶, D Dokic ¹²⁷, MG Dominguez-Silva ¹²⁸, H Douagui ¹²⁹, G

Dray ¹⁰³, R Dubakiene ¹³⁰, SR Durham ¹³¹, G Du Toit ¹³², MS Dykewicz ¹³³, Y El-Gamal ¹³⁴, P Eklund ¹³⁵, E Eller ⁴¹, R Emuzyte ¹³⁶, J Farrell ⁹⁵, A Farsi ⁸¹, J Ferreira de Mello Jr ¹³⁷, J Ferrero ¹³⁸, A Fink-Wagner ¹³⁹, A Fiocchi ¹⁴⁰, WJ Fokkens ¹⁴¹, JA Fonseca ¹⁴², JF Fontaine ¹⁴³, S Forti ⁹⁷, JM Fuentes-Perez ¹⁴⁴, JL Gálvez-Romero ¹⁴⁵, A Gamkrelidze ¹⁴⁶, J Garcia-Aymerich ¹⁴, CY García-Cobas ¹⁴⁷, MH Garcia-Cruz ¹⁴⁸, B Gemicioğlu ¹⁴⁹, S Genova ¹⁵⁰, C George ¹⁵¹, JE Gereda ¹⁵², R Gerth van Wijk ¹⁵³, RM Gomez ¹⁵⁴, J Gómez-Vera ¹⁵⁵, S González Diaz ¹⁵⁶, M Gotua ¹⁵⁷, I Grisle ¹⁵⁸, M Guidacci ¹⁵⁹, NA Guldemond ¹⁶⁰, Z Gutter ¹⁶¹, MA Guzmán ¹⁶², T Haahtela ¹⁶³, J Hajjam ¹⁶⁴, L Hernández ¹⁶⁵, JO'B Hourihane ¹⁶⁶, YR Huerta-Villalobos ¹⁶⁷, M Humbert ¹⁶⁸, G Iaccarino ¹⁶⁹, M Illario ¹⁷⁰, JC Ivancevich ¹⁷¹, EJ Jares ¹⁷², E Jassem ¹⁷³, SL Johnston ¹⁷⁴, G Joos ¹⁷⁵, KS Jung ¹⁷⁶, M Jutel ¹⁷⁷, I Kaidashev ¹⁷⁸, O Kalayci ¹⁷⁹, AF Kalyoncu ¹⁸⁰, J Karjalainen ¹⁸¹, P Kardas ¹⁸², T Keil ¹⁸³, PK Keith ¹⁸⁴, M Khaitov ¹⁸⁵, N Khaltayev ¹⁸⁶, J Kleine-Tebbe ¹⁸⁷, L Klimek ¹⁸⁸, ML Kowalski ¹⁸⁹, M Kuitunen ¹⁹⁰, I Kull ¹⁹¹, P Kuna ⁴⁷, M Kupczyk ⁴⁷, V Kvedariene ¹⁹², E Krzych-Fałta ¹⁹³, P Lacwik ⁴⁷, D Larenas-Linnemann ¹⁹⁴, D Laune ¹⁸, D Lauri ¹⁹⁵, J Lavrut ¹⁹⁶, LTT Le ¹⁹⁷, M Lessa ¹⁹⁸, G Levato ¹⁹⁹, J Li ²⁰⁰, P Lieberman ²⁰¹, A Lipiec ¹⁹³, B Lipworth ²⁰², KC Lodrup Carlsen ²⁰³, R Louis ²⁰⁴, O Lourenço ²⁰⁵, JA Luna-Pech ²⁰⁶, K Maciej ⁴⁷, A Magnan ⁹⁴, B Mahboub ²⁰⁷, D Maier ²⁰⁸, A Mair ²⁰⁹, I Majer ²¹⁰, J Malva ²¹¹, E Mandajieva ²¹², P Manning ²¹³, E De Manuel Keenoy ²¹⁴, GD Marshall ²¹⁵, MR Masjedi ²¹⁶, JF Maspero ²¹⁷, E Mathieu-Dupas ¹⁸, JJ Matta Campos ²¹⁸, AL Matos ²¹⁹, M Maurer ²²⁰, S Mavale-Manuel ²²¹, O Mayora ⁹⁷, MA Medina-Avalos ²²², E Melén ²²³, E Melo-Gomes ²⁶, EO Meltzer ²²⁴, E Menditto ²²⁵, J Mercier ²²⁶, N Miculinic ²²⁷, F Mihaltan ²²⁸, B Milenkovic ²²⁹, G Moda ²³⁰, MD Mogica-Martinez ²³¹, Y Mohammad ²³², I Momas ^{233,234}, S Montefort ²³⁵, R Monti ²³⁶, D Mora Bogado ²³⁷, M Morais-Almeida ²³⁸, FF Morato-Castro ²³⁹, R Mösges ²⁴⁰, A Mota-Pinto ²⁴¹, P Moura Santo ²⁴², J Mullol ²⁴³, L Münter ²⁴⁴, A Muraro ²⁴⁵, R Murray ²⁴⁶, R Naclerio ²⁴⁷, R Nadif ³, M Nalin ²⁸, L Napoli ²⁴⁸, L Namazova-Baranova ²⁴⁹, H Neffen ²⁵⁰, V Niedeberger ²⁵¹, K Nekam ²⁵², A Neou ²⁵³, A Nieto ²⁵⁴, L Nogueira-Silva ²⁵⁵, M Nogueira ^{2,256}, E Novellino ²⁵⁷, TD Nyembue ²⁵⁸, RE O'Hehir ²⁵⁹, C Odzhakova ²⁶⁰, K Ohta ²⁶¹, Y Okamoto ²⁶², K Okubo ²⁶³, GL Onorato ², M Ortega Cisneros ²⁶⁴, S Ouedraogo ²⁶⁵, I Pali-Schöll ²⁶⁶, S Palkonen ¹¹⁵, P Panzner ²⁶⁷, NG Papadopoulos ²⁶⁸, HS Park ²⁶⁹, A Papi ²⁷⁰, G Passalacqua ²⁷¹, E Paulino ²⁷², R Pawankar ²⁷³, S Pedersen ²⁷⁴, JL Pépin ²⁷⁵, AM Pereira ²⁷⁶, M Persico ²⁷⁷, O Pfaar ^{278,279}, J Phillips ²⁸⁰, R Picard ²⁸¹, B Pigearias ²⁸², I Pin ²⁸³, C Pitsios ²⁸⁴, D Plavec ²⁸⁵, W Pohl ²⁸⁶, TA Popov ²⁸⁷, F Portejoie ², P Potter ²⁸⁸, AC Pozzi ²⁸⁹, D Price ²⁹⁰, EP Prokopakis ²⁹¹, R Puy ²⁵⁹, B Pugin ²⁹², RE Pulido Ross ²⁹³, M Przemecka ⁴⁷, KF Rabe ²⁹⁴, F Raciborski ¹⁹³, R Rajabian-Soderlund ²⁹⁵, S Reitsma ¹⁴¹, I Ribeirinho ²⁹⁶, J Rimmer ²⁹⁷, D Rivero-Yeverino ²⁹⁸, JA Rizzo ²⁹⁹, MC Rizzo ³⁰⁰, C Robalo-Cordeiro ³⁰¹, F Rodenas ³⁰², X Rodo ¹⁴, M Rodriguez Gonzalez, ³⁰³, L Rodriguez-Mañas ³⁰⁴, C Rolland ³⁰⁵, S Rodrigues Valle ³⁰⁶, M Roman Rodriguez ³⁰⁷, A Romano ³⁰⁸, E Rodriguez-Zagal ³⁰⁹, G Rolla ³¹⁰, RE Roller-Wirnsberger ³¹¹, M Romano ²⁸, J Rosado-Pinto ³¹², N. Rosario ³¹³, M Rottem ³¹⁴, D Ryan ³¹⁵, H Sagara ³¹⁶, J Salimäki ³¹⁷, B Samolinski ¹⁹³, M Sanchez-Borges ³¹⁸, J Sastre-Dominguez ³¹⁹, GK Scadding ³²⁰, HJ Schunemann ⁵⁸, N Scichilone ³²¹, P Schmid-Grendelmeier ³²², FS Serpa ³²³, S Shamai ²⁴⁰, A Sheikh ³²⁴, M Sierra ⁹⁶, FER Simons ³²⁵, V Siroux ³²⁶, JC Sisul ³²⁷, I Skrindo ³⁷⁸, D Solé ³²⁸, D Somekh ³²⁹, M Sondermann ³³⁰, T Sooronbaev ³³¹, M Sova ³³², M Sorensen, ³³³ M Sorlini ³³⁴, O Spranger ¹³⁹, C Stellato ¹¹⁸, R Stelmach ³³⁵, R Stukas ³³⁶, J Sunyer ¹⁴⁻¹⁷, J Strozek ¹⁹³, A Szylling ¹⁹³, JN Tebyrićá ³³⁷, M Thibaudon ³³⁸, T To ³³⁹, A Todo-Bom ³⁴⁰, PV Tomazic ³⁴¹, S Toppila-Salmi ¹⁶³, U Trama ³⁴², M Triggiani ¹¹⁸, C Suppli Ulrik ³⁴³, M Urrutia-Pereira ³⁴⁴, R Valenta ³⁴⁵, A Valero ³⁴⁶, A Valiulis ³⁴⁷, E Valovirta ³⁴⁸, M van Eerd ¹¹⁹, E van Ganse ³⁴⁹, M van Hague ³⁵⁰, O Vandenplas ³⁵¹, MT Ventura ³⁵², G Vezzani ³⁵³, T Vasankari ³⁵⁴, A Vatrella ¹¹⁸, MT Verissimo ²¹¹, F Viart ⁷⁸, M Viegi ³⁵⁵, D Vicheva ³⁵⁶, T Vontetsianos ³⁵⁷, M Wagenmann ³⁵⁸, S Walker ³⁵⁹, D Wallace ³⁶⁰, DY Wang ³⁶¹, S Wasserman ³⁶², T Werfel ³⁶³, M Westman ³⁶⁴, M Wickman ¹⁹¹, DM Williams ³⁶⁵, S Williams ³⁶⁶, N Wilson, J Wright ³⁶⁷, P Wroczynski ⁴⁰, P Yakovliev ³⁶⁸, BP Yawn ³⁶⁹, PK Yiallourous ³⁷⁰, A Yorgancioglu ³⁷¹, OM Yusuf ³⁷², HJ Zar ³⁷³, L Zhang ³⁷⁴, N Zhong ²⁰⁰, ME Zernotti ³⁷⁵, M Zidarn ³⁷⁶, T Zuberbier ³⁵, C Zubrinich ²⁵⁹, A Zurkühlen ³⁷⁷

MASK STUDY GROUP:

1. University Hospital, Montpellier, France.
2. MACVIA-France, Fondation partenariale FMC VIA-LR, Montpellier, France.
3. VIMA. INSERM U 1168, VIMA : Ageing and chronic diseases Epidemiological and public health approaches, Villejuif, Université Versailles St-Quentin-en-Yvelines, UMR-S 1168, Montigny le Bretonneux, France and Euforea, Brussels, Belgium.
4. Laboratory of Clinical Immunology, Department of Microbiology and Immunology, KU Leuven, Leuven, Belgium.
5. Department of Dermatology, Medical University of Graz, Graz, Austria.
6. Transylvania University Brasov, Brasov, Romania.
7. Swiss Institute of Allergy and Asthma Research (SIAF), University of Zurich, Davos, Switzerland.
8. Project Manager, Chairman of the Council of Municipality of Salerno, Italy.
9. Center for Health Technology and Services Research- CINTESIS, Faculdade de Medicina, Universidade do Porto; and Medida, Lda Porto, Portugal.

10. Allergology department, Centre de l'Asthme et des Allergies Hôpital d'Enfants Armand-Trousseau (APHP); Sorbonne Université, UPMC Univ Paris 06, UMR_S 1136, Institut Pierre Louis d'Epidémiologie et de Santé Publique, Equipe EPAR, Paris, France.
11. Innovación y nuevas tecnologías, Salud Sector sanitario de Barbastro, Barbastro, Spain.
12. Epidemiology of Allergic and Respiratory Diseases, Department Institute Pierre Louis of Epidemiology and Public Health, INSERM and UPMC Sorbonne Université, Medical School Saint Antoine, Paris, France
13. Department of Allergy and Immunology, Hospital Quirón Bizkaia, Erandio, Spain.
14. ISGlobAL, Centre for Research in Environmental Epidemiology (CREAL), Barcelona, Spain.
15. IMIM (Hospital del Mar Research Institute), Barcelona, Spain.
16. CIBER Epidemiología y Salud Pública (CIBERESP), Barcelona, Spain.
17. Universitat Pompeu Fabra (UPF), Barcelona, Spain.
18. Kyomed, Montpellier, France.
19. Argentine Society of Allergy and Immunopathology, Buenos Aires, Argentina.
20. Clinical Immunology and Allergy Unit, Department of Medicine Solna, Karolinska Institutet, Stockholm, and Astrid Lindgren Children's Hospital, Department of Pediatric Pulmonology and Allergy, Karolinska University Hospital, Stockholm, Sweden.
21. David Hide Asthma and Allergy Research Centre, Isle of Wight, United Kingdom.
22. Regionie Puglia, Bari, Italy.
23. Regione Liguria, Genoa, Italy.
24. Upper Airways Research Laboratory, ENT Dept, Ghent University Hospital, Ghent, Belgium.
25. Department of Biomedical Sciences, Humanitas University, Milan, Italy.
26. PNDR, Portuguese National Programme for Respiratory Diseases, Faculdade de Medicina de Lisboa, Lisbon, Portugal.
27. Director of the Geriatric Unit, Department of Internal Medicine (DIBIMIS), University of Palermo, Italy.
28. Telbios SRL, Milan, Italy.
29. Universidade do Estado do Pará, Belem, Brazil.
30. Department of Medicine, University of Cape Town, Cape Town, South Africa.
31. Hospital Civil de Guadalajara Dr Juan I Menchaca, Guadalajara, Mexico.
32. iQ4U Consultants Ltd, London, UK.
33. Section of Respiratory Disease, Department of Oncology, Haematology and Respiratory Diseases, University of Modena and Reggio Emilia, Modena, Italy.
34. Department of Respiratory Medicine, Academic Medical Center (AMC), University of Amsterdam, The Netherlands.
35. Charité - Universitätsmedizin Berlin; Berlin Institute of Health, Comprehensive Allergy Center, Department of Dermatology and Allergy, Global Allergy and Asthma European Network (GA²LEN), Berlin, Germany.
36. Deptt of Respiratory Medicine, National Institute of Diseases of the Chest and Hospital, Dhaka, Bangladesh.
37. Centre for Individualized Medicine, Department of Pediatrics, Faculty of Medicine, Linköping, Sweden.
38. Department of Prevention of Environmental Hazards and Allergology, Medical University of Warsaw, Poland.
39. BIEBER. Department of Dermatology and Allergy, Rheinische Friedrich-Wilhelms-University Bonn, Bonn, Germany
40. Dept of Biochemistry and Clinical Chemistry- Faculty of Pharmacy with the Division of Laboratory Medicine Division, Warsaw Medical University, Poland.
41. Department of Dermatology and Allergy Centre, Odense University Hospital, Odense Research Center for Anaphylaxis (ORCA), Odense, Denmark.
42. Department of Respiratory Medicine and Allergology, University Hospital, Lund, Sweden.
43. Department of Geriatrics, Montpellier University Hospital, Montpellier, France.
44. EA 2991, Euromov, University Montpellier, France.
45. Department of Pathophysiology and Transplantation, University of Milan, IRCCS Fondazione Ca'Granda Ospedale Maggiore Policlinico, Milan, Italy.
46. Argentine Association of Respiratory Medicine, Buenos Aires, Argentina.
47. Division of Internal Medicine, Asthma and Allergy, Barlicki University Hospital, Medical University of Lodz, Poland.
48. Pediatric Department, University of Verona Hospital, Verona, Italy.

- 348 49. Department of Public Health and Infectious Diseases, Sapienza University of Rome, Italy.
- 349 50. Second University of Naples and Institute of Translational Medicine, Italian National Research
- 350 Council.
- 351 51. Woolcock Institute of Medical Research, University of Sydney and Sydney Local Health District,
- 352 Glebe, NSW, Australia.
- 353 52. Allergist, La Rochelle, France.
- 354 53. Associate professor of clinical medicine, Laval's University, Quebec city, Head of medicine
- 355 department, Hôpital de la Malbaie, Quebec, Canada.
- 356 54. Quebec Heart and Lung Institute, Laval University, Québec City, Quebec, Canada.
- 357 55. Centre Hospitalier Valenciennes, France.
- 358 56. Head of Department of Clinical Pharmacy of Lithuanian University of Health Sciences, Kaunas,
- 359 Lithuania.
- 360 57. Institute of Lung Health, Respiratory Biomedical Unit, University Hospitals of Leicester NHS Trust,
- 361 Leicestershire, UK; Department of Infection, Immunity and Inflammation, University of Leicester,
- 362 Leicester, UK.
- 363 58. Department of Health Research Methods, Evidence, and Impact, Division of Immunology and
- 364 Allergy, Department of Medicine, McMaster University, Hamilton, ON, Canada.
- 365 59. Chief of the University Pneumology Unit- AOU Molinette, Hospital City of Health and Science of
- 366 Torino, Italy.
- 367 60. Universitätsmedizin der Johannes Gutenberg-Universität Mainz, Mainz, Germany.
- 368 61. Pharmacist, Municipality Pharmacy, Sarno, Italy.
- 369 62. University of Medicine and Pharmacy Victor Babes, Timisoara, Romania.
- 370 63. Instituto de Pediatria, Hospital Zambrano Hellion Tec de Monterrey, Monterrey, Mexico.
- 371 64. Imperial College and Royal Brompton Hospital, London, UK.
- 372 65. Centro Medico Docente La Trinidad, CaRacas, Venezuela.
- 373 66. Regional Director Assofarm Campania and Vice President of the Board of Directors of Cofaser,
- 374 Salerno, Italy
- 375 67. Service de pneumologie, CHU et université d'Auvergne, Clermont-Ferrand, France.
- 376 68. Department of Respiratory Diseases, Montpellier University Hospital, France.
- 377 69. Imperial College London - National Heart and Lung Institute, Royal Brompton Hospital NHS,
- 378 London, UK.
- 379 70. Federal University of Minas Gerais, Medical School, Department of Pediatrics, Belo Horizonte,
- 380 Brazil
- 381 71. Assitant Director General, Montpellier, Région Occitanie, France.
- 382 72. Mayor of Sarno and President of Salerno Province, Director, Anesthesiology Service, Sarno
- 383 "Martiri del Villa Malta" Hospital, Italy.
- 384 73. Allergy Section, Department of Internal Medicine, Hospital Vall d'Hebron, Barcelona, Spain and
- 385 ARADyAL Spanish Research Network, Barcelona, Spain.
- 386 74. Department of Paediatrics, Oslo University Hospital and University of Oslo, Oslo, Norway.
- 387 75. CEDOC, Integrated Pathophysiological Mechanisms Research Group, Nova Medical School, Campo
- 388 dos Martires da Patria, Lisbon, and Serviço de Imunoalergologia, Centro Hospitalar de Lisboa
- 389 Central, EPE, Lisbon, Portugal.
- 390 76. Regional Ministry of Health of Andalusia, Seville, Spain.
- 391 77. Allergy and Asthma Associates of Southern California, Mission Viejo, CA, USA.
- 392 78. ASA - Advanced Solutions Accelerator, Clapiers, France.
- 393 79. Division of Allergy/Immunology, University of South Florida, Tampa, Fla, USA.
- 394 80. Celentano pharmacy, Massa Lubrense, Italy.
- 395 81. SOS Allergology and Clinical Immunology, USL Toscana Centro, Prato, Italy.
- 396 82. Allergy and Immunology Laboratory, Metropolitan University, Simon Bolivar University,
- 397 Barranquilla, Colombia and SLaa, Sociedad Latinoamericana de Alergia, Asma e Immunologia,
- 398 Branquilla, Columbia.
- 399 83. Department of Public Health and Primary Care, Leiden University Medical Center, Leiden, The
- 400 Netherlands
- 401 84. Capital Institute of Pediatrics, Chaoyang district, Beijing, China.
- 402 85. School of Medicine, University CEU San Pablo, Madrid, Spain.
- 403 86. David Tvildiani Medical University - AIETI Highest Medical School, David Tatishvili Medical
- 404 Center Tbilisi, Georgia.
- 405 87. Pulmonology Research Institute FMBA, Moscow, Russia and GARD Executive Committee, Moscow,
- 406 Russia.

- 407 88. National Heart & Lung Institute, Imperial College, London, UK.
- 408 89. Specialist social worker, Sorrento, Italy.
- 409 90. Argentine Federation of Otorhinolaryngology Societies, Buenos Aires, Argentina.
- 410 91. Eskisehir Osmangazi University, Medical Faculty, ENT Department, Eskisehir, Turkey.
- 411 92. Medicine Department, IRCCS-Azienda Ospedaliera Universitaria San Martino, Genoa, Italy.
- 412 93. Universidade Federal da Bahia, Escola de Enfermagem, Brazil.
- 413 94. Plateforme Transversale d'Allergologie, Institut du Thorax, CHU de Nantes, Nantes, France.
- 414 95. LANUA International Healthcare Consultancy, Northern Ireland, UK.
- 415 96. Innovación y nuevas tecnologías, Salud Sector sanitario de Barbastro, Barbastro, Spain.
- 416 97. Innovation and Research Office, Department of Health and Social Solidarity, Autonomous
417 Province of Trento, Italy.
- 418 98. Life and Health Sciences Research Institute (ICVS), School of Medicine, University of Minho, Braga,
419 Portugal; ICVS/3B's, PT Government Associate Laboratory, Braga/Guimarães, Portugal.
- 420 99. Guadalajara, Mexico.
- 421 100. FIMMG (Federazione Italiana Medici di Medicina Generale), Milan, Italy.
- 422 101. UCIBIO, REQUINTE, Faculty of Pharmacy and Competence Center on Active and Healthy Ageing of
423 University of Porto (Porto4Ageing), Porto, Portugal.
- 424 102. Mexico City, Mexico.
- 425 103. IMT Mines Alès, Université Montpellier, Alès, France.
- 426 104. Department of Medicine, Nova Southeastern University, Davie, University of Miami Dept of
427 Medicine, Miami, Florida, USA.
- 428 105. Regional Director Assofarm Campania and Vice President of the Board of Directors of Cofaser,
429 Salerno, Italy.
- 430 106. ProAR – Nucleo de Excelencia em Asma, Federal University of Bahia, Brasil and WHO GARD
431 Planning Group, Brazil.
- 432 107. Centre for Respiratory Medicine and Allergy, Institute of Inflammation and Repair, University of
433 Manchester and University Hospital of South Manchester, Manchester, UK.
- 434 108. Medical Consulting Czarlewski, Levallois, France.
- 435 109. The Centre for Allergy Research, The Institute of Environmental Medicine, Karolinska Institutet,
436 Stockholm, Sweden.
- 437 110. Azienda Provinciale per i Servizi Sanitari di Trento (APSS-Trento), Italy.
- 438 111. Department of Internal Medicine and Allergy Clinic of Pr Plydoro Ernani de Sao Thiago University
439 Hospital, Federal University of Santa Catarina (UFSC), Florianópolis, SC, Brazil.
- 440 112. Sleep Unit, Department of Neurology, Hôpital Gui-de-Chauliac Montpellier, Inserm U1061, France.
- 441 113. Department of Dermatology and Allergy, Technische Universität München, Munich, Germany;
442 ZAUM-Center for Allergy and Environment, Helmholtz Center Munich, Technische Universität
443 München, Munich, Germany.
- 444 114. Allergy Division, Chest Disease Department, University Hospital of Strasbourg, Strasbourg, France.
- 445 115. EFA European Federation of Allergy and Airways Diseases Patients' Associations, Brussels,
446 Belgium
- 447 116. AQUAS, Barcelona, Spain & EUREGHA, European Regional and Local Health Association, Brussels,
448 Belgium
- 449 117. Policlínica Geral do Rio de Janeiro, Rio de Janeiro – Brasil
- 450 118. Department of Medicine, Surgery and Dentistry "Scuola Medica Salernitana", University of
451 Salerno, Salerno, Italy.
- 452 119. Peercode BV, Geldermalsen, The Netherlands.
- 453 120. Social workers coordinator, Sorrento, Italy.
- 454 121. Federal University of the State of Rio de Janeiro, School of Medicine and Surgery, Rio de Janeiro,
455 Brazil
- 456 122. Allergology and Immunology Discipline, "Iuliu Hatieganu" University of Medicine and Pharmacy,
457 Cluj-Napoca, Romania.
- 458 123. Department of Medicine, Division of Clinical Immunology and Allergy, McMaster University,
459 Hamilton, Ontario, Canada.
- 460 124. Laboratoire de Pharmacologie Respiratoire UPRES EA220, Hôpital Foch, Suresnes, Université
461 Versailles Saint-Quentin, Université Paris Saclay, France.
- 462 125. Farmacie Dei Golfi Group, Massa Lubrense, Italy.
- 463 126. Rangueil-Larrey Hospital, Respiratory Diseases Department, Toulouse, France.
- 464 127. University Clinic of Pulmology and Allergy, Medical Faculty Skopje, R Macedonia.
- 465 128. Mexico City, Mexico.

- 466 129. Service de Pneumo-Allergologie, Centre Hospitalo-Universitaire de Béni-Messous, Algiers, Algeria.
 467 130. Clinic of infectious, chest diseases, dermatology and allergology, Vilnius University, Vilnius,
 468 Lithuania.
 469 131. Allergy and Clinical Immunology National Heart and Lung Institute, Imperial College London, UK.
 470 132. Guy's and St Thomas' NHS Trust, Kings College London, UK.
 471 133. Section of Allergy and Immunology, Saint Louis University School of Medicine, Saint Louis,
 472 Missouri, USA.
 473 134. Pediatric Allergy and Immunology Unit, Children's Hospital, Ain Shams University, Cairo, Egypt.
 474 135. Department of Computing Science, Umeå University, Sweden and Four Computing Oy, Finland.
 475 136. Clinic of Children's Diseases, Faculty of Medicine, Vilnius University, Vilnius, Lithuania.
 476 137. University of São Paulo Medical School, Sao Paulo, Brazil
 477 138. Andalusian Agency for Healthcare Quality, Seville, Spain.
 478 139. Global Allergy and Asthma Platform GAAPP, Vienna, Austria.
 479 140. Division of Allergy, Department of Pediatric Medicine - The Bambino Gesù Children's Research
 480 Hospital Holy see, Rome, Italy.
 481 141. Department of Otorhinolaryngology, Academic Medical Centre, Amsterdam, the Netherlands.
 482 142. CINTESIS, Center for Research in Health Technologies and Information Systems, Faculdade da
 483 Medicina da Universidade do Porto, Porto, Portugal and MEDIDA, Lda, Porto, Portugal
 484 143. Allergist, Reims, France.
 485 144. Hospital general regional 1 "Dr Carlos Mc Gregor Sanchez Navarro" IMSS, Mexico City, Mexico.
 486 145. Regional hospital of ISSSTE, Puebla, Mexico.
 487 146. National Center for Disease Control and Public Health of Georgia, Tbilisi, Georgia.
 488 147. Guadalajara, Mexico.
 489 148. Allergy Clinic, National Institute of Respiratory Diseases, Mexico City, Mexico.
 490 149. Department of Pulmonary Diseases, Istanbul University, Cerrahpasa Faculty of Medicine, Turkey.
 491 150. Allergology unit, UHATEM "NIPirogov", Sofia, Bulgaria.
 492 151. Medical University, Faculty of Public Health, Sofia.
 493 152. Allergy and Immunology Division, Clinica Ricardo Palma, Lima, Peru.
 494 153. Department of Internal Medicine, section of Allergology, Erasmus MC, Rotterdam, The
 495 Netherlands.
 496 154. Allergy & Asthma Unit, Hospital San Bernardo Salta, Argentina.
 497 155. Allergy Clinic, Hospital Regional del ISSSTE 'Lic. López Mateos', Mexico City, Mexico.
 498 156. Head and Professor, Centro Regional de Excelencia CONACYT y WAO en Alergia, Asma e
 499 Inmunologia, Hospital Universitario, Universidad Autónoma de Nuevo León, Monterrey NL,
 500 Mexico.
 501 157. Center of Allergy and Immunology, Georgian Association of Allergology and Clinical Immunology,
 502 Tbilisi, Georgia.
 503 158. Latvian Association of Allergists, Center of Tuberculosis and Lung Diseases, Riga, Latvia.
 504 159. Federal District Base Hospital Institute, Brasília, Brazil.
 505 160. Institute of Health Policy and Management iBMG, Erasmus University, Rotterdam, The
 506 Netherlands
 507 161. University Hospital Olomouc – National eHealth Centre, Czech Republic.
 508 162. Immunology and Allergy Division, Clinical
 509 Hospital, University of Chile, Santiago, Chile.
 510 163. Skin and Allergy Hospital, Helsinki University Hospital, University of Helsinki, Helsinki, Finland.
 511 164. Centich : centre d'expertise national des technologies de l'information et de la
 512 communication pour l'autonomie, Gérontopôle autonomie longévité des Pays de la Loire, Conseil
 513 régional des Pays de la Loire, Centre d'expertise Partenariat Européen d'Innovation pour un
 514 vieillissement actif et en bonne santé, Nantes, France.
 515 165. Autonomous University of Baja California, Ensenada, Baja California, Mexico.
 516 166. Department of Paediatrics and Child Health, University College Cork, Cork, Ireland.
 517 167. Hospital General Regional 1 "Dr. Carlos MacGregor Sánchez Navarro" IMSS, Mexico City, Mexico.
 518 168. Université Paris-Sud; Service de Pneumologie, Hôpital Bicêtre; Inserm UMR_S999, Le Kremlin
 519 Bicêtre, France.
 520 169. Dipartimento di medicina, chirurgia e odontoiatria, università di Salerno, Italy.
 521 170. Division for Health Innovation, Campania Region and Federico II University Hospital Naples (R&D
 522 and DISMET) Naples, Italy.
 523 171. Servicio de Alergia e Inmunologia, Clinica Santa Isabel, Buenos Aires, Argentina.
 524 172. President, Libra Foundation, Buenos Aires, Argentina.

- 525 173. Medical University of Gdańsk, Department of Allergology, Gdansk, Poland.
- 526 174. Airway Disease Infection Section, National Heart and Lung Institute, Imperial College; MRC &
- 527 Asthma UK Centre in Allergic Mechanisms of Asthma, London, UK.
- 528 175. Dept of Respiratory Medicine, Ghent University Hospital, Ghent, Belgium.
- 529 176. Hallym University College of Medicine, Hallym University Sacred Heart Hospital, Gyeonggi-do,
- 530 South Korea.
- 531 177. Department of Clinical Immunology, Wrocław Medical University, Poland.
- 532 178. Ukrainina Medical Stomatological Academy, Poltava, Ukraine.
- 533 179. Pediatric Allergy and Asthma Unit, Hacettepe University School of Medicine, Ankara, Turkey.
- 534 180. Hacettepe University, School of Medicine, Department of Chest Diseases, Immunology and Allergy
- 535 Division, Ankara, Turkey.
- 536 181. Allergy Centre, Tampere University Hospital, Tampere, Finland.
- 537 182. First Department of Family Medicine, Medical University of Lodz, Poland.
- 538 183. Institute of Social Medicine, Epidemiology and Health Economics, Charité - Universitätsmedizin
- 539 Berlin, Berlin, and Institute for Clinical Epidemiology and Biometry, University of Wuerzburg,
- 540 Germany.
- 541 184. Department of Medicine, McMaster University, Health Sciences Centre 3V47, West, Hamilton,
- 542 Ontario, Canada.
- 543 185. National Research Center, Institute of Immunology, Federal Medicobiological Agency, Laboratory
- 544 of Molecular immunology, Moscow, Russian Federation.
- 545 186. GARD Chairman, Geneva, Switzerland.
- 546 187. Allergy & Asthma Center Westend, Berlin, Germany.
- 547 188. Center for Rhinology and Allergology, Wiesbaden, Germany.
- 548 189. Department of Immunology, Rheumatology and Allergy, Medical University of Lodz, and HARC,
- 549 Poland.
- 550 190. Children's Hospital and University of Helsinki, Finland.
- 551 191. Department of Clinical Science and Education, Södersjukhuset, Karlinska Institutet, Stockholm
- 552 and Sach's Children and Youth Hospital, Södersjukhuset, Stockholm, Sweden.
- 553 192. Faculty of Medicine, Vilnius University, Vilnius, Lithuania.
- 554 193. Department of Prevention of Environmental Hazards and Allergology, Medical University of
- 555 Warsaw, Poland.
- 556 194. Center of Excellence in Asthma and Allergy, Médica Sur Clinical Foundation and Hospital, México
- 557 City, Mexico.
- 558 195. Presidente CMMC, Milano, Italy.
- 559 196. Head of the Allergy Department of Pedro de Elizalde Children's Hospital, Buenos Aires, Argentina.
- 560 197. University of Medicine and Pharmacy, Hochiminh City, Vietnam.
- 561 198. Federal University of Bahia, Brazil.
- 562 199. Sifmed, Milano, Italy.
- 563 200. State Key Laboratory of Respiratory Diseases, Guangzhou Institute of Respiratory Disease, the
- 564 First Affiliated Hospital of Guangzhou Medical University, Guangzhou, China.
- 565 201. Departments of Internal Medicine and Pediatrics (Divisions of Allergy and Immunology),
- 566 University of Tennessee College of Medicine, Germantown, TN, USA.
- 567 202. Scottish Centre for Respiratory Research, Cardiovascular & Diabetes Medicine, Medical Research
- 568 Institute, Ninewells Hospital, University of Dundee, UK.
- 569 203. Oslo University Hospital, Department of Paediatrics, Oslo, and University of Oslo, Faculty of
- 570 Medicine, Institute of Clinical Medicine, Oslo, Norway.
- 571 204. Department of Pulmonary Medicine, CHU Sart-Tilman, and GIGA I3 research group, Liege,
- 572 Belgium.
- 573 205. Faculty of Health Sciences and CICS – UBI, Health Sciences Research Centre, University of Beira
- 574 Interior, Covilhã, Portugal.
- 575 206. Department of Philosophical, Methodological and Instrumental Disciplines, CUCS, University of
- 576 Guadalajara, Guadalajara, Mexico.
- 577 207. Department of Pulmonary Medicine, Rashid Hospital, Dubai, UAE.
- 578 208. Biomax Informatics AG, Munich, Germany.
- 579 209. Directorate of Finance, eHealth & Pharmaceuticals, Scottish Government Health Department,
- 580 Edinburgh, UK.
- 581 210. Department of Respiratory Medicine, University of Bratislava, Bratislava, Slovakia.
- 582 211. Coimbra Institute for Clinical and Biomedical Research (iCBR), Faculty of Medicine, University of
- 583 Coimbra, Portugal; Ageing@Coimbra EIP-AHA Reference Site, Coimbra, Portugal.

- 584 212. Medical center Iskar Ltd Sofia, Bulgaria.
585 213. Department of Medicine (RCSI), Bon Secours Hospital, Glasnevin, Dublin, Ireland.
586 214. Kronikgune, International Centre of Excellence in Chronicity Research Barakaldo, Bizkaia, Spain
587 215. Division of Clinical Immunology and Allergy, Laboratory of Behavioral Immunology Research, The
588 University of Mississippi Medical Center, Jackson, Mississippi, USA.
589 216. Tobacco Control Research Centre;Iranian Anti Tobacco Association, Tehran, Iran.
590 217. Argentine Association of Allergy and Clinical Immunology, Buenos Aires, Argentina.
591 218. Mexico City, Mexico.
592 219. University of Southeast Bahia, Brazil.
593 220. Allergie-Centrum-Charité at the Department of Dermatology and Allergy, Charité -
594 Universitätsmedizin Berlin, Germany
595 221. Maputo Central Hospital--Department of Paediatrics, Mozambique.
596 222. Veracruz, Mexico.
597 223. Sachs' Children and Youth Hospital, Södersjukhuset, Stockholm and Institute of Environmental
598 Medicine, Karolinska Institutet, Stockholm, Sweden.
599 224. Allergy and Asthma Medical Group and Research Center, San Diego, California, USA.
600 225. CIRFF, Federico II University, Naples, Italy.
601 226. Department of Physiology, CHRU, University Montpellier, Vice President for Research,
602 PhyMedExp, INSERM U1046, CNRS UMR 9214, France.
603 227. Croatian Pulmonary Society.
604 228. National Institute of Pneumology M Nasta, Bucharest, Romania.
605 229. Clinic for Pulmonary Diseases, Clinical Center of Serbia, Faculty of Medicine, University of
606 Belgrade, Serbian Association for Asthma and COPD, Belgrade, Serbia.
607 230. Regione Piemonte, Torino, Italy.
608 231. Col Jardines de Sta Monica, Tlalnepantla, Mexico.
609 232. National Center for Research in Chronic Respiratory Diseases, Tishreen University School of
610 Medicine, Latakia, Syria.
611 233. Department of Public health and health products, Paris Descartes University-Sorbonne Paris Cité,
612 EA 4064 and Paris Municipal Department of social action, childhood, and health, Paris, France .
613 234. Paris municipal Department of social action, childhood, and health, Paris, France.
614 235. Lead Respiratory Physician Mater Dei Hospital Malta, Academic Head of Dept and Professor of
615 Medicine University of Malta, Deputy Dean Faculty of Medicine and Surgery University of
616 Medicine, La Valette, Malta.
617 236. Department of Medical Sciences, Allergy and Clinical Immunology Unit, University of Torino &
618 Mauriziano Hospital, Torino, Italy.
619 237. Instituto de Prevision Social IPS HC, Socia de la SPAAI, Tesorera de la SLAAI, Asuncion, Paraguay.
620 238. Allergy Center, CUF Descobertas Hospital, Lisbon, Portugal.
621 239. Universidade de São Paulo, São Paulo, Brazil.
622 240. Institute of Medical Statistics, and Computational Biology, Medical Faculty, University of Cologne,
623 Germany and CRI-Clinical Research International-Ltd, Hamburg, Germany.
624 241. General Pathology Institute, Faculty of Medicine, University of Coimbra, Portugal;
625 Ageing@Coimbra EIP-AHA Reference Site, Coimbra, Portugal.
626 242. Federal University of Bahia, Brazil.
627 243. Rhinology Unit & Smell Clinic, ENT Department, Hospital Clínic; Clinical & Experimental
628 Respiratory Immunoallergy, IDIBAPS, CIBERES, University of Barcelona, Spain.
629 244. Danish Commitee for Health Education, Copenhagen East, Denmark.
630 245. Food Allergy Referral Centre Veneto Region, Department of Women and Child Health, Padua
631 General University Hospital, Padua, Italy.
632 246. Director, Medical Communications Consultant, MedScript Ltd, Dundalk, Co Louth, Ireland.
633 247. Johns Hopkins School of Medicine, Baltimore, Maryland, USA.
634 248. General Manager of COFASER - Pharmacy Services Consortium, Salerno, Italy.
635 249. Scientific Centre of Children's Health under the MoH, Russian National Research Medical
636 University named Pirogov, Moscow, Russia.
637 250. Director of Center of Allergy, Immunology and Respiratory Diseases, Santa Fe, Argentina Center
638 for Allergy and Immunology, Santa Fe, Argentina.
639 251. Dept of Otorhinolaryngology, Medical University of Vienna, AKH, Vienna, Austria.
640 252. Hospital of the Hospitaller Brothers in Buda, Budapest, Hungary.
641 253. Die Hautambulanz and Rothhaar study center, Berlin, Germany.
642 254. Neumología y Alergología Infantil, Hospital La Fe, Valencia, Spain.

- 643 255. Center for Health Technology and Services Research - CINTESIS and Department of Internal
644 Medicine, Centro Hospitalar Sao Joao, Porto, Portugal.
645 256. Caisse d'assurance retraite et de la santé au travail du Languedoc-Roussillon (CARSAT-LR),
646 Montpellier, France.
647 257. Director of Department of Pharmacy of University of Naples Federico II, Naples, Italy.
648 258. ENT Department, University Hospital of Kinshasa, Kinshasa, Congo.
649 259. Department of Allergy, Immunology and Respiratory Medicine, Alfred Hospital and Central
650 Clinical School, Monash University, Melbourne, Victoria, Australia; Department of Immunology,
651 Monash University, Melbourne, Victoria, Australia.
652 260. Medical center "Research expert", Varna, Bulgaria.
653 261. National Hospital Organization, Tokyo National Hospital, Tokyo, Japan.
654 262. Dept of Otorhinolaryngology, Chiba University Hospital, Chiba, Japan.
655 263. Dept of Otolaryngology, Nippon Medical School, Tokyo, Japan.
656 264. Jalsco, Guadalajara.
657 265. Centre Hospitalier Universitaire Pédiatrique Charles de Gaulle, Ouagadougou, Burkina Faso.
658 266. Dept of Comparative Medicine; Messerli Research Institute of the University of Veterinary
659 Medicine and Medical University, Vienna, Austria.
660 267. Department of Immunology and Allergology, Faculty of Medicine and Faculty Hospital in Pilsen,
661 Charles University in Prague, Pilsen, Czech Republic.
662 268. Center for Pediatrics and Child Health, Institute of Human Development, Royal Manchester
663 Children's Hospital, University of Manchester, Manchester, UK Allergy Department, 2nd Pediatric
664 Clinic, Athens General Children's Hospital "P&A Kyriakou," University of Athens, Athens 11527,
665 Greece.
666 269. Department of Allergy and Clinical Immunology, Ajou University School of Medicine, Suwon,
667 South Korea.
668 270. Respiratory Medicine, Department of Medical Sciences, University of Ferrara, Ferrara, Italy.
669 271. Allergy and Respiratory Diseases, Ospedale Policlinico San Martino -University of Genoa, Italy.
670 272. Farmacias Holon, Lisbon, Portugal.
671 273. Department of Pediatrics, Nippon Medical School, Tokyo, Japan.
672 274. University of Southern Denmark, Kolding, Denmark.
673 275. Université Grenoble Alpes, Laboratoire HP2, Grenoble, INSERM, U1042 and CHU de Grenoble,
674 France.
675 276. Allergy Unit, CUF-Porto Hospital and Institute; Center for Research in Health Technologies and
676 information systems CINTESIS, Universidade do Porto, Portugal.
677 277. Sociologist, municipality area n33, Sorrento, Italy.
678 278. Center for Rhinology and Allergology, Wiesbaden, Germany.
679 279. Department of Otorhinolaryngology, Head and Neck Surgery, Universitätsmedizin Mannheim,
680 Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany.
681 280. Centre for empowering people and communities, Dublin, UK.
682 281. Conseil Général de l'Economie Ministère de l'Economie, de l'Industrie et du Numérique, Paris,
683 France.
684 282. Société de Pneumologie de Langue Française, Espace francophone de Pneumologie, Paris, France.
685 283. Département de pédiatrie, CHU de Grenoble, Grenoble France.
686 284. Medical School, University of Cyprus, Nicosia, Cyprus.
687 285. Children's Hospital Srebrnjak, Zagreb, School of Medicine, University J.J. Strossmayer, Osijek,
688 Croatia.
689 286. Karl Landsteiner Institute for Clinical and Experimental Pneumology, Hietzing Hospital, Vienna,
690 Austria.
691 287. University Hospital 'Sv. Ivan Rilski"', Sofia, Bulgaria.
692 288. Allergy Diagnostic and Clinical Research Unit, University of Cape Town Lung Institute, Cape Town,
693 South Africa.
694 289. Vice-Presidente of IML, Milano, Italy.
695 290. Centre of Academic Primary Care, Division of Applied Health Sciences, University of Aberdeen,
696 Aberdeen, U K; Observational and Pragmatic Research Institute, Singapore, Singapore.
697 291. Department of Otorhinolaryngology University of Crete School of Medicine, Heraklion, Greece.
698 292. European Forum for Research and Education in Allergy and Airway Diseases (EUFOREA),
699 Brussels, Belgium.
700 293. Cancun, Quintana Roo, Mexico.

- 701 294. LungenClinic Grosshansdorf, Airway Research Center North, Member of the German Center for
702 Lung Research (DZL), Grosshansdorf, Germany Department of Medicine, Christian Albrechts
703 University, Airway Research Center North, Member of the German Center for Lung Research
704 (DZL), Kiel, Germany.
- 705 295. Department of Nephrology and Endocrinology, Karolinska University Hospital, Stockholm,
706 Sweden.
- 707 296. Farmácia São Paio, Vila Nova de Gaia, Porto, Portugal.
- 708 297. St Vincent's Hospital and University of Sydney, Sydney, New South Wales, Australia.
- 709 298. Puebla, Mexico.
- 710 299. Serviço de Pneumologia-Hosp das Clinicas UFPE-EBSERH, Recife, Brazil.
- 711 300. Universidade Federal de São Paulo, São Paulo, Brazil.
- 712 301. Centre of Pneumology, Coimbra University Hospital, Portugal.
- 713 302. Polibienestar Research Institute, University of Valencia, Valencia, Spain.
- 714 303. Pediatric Allergy and Clinical Immunology, Hospital Angeles Pedregal, Mexico City, Mexico.
- 715 304. Getafe University Hospital Department of Geriatrics, Madrid, Spain.
- 716 305. Association Asthme et Allergie, Paris, France.
- 717 306. Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil.
- 718 307. Primary Care Respiratory Research Unit Institutode Investigación Sanitaria de Palma IdisPa,
719 Palma de Mallorca, Spain.
- 720 308. Allergy Unit, Presidio Columbus, Rome, Catholic University of Sacred Heart, Rome and IRCCS Oasi
721 Maria SS, Troina, Italy.
- 722 309. Mexico City, Mexico.
- 723 310. Regione Piemonte, Torino, Italy.
- 724 311. Medical University of Graz, Department of Internal Medicine, Graz, Austria.
- 725 312. Serviço de Imunoalergologia Hospital da Luz Lisboa Portugal.
- 726 313. Hospital de Clinicas, University of Parana, Brazil.
- 727 314. Division of Allergy Asthma and Clinical Immunology, Emek Medical Center, Afula, Israel.
- 728 315. Honorary Clinical Research Fellow, Allergy and Respiratory Research Group, The University of
729 Edinburgh, Edinburgh, Past President SLAAI, FACAAL, UK.
- 730 316. Showa University School of Medicine, Tokyo, Japan.
- 731 317. Association of Finnish Pharmacies.
- 732 318. Allergy and Clinical Immunology Department, Centro Médico-Docente la, Trinidad and Clínica El
733 Avila, Caracas, Venezuela.
- 734 319. Faculty of Medicine, Autnonous University of Madrid, Spain.
- 735 320. The Royal National TNE Hospital, University College London, UK.
- 736 321. DIBIMIS, University of Palermo, Italy.
- 737 322. Allergy Unit, Department of Dermatology, University Hospital of Zurich, Zürich, Switzerland.
- 738 323. Asthma Reference Center, Escola Superior de Ciencias da Santa Casa de Misericordia de Vitoria -
739 Esperito Santo, Brazil.
- 740 324. Allergy and Respiratory Research Group, Centre for Population Health Sciences, The University of
741 Edinburgh, Medical School, UK.
- 742 325. Department of Pediatrics & Child Health, Department of Immunology, Faculty of Medicine,
743 University of Manitoba, Winnipeg, Manitoba, Canada.
- 744 326. INSERM, Université Grenoble Alpes, IAB, U 1209, Team of Environmental Epidemiology applied to
745 Reproduction and Respiratory Health, Université Joseph Fourier, Grenoble, France.
- 746 327. Sociedad Paraguaya de Alergia Asma e Inmunología, Paraguay.
- 747 328. Division of Allergy, Clinical Immunology and Rheumatology, Department of Pediatrics, Federal
748 University of São Paulo, São Paulo, Brazil.
- 749 329. European Health Futures Forum (EHFF), isle of Wright, UK.
- 750 330. ENT, Aachen, Germany.
- 751 331. Kyrgyzstan National Centre of Cardiology and Internal medicine, Euro-Asian respiratory Society,
752 Bishkek, Kyrgyzstan.
- 753 332. University Hospital Olomouc, Czech Republic.
- 754 333. Department of Paediatric and Adolescent medicine, University Hospital of North Norway, Tromsø,
755 Paediatric Research Group, Department of Clinical Medicine, Faculty of Health Sciences, UiT The
756 Arctic University of Norway, Tromsø, Norway.
- 757 334. Presidente, IML (Lombardy Medical Initiative), Bergamo, Italy.
- 758 335. Pulmonary Division, Heart Institute (InCor), Hospital da Clinicas da Faculdade de Medicina da
759 Universidade de Sao Paulo, Sao Paulo, Brazil.

- 760 336. Public Health Institute of Vilnius University, Vilnius, Lithuania.
761 337. Universidade Federal do Estado do Rio de Janeiro, Rio de Janeiro - Brazil
762 338. RNSA (Réseau National de Surveillance Aérobiologique), Brussieu, France.
763 339. The Hospital for Sick Children, Dalla Lana School of Public Health, University of Toronto, Canada.
764 340. Imunoalergologia, Centro Hospitalar Universitário de Coimbra and Faculty of Medicine, University
765 of Coimbra, Portugal.
766 341. Department of ENT, Medical University of Graz, Austria.
767 342. Campania Region, Division on Pharmacy and devices policy, Naples, Italy.
768 343. Department of Respiratory Medicine, Hvidovre Hospital & University of Copenhagen, Denmark.
769 344. Universidade Federal dos Pampas, Uruguaiana, Brazil.
770 345. Division of Immunopathology, Department of Pathophysiology and Allergy Research, Center for
771 Pathophysiology, Infectiology and Immunology, Medical University of Vienna, Vienna, Austria.
772 346. Pneumology and Allergy Department CIBERES and Clinical & Experimental Respiratory
773 Immunoallergy, IDIBAPS, University of Barcelona, Spain.
774 347. Vilnius University Institute of Clinical Medicine, Clinic of Children's Diseases, and Institute of
775 Health Sciences, Department of Public Health, Vilnius, Lithuania; European Academy of
776 Paediatrics (EAP/UEMS-SP), Brussels, Belgium.
777 348. Department of Lung Diseases and Clinical Immunology Allergology, University of Turku and
778 Terveystalo allergy clinic, Turku, Finland.
779 349. PELyon; HESPER 7425, Health Services and Performance Research - Université Claude Bernard
780 Lyon, France.
781 350. Immunology and Allergy Unit, Department of Medicine Solna, Karolinska Institutet and University
782 Hospital, Stockholm.
783 351. Department of Chest Medicine, Centre Hospitalier Universitaire UCL Namur, Université
784 Catholique de Louvain, Yvoir, Belgium.
785 352. University of Bari Medical School, Unit of Geriatric Immunoallergology, Bari, Italy.
786 353. Pulmonary Unit, Department of Medical Specialties, Arcispedale SMaria Nuova/IRCCS, AUSL di
787 Reggio Emilia, Italy.
788 354. FILHA, Finnish Lung Association, Helsinki, Finland.
789 355. Pulmonary Environmental Epidemiology Unit, CNR Institute of Clinical Physiology, Pisa, Italy ; and
790 CNR Institute of Biomedicine and Molecular Immunology "A Monroy", Palermo, Italy.
791 356. Medical University, Plovdiv, Bulgaria, Department of Otorhinolaryngology, Plovdiv, Bulgaria.
792 357. Sotiria Hospital, Athens, Greece.
793 358. Dept of Otorhinolaryngology, Universitätsklinikum Düsseldorf, Germany.
794 359. Asthma UK, Mansell street, London, UK.
795 360. Nova Southeastern University, Fort Lauderdale, Florida, USA.
796 361. Department of Otolaryngology, Yong Loo Lin School of Medicine, National University of Singapore,
797 Singapore, Singapore.
798 362. Department of Medicine, Clinical Immunology and Allergy, McMaster University, Hamilton,
799 Ontario, Canada.
800 363. Division of Immunodermatology and Allergy Research, Department of Dermatology and Allergy,
801 Hannover Medical School, Hannover, Germany.
802 364. Department of Medicine Solna, Immunology and Allergy Unit, Karolinska Institutet and
803 Department of ENT diseases, Karolinska University Hospital, Stockholm, Sweden.
804 365. Eshelman School of Pharmacy, University of North Carolina, Chapel Hill, NC, USA.
805 366. International Primary Care Respiratory Group IPCRG, Aberdeen, Scotland.
806 367. Bradford Institute for Health Research, Bradford Royal Infirmary, Bradford, UK.
807 368. Allergologist - Medical College of Medical Faculty, Thracian University, Stara Zagora, Bulgaria.
808 369. Department of Research, Olmsted Medical Center, Rochester, Minnesota, USA.
809 370. Cyprus International Institute for Environmental & Public Health in Association with Harvard
810 School of Public Health, Cyprus University of Technology, Limassol, Cyprus; Department of
811 Pediatrics, Hospital "Archbishop Makarios III", Nicosia, Cyprus.
812 371. Celal Bayar University Department of Pulmonology, Manisa, Turkey.
813 372. The Allergy and Asthma Institute, Pakistan.
814 373. Department of Paediatrics and Child Health, Red Cross Children's
815 Hospital, and MRC Unit on Child & Adolescent Health, University of Cape Town, Cape Town, South
816 Africa.
817 374. Department of Otolaryngology Head and Neck Surgery, Beijing TongRen Hospital and Beijing
818 Institute of Otolaryngology, Beijing, China.

375. Universidad Católica de Córdoba, Córdoba, Argentina.
 376. University Clinic of Respiratory and Allergic Diseases, Golnik, Slovenia.
 377. Gesundheitsregion KölnBonn - HRCB Projekt GmbH, Köln, Germany.
 378. Akershus University Hospital, Department of Otorhinolaryngology, Akershus, Norway.

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Address for correspondence

Professor Jean Bousquet
 CHU Arnaud de Villeneuve, 371 Avenue du Doyen Gaston Giraud, 34295 Montpellier Cedex 5, France Tel +33 611 42 88 47, Fax :+33 467 41 67 01 jean.bousquet@orange.fr

Conflict of interest

F Amat reports grants and personal fees from Novartis, non-financial support from Zambon, Stallergènes Greer, outside the submitted work.
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T Zuberbier reports and Organizational affiliations: Committee member: WHO-Initiative "Allergic Rhinitis and Its Impact on Asthma" (ARIA) - Member of the Board: German Society for Allergy and Clinical Immunology (DGAKI) - Head: European Centre for Allergy Research Foundation (ECARF) - Secretary General: Global Allergy and Asthma European Network (GA²LEN) - Member: Committee on Allergy Diagnosis and Molecular Allergology, World Allergy Organization (WAO). outside the submitted work.

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Abstract

Allergic Rhinitis and its Impact on Asthma (ARIA) has evolved from a guideline using the best approach to integrated care pathways (ICPs) using mobile technology in AR and asthma multimorbidity. The proposed next phase of ARIA is Change Management (CM) with the aim of providing an active and healthy life to rhinitis sufferers and to those with asthma multimorbidity across the life cycle whatever their gender or socio-economic status in order to reduce health and social inequities incurred by the disease. ARIA has followed the 8-step model of Kotter to assess and implement the impact of rhinitis on asthma multimorbidity and to propose multimorbid guidelines. A second change management strategy is proposed by ARIA Phase 4 to increase self-medication and shared decision making in rhinitis and asthma multimorbidity. An innovation of ARIA has been the development and validation of IT evidence-based tools (MASK: Mobile Airways Sentinel Network) that can inform patient decisions on the basis of a self-care plan proposed by the health care professional.

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Abbreviations

AHA:	Active and Healthy Ageing
AIRWAYS ICPs:	Integrated care pathways for airway diseases
AIT:	Allergen immunotherapy
AR:	Allergic rhinitis
ARIA:	Allergic Rhinitis and its Impact on Asthma
BAMSE:	Barn Allergi Milj. Stockholm Epidemiologi Projektet
CDSS:	Clinical decision support system
CM:	Change management
CM2:	Second phase of change management
DG CONNECT:	Directorate General for Communications Networks, Content & Technology
DG Santé:	Directorate General for Health and Food Safety
DG:	Directorate General
EAACI:	European Academy of Allergy and Clinical Immunology
EFA:	European Federation of Allergy and Airways Diseases Patients' Associations
EGEA:	Epidemiological study on the Genetics and Environment of Asthma, bronchial hyperresponsiveness and atopy
EIP on AHA:	European Innovation Partnership on Active and Healthy Ageing
EIP:	European Innovation Partnership
ELF:	European Lung Foundation
EQ-5D:	EuroquoL
ERS:	European Respiratory Society
EUFOREA:	European Forum for Research and Education in Allergy
GARD:	WHO Global Alliance against Chronic Respiratory Diseases
HCP:	Health care professional
ICP:	Integrated care pathway
ICT:	Information and communication technology
IT:	Information technology
JA-CHRODIS:	Joint Action on Chronic Diseases and Promoting Healthy Ageing across the Life Cycle
MACVIA-LR:	contre les MALadies Chroniques pour un Vieillissement Actif (Fighting chronic diseases for AHA)
MASK:	Mobile Airways Sentinel network
MAS:	German Multicenter Allergy Study
MeDALL:	Mechanisms of the Development of Allergy
mHealth:	mobile health
OTC:	Over the counter
POLLAR:	Impact of air POLLution on Asthma and Rhinitis
QOL:	Quality of life
SCUAD:	Severe chronic upper airway disease
SDM:	Shared decision making
TRL:	Technology Readiness level
VAS:	Visual analogue scale
WHO:	World Health Organization
WPAI-AS:	Work Productivity and Activity questionnaire

Introduction

Allergic Rhinitis and its Impact on Asthma (ARIA) has evolved from a guideline using the best approach^{1,5} to integrated care pathways (ICPs) using mobile technology in AR and asthma multimorbidity⁶. The term co-morbidity is commonly used for allergic diseases, but multimorbidity might be more appropriate. Comorbidity is the presence of one or more additional diseases co-occurring with a primary disease or the effect of such additional disorders or diseases. Multimorbidity is a term which means co-occurring diseases in the same patient^{7,8}.

ARIA provides an evidence-based approach for managing the patient's needs but real-life data have shown that few patients use guidelines and that they often self-medicate (Menditto, in preparation). Moreover, patients largely use OTC medications dispensed in pharmacies^{9,11}. Self-care and shared decision making (SDM) centered around the patient should be used more frequently.

Change is inevitable in health care. ARIA has followed a change management (CM) strategy in the past, but a new revised plan should be considered in order to fill the gaps of knowledge translation into practice and to increase the benefits of self-care in care pathways (ICPs) using the currently-available ICT tools¹². These changes should prepare and support individuals, teams and organizations in making organizational change centered around the patient for more efficient care.

1- Background

1-1- The four ARIA phases

ARIA was initiated during a World Health Organization (WHO) workshop in 1999² and has evolved in four phases:

Phase 1: Development of an evidence-based document to provide a guide for the diagnosis and management of AR and asthma multimorbidity^{1, 2}. In 2008, ARIA was updated using the same recommendation system^{1, 13}. ARIA has been disseminated and is implemented in over 70 countries around the world¹⁴.

Phase 2: In its 2010 Revision, ARIA was the first chronic respiratory disease guideline to adopt the GRADE (Grading of Recommendation, Assessment, Development and Evaluation) approach, an advanced evidence evaluation and recommendation methodology for guidelines^{3,5}. When guidelines are made using the same methodology, the recommendations are similar^{5, 15}.

Phase 3: ARIA focused on the implementation of emerging technologies for individualized and predictive medicine to develop ICPs for the management of AR and asthma by a multi-disciplinary group centered around the patients^{16,19,20,23} (MASK: Mobile Airways Sentinel Network).

The proposed ARIA phase 4 is CM to provide an active and healthy life to rhinitis and asthma sufferers across the life cycle whatever their gender or socio-economic status with the aim to reduce health and social inequities globally.

1-2- Shared decision making and patient empowerment

In SDM, both the patient and the physician contribute to the medical decision-making process, placing the patient at the centre of the decision-making paradigm²⁴. Physicians explain treatments and alternatives to patients who then choose the treatment option that best aligns with their beliefs, lifestyles and goals along with the benefits and risks²⁵. In contrast to SDM, the traditional medical care system places physicians in a position of authority, with patients playing a passive role in care. Patients want greater involvement in SDM²⁶. An innovation of SDM in ARIA is the use of IT evidence-based tools that can inform patient decisions on the basis of a guided self-management plan proposed by their health care professionals²⁷. In asthma, the effectiveness of four SDM studies shows improvement of control and some other parameters but more studies are needed to confirm the data²⁸.

1-3- Change management

Change is inevitable in health care. However, many change projects fail due to varied belief and cultural circumstances, poor planning, unmotivated staff, deficient communication, or excessively frequent changes²⁹.

CM aims to prepare and support individuals, teams and organizations in making organizational change. It proposes methods redirecting or redefining resources, business processes, budget allocation and/or modes of operation. When properly applied, CM significantly changes healthcare and its organization. However, health systems differ largely between countries or even regions and a combination of CM with ICPs may be more relevant allowing each organization to use the CM principles according to their needs and regulations. CM deals with different disciplines from healthcare, behavioral and social sciences to IT and business solutions.

Although theories may seem abstract and impractical for healthcare practice, they can help in planning solutions to common healthcare problems²⁹. The Lewin's 3-Step model is widely used^{30,31}: unfreezing, moving, and refreezing³¹. Lippitt³² and Kotter¹² have added intermediate steps (Table 1)²⁹.

Several models of organizational and personal change have been reviewed for respiratory diseases³³.
Kotter's theory has been applied to different fields of medicine^{34,36} and pharmacies³⁷.

2- ARIA Phases 1 and 2 followed the Kotter's 8-step change model

2-1- Goals

Guidelines such as GINA (Global INitiative for Asthma)^{38,39}, GOLD (Global initiative for Lung Diseases)^{40,41}, EPOS⁴² and ARIA^{2, 3, 13} developed a CM strategy that was very effective and produced many updates and revisions while having a positive impact on clinical care and influencing research priorities.

Most guidelines are condition specific but ARIA was unique as it included for the first time the multimorbid component of the airway diseases. Although it followed the patient's perspectives, epidemiologic evidence⁴³ and some supporting mechanistic studies⁴⁴, this concept was not accepted by the leadership of GINA who considered neither the asthma-rhinitis multimorbidity concept nor the benefit for the patients.

2-2- The 8-step model

2-2-1- Establish a sense of urgency

The sense of urgency should identify and highlight the potential threats and the repercussions that might arise in the future by examining the opportunities which can be tapped through effective interventions. In AR and asthma, in the 1990s, the sense of urgency was to provide guidelines that could reduce both the burden of the diseases and the deaths (in asthma). Although there were papers indicating the links between the upper and lower airways^{45, 46}, the impact of rhinitis on asthma was not fully recognized and ARIA was initiated to better reconize the inter-relationships between the two diseases and to propose multimorbid guidelines.

2-2-2- Create a guiding coalition

The ARIA working group was initiated during a WHO meeting (December 1999) and evolved as a powerful group with 400 members in 70 countries¹⁴. Members have been working together for years and include all stakeholders needed for CM^{1,6}. The patients' organization EFA (European Federation of Allergy and Airways Diseases Patients' Associations) has always been an active member of ARIA.

2-2-3- Develop a vision and strategy

The ARIA vision has always been to provide a guide for the diagnosis and management of AR and asthma multimorbidity, including developing countries,^{1, 2} using the best available evidence^{3,5}. ARIA has established two major targets: the recognition and implementation of the asthma-rhinitis multimorbidity as well as a new classification (intermittent-persistent and mild-moderate severe AR) to meet patients' expectations. Moreover, ARIA priorities have always included primary care physicians, pharmacists and patients' organizations.

2-2-4- Communicate the change vision

One of the ARIA strengths has been to communicate its vision effectively worldwide. Over 1,000 papers have been posted on Pubmed from over 50 countries using the ARIA recommendations¹⁴. The number of training sessions in over 70 countries cannot be counted. ARIA has been endorsed by many governments and international organizations: ARIA recommendations have been used for the labeling of allergen immunotherapy by the European Medicine Agency.

2-2-5- Empower others to act on the vision

Organizational processes and structures are in place and are aligned with the overall organizational vision. However, a continuous check is needed for barriers and for people who are resisting change. We have implemented proactive actions to remove the obstacles involved in the process of change.

ARIA has been recognized as the major rhinitis and asthma multimorbidity guideline for years in most countries except for the US and Japan. However, the recent US guidelines are using the evidence-based approach of ARIA (GRADE: Grading of Recommendations, Assessment, Development and Evaluation), and the recommendations are similar^{15, 47, 48} to those of ARIA⁵. The recent Japanese guidelines for AR are also making bridges with ARIA⁴⁹.

2-2-6- Generate short-term wins

As proposed by Kotter¹², creating short-term wins early in the change process, instead of having one long-term goal, can give a feeling of victory in the early stages of change, which will reinforce support to the strategy.

The concept of asthma and rhinitis multimorbidity is now globally accepted in developed and developing countries⁵⁰. It is now recognized that multimorbidity is independent of IgE-mediated allergy^{8,51} and new phenotypes of severe airway disease have been identified. The implementation of the multimorbid concept in clinical practice has a direct benefit for the patient whose nasal symptoms are often more bothersome than asthma.

2-2-7- Consolidate gains and produce more change

The goals of step 7¹² are to achieve continuous improvement by analysing the success stories individually and improving from those individual experiences. These goals are exactly those that have been followed by ARIA for the past 18 years.

2-2-8- Anchor new approaches in the culture and institutionalize the changes

The goals of step 8¹² are met by the ARIA strategy:

1. Discuss widely the successful stories related to change initiatives.
2. Ensure that the change becomes an integral part of the practice and is highly visible.
3. Ensure that the support of the existing as well as the new leaders continues to extend towards the change.

2-3- Results, drawbacks and solutions

ARIA has fully achieved its goals following the 8-step Kotter's model of (Figure 1). The outcome assessment can be measured (i) by the numbers of citations of ARIA. ARIA 2001 has been cited 1750 times, ARIA 2008 over 2300 times (only paper in asthma cited >200 times a year) and ARIA 2010 710 times. This initiative is far better cited than GINA. (ii) By the countries that have endorsed ARIA in their national allergy program: Finland, Malaysia, Philippines, Portugal, Singapore. (iii) By the approval of treatments by agencies: The European Medicines Agency used the ARIA classification in the approval of Acarizax® (mite sublingual immunotherapy).

Some drawbacks have been pointed out in Kotter's change model¹². In particular, the model is essentially top-down and may discourage any scope for participation or co-creation. In ARIA, we considered that the first CM model was a great success but that its life cycle had come to an end. It was then decided within the coalition to propose a new CM model based on patients' needs and emerging technologies (CM2 model).

Since the Kotter model cannot be redesigned, we proposed a new maturity CM model based on the same Kotter's 8-step change model¹². We used ARIA Phase 3 (care pathways for rhinitis and asthma multimorbidity using mobile technology)⁶ to better plan the second CM model (CM2 model) and make new assumptions with a patient's centered approach.

3- The *Allergy Diary* strengthens change management

3-1- MASK

In 2012, the European Commission launched the European Innovation Partnership on Active and Healthy Ageing (DG Santé and DG CONNECT) (52). The B3 Action Plan, devoted to innovative integrated care models for chronic diseases, selected integrated care pathways for airway diseases (AIRWAYS ICPs)^{53, 54} with a life cycle approach⁵⁵ as the model of chronic diseases. An AIRWAYS ICPs Action Plan was devised⁵³, implemented⁵⁴ and scaled up^{56, 57}. AIRWAYS ICPs is a GARD (WHO Global Alliance for Chronic Respiratory Diseases)⁵⁸ research demonstration project (Figure 2).

MASK, the ARIA Phase 3, is an AIRWAYS ICPs tool^{6, 59}. It represents a Good Practice focusing on the implementation of multi-sectoral care pathways using emerging technologies with real life data in rhinitis and asthma multi-morbidity. MASK follows the JA-CHRODIS (Joint Action on Chronic Diseases and Promoting Healthy Ageing across the Life Cycle, 2nd EU Health Programme 2008-2013⁶⁰) recommendations for good practices¹⁸.

MASK was initiated to reduce the global burden of rhinitis and asthma, by giving the patient a simple tool to better prevent and manage respiratory allergic diseases. More specifically, MASK should help to (i) understand the disease mechanisms and the effects of air pollution in allergic diseases (ii) better appraise the burden incurred by medical needs but also indirect costs, (iii) propose novel multidisciplinary care pathways integrating pollution and patients' literacy, (iv) improve work productivity, (v) propose the basis for a sentinel network at the EU level for pollution and allergy and (vi) assess the societal implications of the project to reduce health and social inequalities globally.

3-2- The Allergy Diary

The mobile technology of MASK is the *Allergy Diary*, an App (Android and iOS) freely available for AR and asthma sufferers in 23 countries (16 EU countries, Argentina, Australia, Brazil, Canada, Mexico, Switzerland and Turkey) and 16 languages (translated and back-translated, culturally adapted and legally compliant)⁶ (Figure 3). Anonymized users fill in a simple questionnaire on asthma and rhinitis upon registration and daily assess the impact of the disease using a visual analogue scale (VAS)⁶¹ for global allergy symptoms, rhinitis, conjunctivitis, asthma and work. Moreover, a questionnaire is applied every week to assess disease impact on patients' QOL (EQ-5D)²¹.

Data of pilot studies in up to 17,000 users and over 95,000 days are available. The *Allergy Diary* has been validated¹⁹ and has shown that (i) totally anonymized geolocation can be used in 23 countries (in preparation), (ii) data can be analyzed in 23 countries and 17 languages, (iii) sleep, work productivity and daily activities are impaired in AR^{16, 17}, (iv) daily work productivity is associated with AR severity¹⁶, (v) the everyday use of medications can be monitored proposing a novel assessment of

treatment patterns ²⁰, (vi) novel patterns of multimorbidity have been identified ²² and confirmed in epidemiological studies ^{8, 62} and (vii) over 70% of AR patients self-medicate and are non-adherent to medications (Menditto, in preparation).

The *Allergy Diary* (TRL 9, Technology Readiness level 9) represents a validated mHealth tool for the management of AR. Asthma has also been monitored but data have not yet been analyzed. Economic impact can be monitored using work productivity. The results of the *Allergy Diary* have made innovative approaches of AR possible and are directly strengthening CM strategies in ARIA.

3-3- Transfer of Innovation of MASK

A Transfer of Innovation (Twinning) project has been funded by the European Innovation Partnership on Active and Healthy Ageing (EIP on AHA) using MASK in 25 Reference Sites or regions across Europe, Argentina, Australia, Brazil, Columbia and Mexico ⁶³. The number of countries is increasing and MASK should be rapidly operative in the US, China, India (in English only) and Japan. This will improve the understanding, assessment of burden, diagnosis and management of rhinitis in old age by comparison with an adult population. The Twinning has been tested in Germany (Region Kohl-Bonn) in a pilot study that has now been extended to the other German cities and countries of the Twinning project.

3-4- Clinical decision support system

Clinical decision support systems (CDSS) are software algorithms that advise health care providers on the diagnosis and management of patients based on the interaction of patient data and medical information. They should be based on the best evidence to aid patients and health care professionals to jointly determine treatment (SDM). In allergic rhinitis, the MASK CDSS is incorporated into a tablet interoperable with the *Allergy Diary* ⁶⁴ for health care professionals (*ARIA Allergy Diary Companion*) ^{6, 59}. This is based on an algorithm to aid clinicians to select pharmacotherapy for AR patients and to stratify their disease severity ⁶⁵. This approach will be adapted for the patient's guided self-care in a context of SDM.

3-5- POLLAR

Interactions between air pollution, sleep and allergic diseases are clear but insufficiently understood. POLLAR (Impact of Air POLLution in Asthma and Rhinitis) is a new Horizon 2020 project of the EIT Health (European Institute of Innovation and Technology for Health) that will embed environmental data into the *Allergy Diary*. POLLAR aims at combining emerging technologies (including the *Allergy Diary*, Technology Readiness level TRL9 meaning that the system is proven in operational environment) with machine learning to (i) understand the effects of air pollution in AR and

its impact on sleep, work and asthma, (ii) assess societal consequences, shared with citizens, and professionals (iii) propose preventive strategies including a sentinel network and (iv) develop participative policies.

4- ARIA Phases 3 and 4 deploy a novel Kotter's 8-step change model

4-1- Goals

Although the first CM model developed by the ARIA Initiative was a great success, there are still unmet needs in the treatment of asthma and rhinitis multimorbidity. In ARIA Phase 4, we encourage the participation of all the stakeholders.

4-2- The 8-step model

4-2-1- Establish a sense of urgency

ICPs will include multi-disciplinary structured care plans detailing the key steps of patient care including self-care as proposed by AIRWAYS ICPs⁵³ (Integrated care pathways for airway diseases). GRADE-based guidelines for physicians are available for AR and their recommendations are similar^{3, 5, 15}. However, they are based on the assumption that patients regularly use their treatment and are not tested with real-life data. Unfortunately, adherence to treatment is very low and real-life studies do not necessarily accord with all recommendations²⁰. New-generation guidelines embedding real life data are being developed.

4-2-2- Create a guiding coalition

The ARIA working group initiated in 1999 includes over 500 members in 70 countries¹⁴. A successful coalition working on CM2 has been identified within the group.

The AIRWAYS ICPs coalition was established in 2014 and is part of the European Innovation Partnership on Active and Healthy Ageing (DG Santé and DG CNECT)⁵³. Moreover, many national and European scientific societies (European Academy of Allergy and Clinical Immunology (EAACI), European Respiratory Society (ERS) and International Primary Care Respiratory Group (IPCRG)), and other patients' organization (European Lung Foundation (ELF), Asthma UK) have joined the coalition. It is a WHO GARD (WHO Global Alliance against Chronic Respiratory Diseases) demonstration project. Finally, the transfer of innovation of ARIA has been carried out to the Reference Sites of the European Innovation Partnership on Active and Healthy Ageing⁶³.

This CM2 guiding coalition is already in place in EUFOREA (European Forum for Research and Education in Allergy and Airways Diseases, <http://www.euforea.eu>)⁶⁶.

4-2-3- Develop a vision and strategy

The vision of ARIA phase 4 is to provide CM2 for AR and asthma multimorbidity in order to develop SDM with the ultimate goal of improving AR and asthma control while maintaining quality-of-life and reducing costs, using mobile technology and real-time data management to inform decisions.

The strategy for realizing the changes is based on the patient-centered implementation of ICPs⁵³ using IT solutions such as the *Allergy Diary*⁶.

4-2-4- Communicate the change vision

The updated vision (CM2) will use the experience of the first CM strategy. It has already been discussed among the ARIA CM coalition members and the present paper is the first to be published. However, it takes time to address the concerns of all stakeholders, and papers published recently on the *Allergy Diary* may help to convince many. ARIA is involving a maximum number of people to deploy the CM vision.

The integration of new paths of understanding health and change is a requirement for the strategy. The CM2-model clearly expands and strengthens the potential for actual change to occur and take hold in all kinds of organizations and institutions. Supplementary to the ambition of change in existing practices and institutions, it is also important to consider the integration of other modes of communication and dissemination on the basis of healthy behaviour. A central example is the general need to raise the level of health literacy in society. The general public should clearly not be perceived simply as “patients waiting for something to happen”. They should have the ability to navigate and understand health messages, an essential tool for self-managing wellbeing, even before any actual condition or major challenge actually occurs. But to do so, one must consider how to improve this health literacy by integrating it much better into the educational system and cultural settings to which it applies. This is a very long-term investment in self-care and prevention. A later target audience with a higher level of health literacy will naturally also ensure an easier adoption of subsequent health messages, possibly using ICT⁶⁷. The basis for understanding is simply enhanced compared to the previous scenario. In a similar line of thinking, one could also consider a wider community-oriented approach to dissemination. This could also cover social media and self-help groups, as some of the later patients would benefit not only from both personal previous experience and knowledge about these ailments, but also from a supportive environment, that would be better able to support and help these citizens/friends/family members – regardless of age – in their attempt to adapt to new modes of

behavior. This is a wider application of the CM2-model and should also be considered in our work to help patients and citizens.

4-2-5- Empower others to act on the vision

Organizational processes and structures are in place and are aligned with the overall organizational vision. However, we need to continuously check for barriers and for those who are resistant to change and focus on the education of both physicians and patients on how to achieve the best outcomes of treatment. We are acting proactively to remove the obstacles involved in the process of change.

4-2-6- Generate short-term wins

We propose to create new short-term (e.g. 12 months) and medium-term (e.g. 24 months) targets. In 2018, a high-level meeting organized by POLLAR will approach the *improvement in care pathway* design to enhance patient participation, health literacy and self-care through technology-assisted ‘patient activation’. In this meeting, rhinitis and asthma multimorbidity will be used as a model of non-communicable disease (Figure 4). Three major aspects of ICPs will be considered: self-care, pharmacy care and next-generation guidelines in which the recommendations of the GRADE-guidelines on AR^{5, 15} will be tested in real life using MASK.

4-2-7- Consolidate gains and produce more change

Most of the goals of Kotter’s change model step-7¹² have been met by the ARIA CM and will be further developed in CM2.

Conclusions

For the past 18 years, ARIA has had the major goal of providing a guide for the diagnosis and management of AR and asthma multimorbidity applicable to developing countries^{1, 2} using the best evidence³⁻⁵. ARIA Phases 1 and 2 were developed in accordance to Kotter’s 8 step change model and can be used as a model of CM in chronic diseases. However, there are still unmet needs for the management of rhinitis and asthma in real life.

A second CM model has been proposed by ARIA Phases 3 and 4. It was initiated by the development in 23 countries of an App that showed partly unexpected results. Patients with AR (and possibly with asthma) do not follow physicians’ advice: they self-medicate. There is an urgent need to harness this information and to update our concept of treatment as well as treatment adherence using mobile technology and care pathways. This is the goal of ARIA Phase 4 and the second wave of CM.

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Table 1: Examples of planned change management models. Adapted from (31)

Lewin (68)	Kotter (12)	Lippitt (32)
Unfreezing	<i>Step 1:</i> Establish a sense of urgency <i>Step 2:</i> Create a guiding coalition <i>Step 3:</i> Develop a vision and strategy	<i>Phase 1:</i> Diagnose the problem <i>Phase 2:</i> Assess motivation and capacity for change <i>Phase 3:</i> Assess change agent's motivation and resources
Moving	<i>Step 4:</i> Communicate the change vision <i>Step 5:</i> Empower others to act on the vision <i>Step 6:</i> Generate short-term wins <i>Step 7:</i> Consolidate gains and produce more change	<i>Phase 4:</i> Select a progressive change objective <i>Phase 5:</i> Choose appropriate role of the change agent
Refreezing	<i>Step 8:</i> Anchor new approaches in the culture and institutionalize the changes	<i>Phase 6:</i> Terminate the helping relationship

Figure 1: Change management strategy of ARIA Phases 1 and 2

ARIA: Allergic Rhinitis and its Impact on Asthma, BAMSE: Barn Allergi Milj. Stockholm Epidemiologi Projektet , EGEA: Epidemiological study on the Genetics and Environment of Asthma, bronchial hyperresponsiveness and atopy, GRADE, MAS: German Multicenter Allergy Study, MASK: Mobile Airways Sentinel network, MeDALL: Mechanisms of the Development of Allergy, SDM: Share decision making, T2: Type 2 immunity

Figure 2: Links between ARIA and MASK for change management

AIRWAYS-ICPs: Integrated Care Pathways for airway diseases (European Innovation Partnership on Active and Healthy Ageing), WHO CC: World Health Organisation Collaborating Center, DigitalHealthEurope: Digital Transformation of Health in Europe (H2020), Euriphi: Better Health and care, economic growth and sustainable health systems (H2020), GA²LEN: Global Allergy and Asthma European network (FP6), GARD: Global Alliance against Chronic Respiratory Diseases, Good Practice of DG Santé: Good Practice on digitally-enabled, integrated, person-centred care of the Directorate-General for Health and Food Safety (European Commission), ICP: Integrated care pathway, MACVIA-LR: Contre les Maladies Chroniques pour un Vieillissement Actif (European Innovation Partnership on Active and Healthy Ageing), MeDALL: Mechanisms of the Development of ALLergy (FP7), POLLAR: Impact of air POLLution in Asthma and Rhinitis (EIT Health), SPAL: EU Development and Structural Funds, Sunfrail, Twinning: Vigour: (Evidence-Based Guidance to Scale-up Integrated Care in Europe, 3rd Health Programme).

Figure 3: The Allergy Diary

GPDR: General Data Protection Regulation (<https://www.eugdpr.org>)

Figure 4: Change management based on next-generation ICPs

ACCEPTED MANUSCRIPT

F1

Current knowledge (2000)

- Clinical practice: allergic multi-morbidity is common and represents a patient's need
 - ECRHS: epidemiologic evidence for allergic multi-morbidity
- Nasal and bronchial biopsies confirm commonalities in rhinitis and asthma

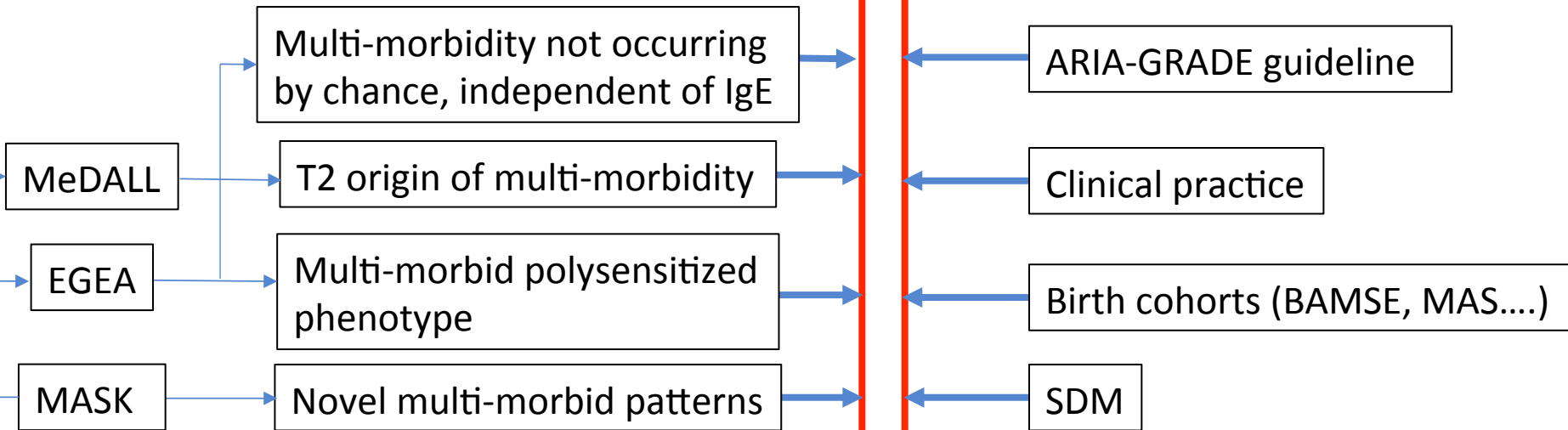
2000



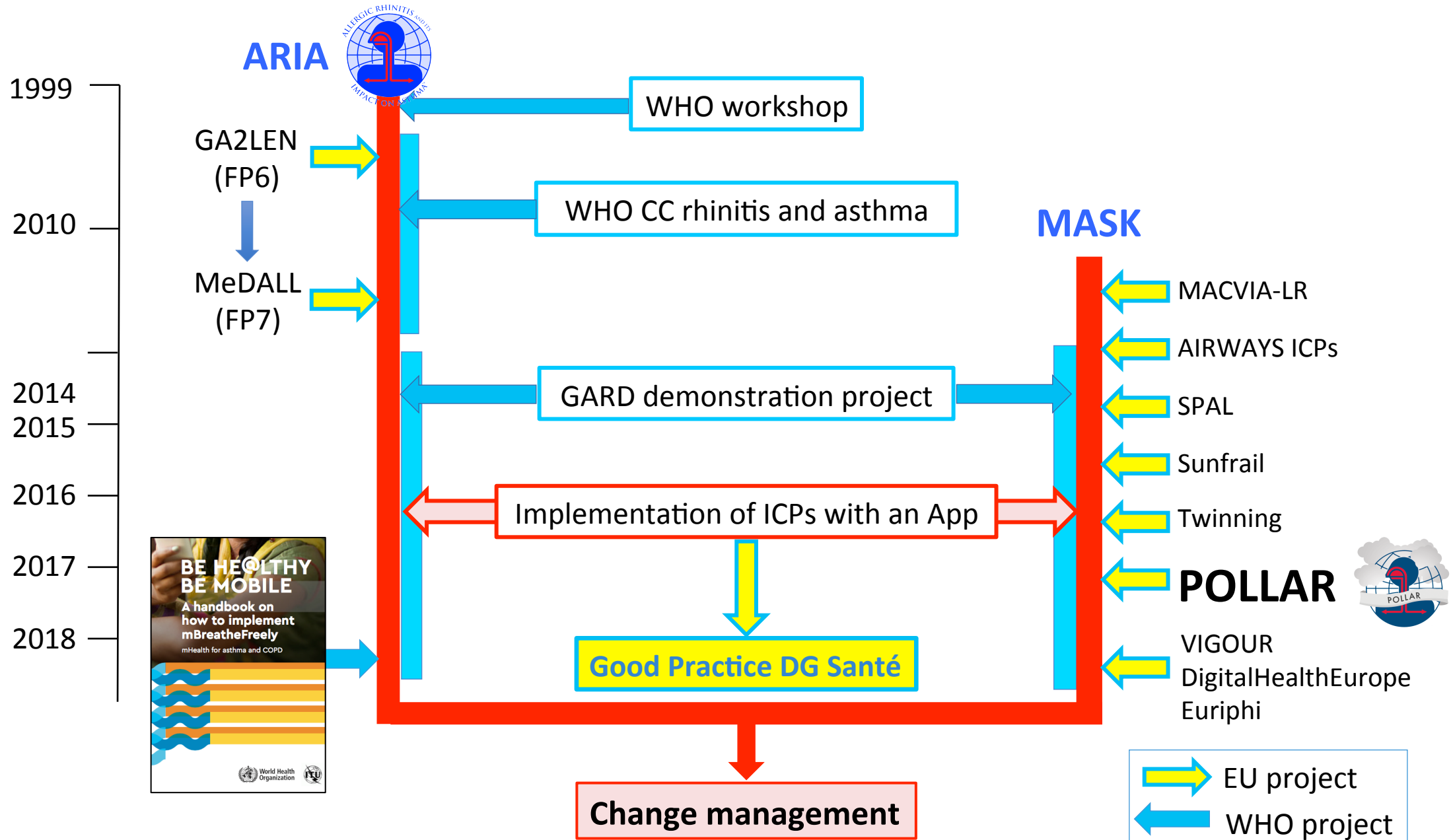
Mechanistic, epidemiological and clinical studies reinforcing the ARIA multi-morbidity concept

2010

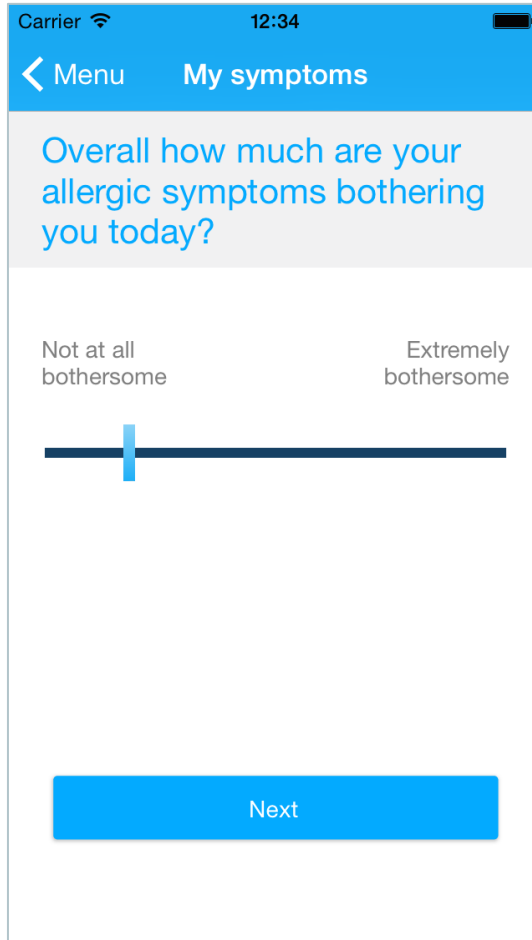
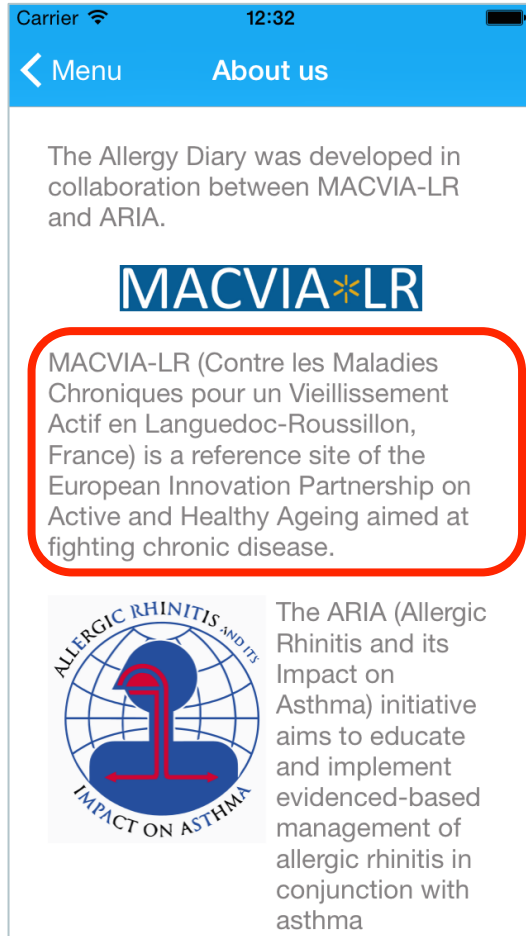
2017



Change management: allergic multi-morbidity is adopted in clinical practice worldwide



The Allergy Diary: MASK-air

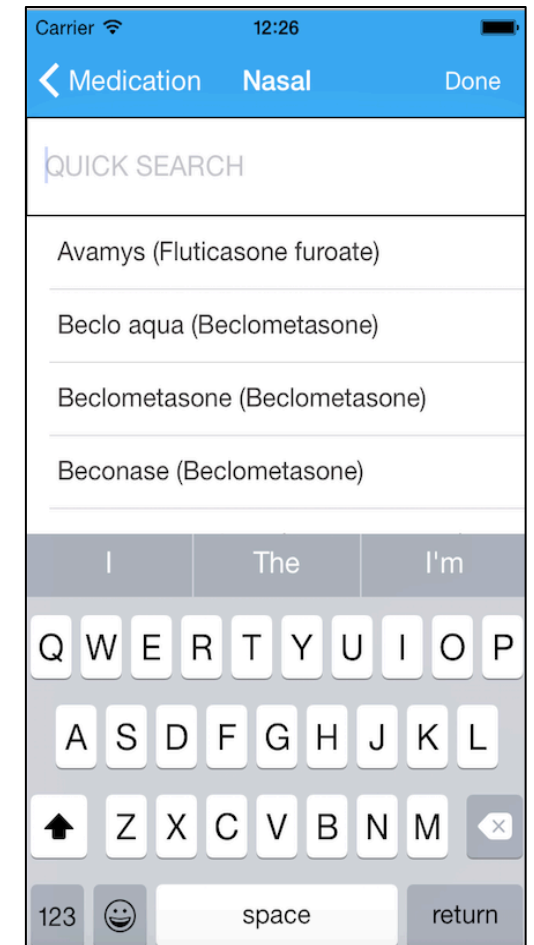


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