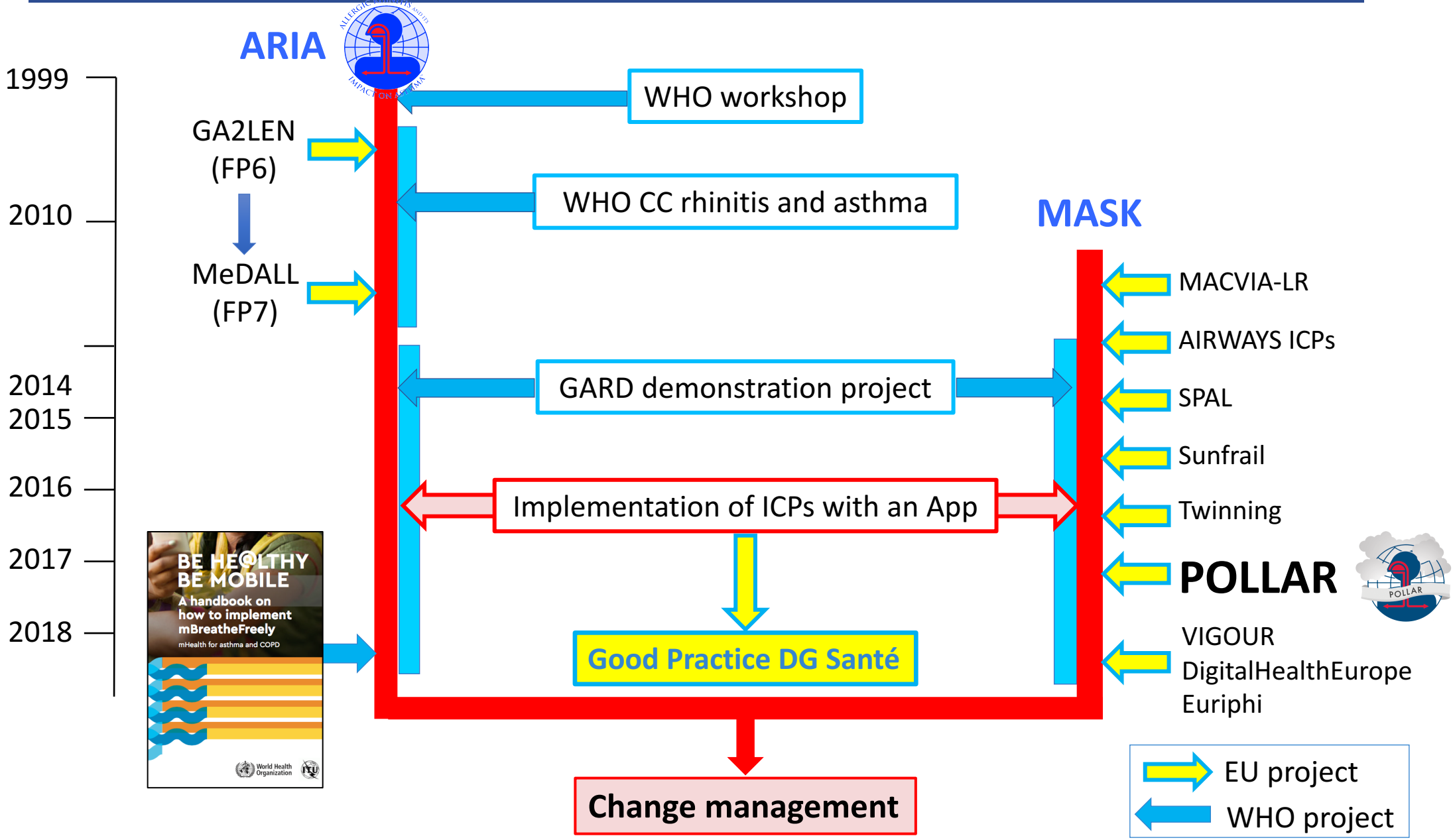
Intertwined links between ARIA, MASK & POLLAR



MASK (Mobile Airways Sentinel Network)

1- The goals

2- The cell phone (The Allergy Diary)

3- Innovation in epidemiology

4- Innovation in management

5- Next-generation care pathways

ARIA 2016: Care pathways implementing emerging technologies for predictive medicine in rhinitis and asthma across the life cycle

Bousquet et al. Clin Transl Allergy (2016) 6:47

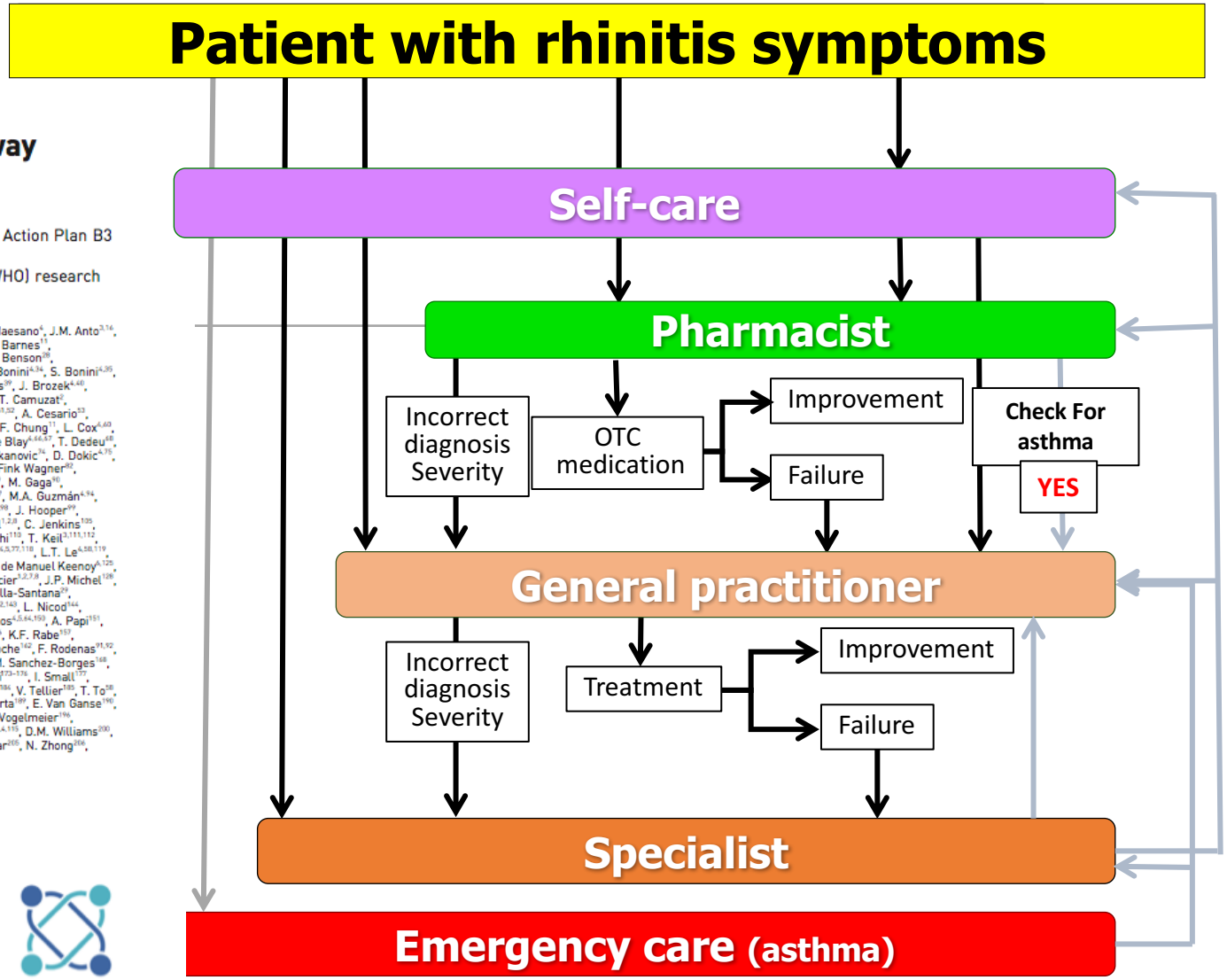
J. Bousquet, P. W. Hellings, I. Agache, A. Bedbrook, C. Bachert, K. C. Bergmann, M. Bewick, C. Bindslev-Jensen, S. Bosnic-Anticevitch, C. Bucca, D. P. Caimmi, P. A. M. Camargos, G. W. Canonica, T. Casale, N. H. Chavannes, A. A. Cruz, G. De Carlo, R. Dahl, P. Demoly, P. Devillier, J. Fonseca, W. J. Fokkens, N. A. Guldemond, T. Haahtela, M. Illario, J. Just, T. Keil, L. Klimek, P. Kuna, D. Larenas-Linnemann, M. Morais-Almeida, J. Mullol, R. Murray, R. Naclerio, R. E. O'Hehir, N. G. Papadopoulos, R. Pawankar, P. Potter, D. Ryan, B. Samolinski, H. J. Schunemann, A. Sheikh, F. E. R. Simons, C. Stellato, A. Todo-Bom, P. V. Tomazic, A. Valiulis, E. Valovirta, M. T. Ventura, M. Wickman, I. Young, A. Yorgancioglu, T. Zuberbier, W. Aberer, C. A. Akdis, M. Akdis, I. Annesi-Maesano, J. Ankri, I. J. Ansotegui, J. M. Anto, S. Arnavielhe, A. Asarnoj, H. Arshad, F. Avolio, I. Baiardini, C. Barbara, M. Barbagallo, E. D. Bateman, B. Beghé, E. H. Bel, K. S. Bennoor, M. Benson, A. Z. Białoszewski, T. Bieber, L. Bjermer, H. Blain, F. Blasi, A. L. Boner, M. Bonini, S. Bonini, I. Bosse, J. Bouchard, L. P. Boulet, R. Bourret, P. J. Bousquet, F. Braido, A. H. Briggs, C. E. Brightling, J. Brozek, R. Buhl, C. Bunu, E. Burte, A. Bush, F. Caballero-Fonseca, M. A. Calderon, T. Camuzat, V. Cardona, P. Carreiro-Martins, A. M. Carriazo, K. H. Carlsen, W. Carr, A. M. Cepeda Sarabia, M. Cesari, L. Chatzi, R. Chiron, T. Chivato, E. Chkhartishvili, A. G. Chuchalin, K. F. Chung, G. Ciprandi, J. Correia de Sousa, L. Cox, G. Crooks, A. Custovic, S. E. Dahlen, U. Darsow, T. Dedeu, D. Deleanu, J. A. Denburg, G. De Vries, A. Didier, A. T. Dinh-Xuan, D. Dokic, H. Douagui, G. Dray, R. Dubakiene, S. R. Durham, G. Du Toit, M. S. Dykewicz, P. Eklund, Y. El-Gamal, E. Ellers, R. Emuzyte, J. Farrell, A. Fink Wagner, A. Fiocchi, M. Fletcher, F. Forastiere, M. Gaga, A. Gamkrelidze, B. Gemicioğlu, J. E. Gereda, R. Gerth van Wick, S. González Diaz, I. Grisle, L. Grouse, Z. Gutter, M. A. Guzmán, B. Hellquist-Dahl, J. Heinrich, F. Horak, J. O'. B. Hourihane, M. Humbert, M. Hyland, G. Iaccarino, E. J. Jares, C. Jeandel, S. L. Johnston, G. Joos, O. Jonquet, K. S. Jung, M. Jutel, I. Kaidashev, M. Khaitov, O. Kalayci, A. F. Kalyoncu, P. Kardas, P. K. Keith, M. Kerkhof, H. A. M. Kerstjens, N. Khaltaev, M. Kogevinas, V. Kolek, G. H. Koppelman, M. L. Kowalski, M. Kuitunen, I. Kull, V. Kvedariene, B. Lambrecht, S. Lau, D. Laune, L. T. T. Le, P. Lieberman, B. Lipworth, J. Li, K. C. Lodrup Carlsen, R. Louis, C. Lupinek, W. MacNee, Y. Magar, A. Magnan, B. Mahboub, D. Maier, I. Majer, J. Malva, P. Manning, E. De Manuel Keenoy, G. D. Marshall, M. R. Masjedi, E. Mathieu-Dupas, M. Maurer, S. Mavale-Manuel, E. Melén, E. Melo-Gomes, E. O. Meltzer, J. Mercier, H. Merk, N. Miculinic, F. Mihaltan, B. Milenkovic, J. Millot-Keurinck, Y. Mohammad, I. Momas, R. Mösges, A. Muraro, L. Namazova-Baranova, R. Nadif, H. Neffen, K. Nekam, A. Nieto, B. Niggemann, L. Nogueira-Silva, M. Nogues, T. D. Nyembue, K. Ohta, Y. Okamoto, K. Okubo, M. Olive-Elias, S. Ouedraogo, P. Paggiaro, I. Pali-Schöll, S. Palkonen, P. Panzner, A. Papi, H. S. Park, G. Passalacqua, S. Pedersen, A. M. Pereira, O. Pfaar, R. Picard, B. Pigearias, I. Pin, D. Plavec, W. Pohl, T. A. Popov, F. Portejoie, D. Postma, L. K. Poulsen, D. Price, K. F. Rabe, F. Raciborski, G. Roberts, C. Robalo-Cordeiro, F. Rodenas, L. Rodriguez-Mañas, C. Rolland, M. Roman Rodriguez, A. Romano, J. Rosado-Pinto, N. Rosario, M. Rottem, M. Sanchez-Borges, J. Sastre-Dominguez, G. K. Scadding, N. Scichilone, P. Schmid-Grendelmeier, E. Serrano, M. Shields, V. Siroux, J. C. Sisul, I. Skrindo, H. A. Smit, D. Solé, T. Sooronbaev, O. Spranger, R. Stelmach, P. J. Sterk, T. Strandberg, J. Sunyer, C. Thijs, M. Triggiani, R. Valenta, A. Valero, M. van Eerd, E. van Ganse, M. van Hague, O. Vandenplas, L. L. Varona, B. Vellas, G. Vezzani, T. Vazankari, G. Viegi, T. Vontetsianos, M. Wagenmann, S. Walker, D. Y. Wang, U. Wahn, T. Werfel, B. Whalley, D. M. Williams, S. Williams, N. Wilson, J. Wright, B. P. Yawn, P. K. Yiallouros, O. M. Yusuf, A. Zaidi, H. J. Zar, M. E. Zernotti, L. Zhang, N. Zhong, M. Zidarn

Stepwise care pathways

Integrated care pathways for airway diseases (AIRWAYS-ICPs)

European Innovation Partnership on Active and Healthy Ageing, Action Plan B3 Mechanisms of the Development of Allergy (MeDALL, WP10)
GARD (Global Alliance against Chronic Respiratory Diseases, WHO) research demonstration project

J. Bousquet[1–9], A. Addis[7,10], I. Adcock[11], I. Agache[4,12,13], A. Agusti[14], A. Alonso[15], I. Annesi-Maesano[4], J.M. Anto[3,16], C. Bachert[3,4,17,18], C.E. Baena-Cagnani[4,19], C. Bai[20,21], A. Baigenzhin[22], C. Barbara[7,23], P.J. Barnes[13], E.D. Bateman[4,24], L. Beck[25], A. Bedbrook[2,4], E.H. Bel[26], O. Benezet[2], K.S. Bennoor[4,27], M. Benson[28], M. Bernabeu-Wittel[29,30], M. Bewick[31], C. Bindslev-Jensen[4,32], H. Blain[1,2,8], F. Blasi[33], M. Bonini[4,34], S. Bonini[4,35], L.P. Boulet[4,36], A. Bourdin[1,2,8,37], R. Bourret[1,2], P.J. Bousquet[4], C.E. Brightling[38], A. Briggs[39], J. Brozek[4,40], R. Buhl[41], A. Bush[4,42], D. Caimmi[1,2,4], M. Calderon[43,44], P. Calverley[45], P.A. Camargos[4,46], T. Camuzat[2], G.W. Canonica[4,47], K.H. Carlsen[3,4,48,49], T.B. Casale[4], M. Cazzola[50], A.M. Cepeda Sarabia[4,51,52], A. Cesario[53], Y.Z. Chen[54], E. Chkhartishvili[55], N.H. Chavannes[4,56,57], R. Chiron[1,2,4], A. Chuchalin[4,58,59], K.F. Chung[11], L. Cox[4,60], G. Crooks[61], M.G. Crooks[62], A.A. Cruz[4,58,63], A. Custovic[4,5,64], R. Dahl[4,32], S.E. Dahlen[65], F. De Blay[4,66,67], T. Dedeu[68], D. Deleanu[4,12,69], P. Demoly[1,2,4,5,7,8], P. Devillier[4,70], A. Didier[71,72], A.T. Dinh-Xuan[73], R. Djukanovic[74], D. Dokic[4,75], H. Douagui[4,76], R. Dubakiene[4,77,78], S. Eglin[79], F. Elliot[80], R. Emuzyte[4,77,78], L. Fabbri[81], A. Fink Wagner[82], M. Fletcher[58,83], W.J. Fokkens[4,26,84], J. Fonseca[4,23,85,86], A. Franco[87], P. Frith[88], A. Furber[89], M. Gaga[90], J. Garcés[91,92], J. Garcia-Aymerich[3,16], A. Gamkrelidze[4,93], S. Gonzales-Diaz[4,52], F. Gouzi[1,37], M.A. Guzmán[4,94], T. Haahtela[3,4,95], D. Harrison[96], M. Hayot[1,2,8], L.G. Heaney[97], J. Heinrich[3], P.W. Hellings[4,5,98], J. Hooper[99], M. Humbert[71], M. Hyland[100], G. Iaccarino[101–103], D. Jakovenko[2], J.R. Jardim[104], C. Jeandel[1,2,8], C. Jenkins[105], S.L. Johnston[4,106], O. Jonquet[1,2,8], G. Joos[17], K.S. Jung[107], O. Kalaycı[4,5,108,109], S. Karunanithi[110], T. Keil[3,111,112], N. Khaltaev[4,58], V. Kolek[113], M.L. Kowalski[114], I. Kull[3,115], P. Kuna[4,7,58,116,117], V. Kvedariene[4,5,77,118], L.T. Le[4,58,119], K.C. Lodrup Carlsen[3,4,48,49], R. Louis[120], W. MacNee[121], A. Mair[122], I. Majer[123], P. Manning[124], E. de Manuel Keenoy[4,125], M.R. Masjedi[126], E. Melen[3,4,115], E. Melo-Gomes[7,23], A. Menzies-Gow[127], G. Mercier[1,2,8], J. Mercier[1,2,7,8], J.P. Michel[128], N. Miculinic[129], F. Mihaltan[4,12,130], B. Milenkovic[131–133], M. Molimard[134], I. Momas[135], A. Montilla-Santana[29], M. Morais-Almeida[136,137], M. Morgan[138], M. N'Diaye[139], S. Nafti[4,140], K. Nekam[4,141], A. Neou[142,143], L. Nicod[144], R. O'Hehir[4,145], K. Ohta[4,146], P. Paggiaro[147], S. Palkonen[3,4,148], S. Palmer[149], N.G. Papadopoulos[4,5,64,150], A. Papi[151], G. Passalacqua[4,47], I. Pavord[152], B. Pigearias[153], D. Plavec[154], D.S. Postma[3,155], D. Price[4,94,156], K.F. Rabe[157], F. Radier Pontal[2], J. Redon[4,158], S. Rennard[159], J. Roberts[160], J.M. Robine[2,161], J. Roca[14], N. Roche[162], F. Rodenas[91,92], A. Roggeri[163], C. Rolland[164], J. Rosado-Pinto[4,7,23,58], D. Ryan[4,56,165,166], B. Samolinski[7,117,167], M. Sanchez-Borges[168], H.J. Schünemann[40], A. Sheikh[166,169], M. Shields[170], N. Siafakas[171], Y. Sibille[172], T. Similowski[173–176], I. Small[177], O. Sola-Morales[178], T. Sooronbaev[4,58,179,180], R. Stelmach[181], P.J. Sterk[29], T. Stiris[182,183], P. Sud[184], V. Tellier[185], T. To[28], A. Todo-Bom[186], M. Triggiani[187], R. Valenta[4,188], A.L. Valero[14], A. Valiulis[4,77,78,183,189], E. Valovirta[189], E. Van Ganse[190], O. Vandenplas[4,174], T. Vasankari[191], J. Vestbo[192,193], G. Vezzani[194], G. Viegi[195], L. Visier[1,2,8], C. Vogelmeier[196], T. Vontetsianos[197], R. Wagstaff[198], U. Wahn[143], B. Wallaert[66,199], B. Whalley[200], M. Wickman[3,4,115], D.M. Williams[200], N. Wilson[201], B.P. Yawn[4,202], P.K. Yiallouros[4,203], A. Yorgancioglu[4,108], O.M. Yusuf[58,204], H.J. Zar[205], N. Zhong[206], M. Zidarn[4,207] and T. Zuberbier[142,143]



Goals

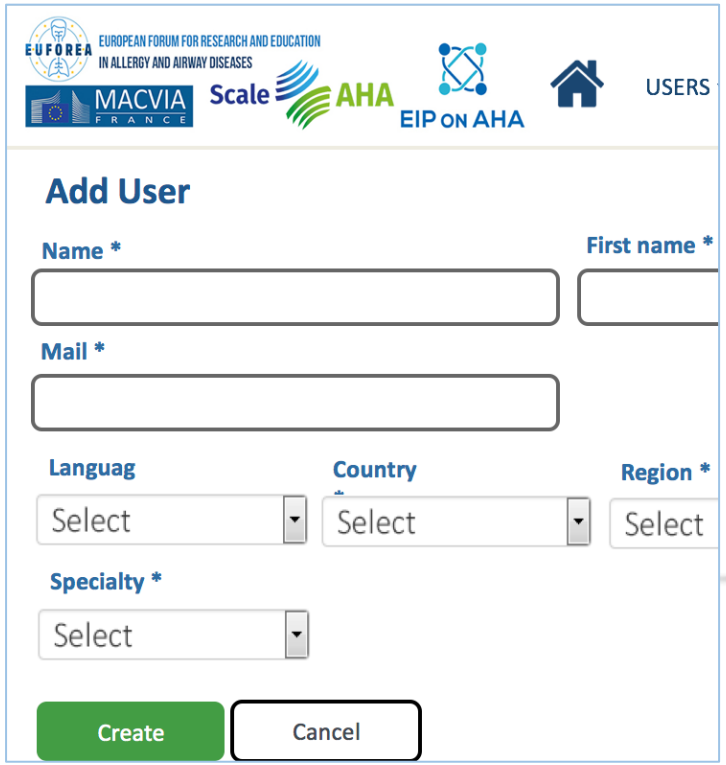
1. Develop for each step a document with a 4-pages pocket-guide
2. Include mHealth for each step
3. From one step to the next one
4. When to go to the next step
5. Stepwise approach for management
6. Develop machine learning to optimize ICPs

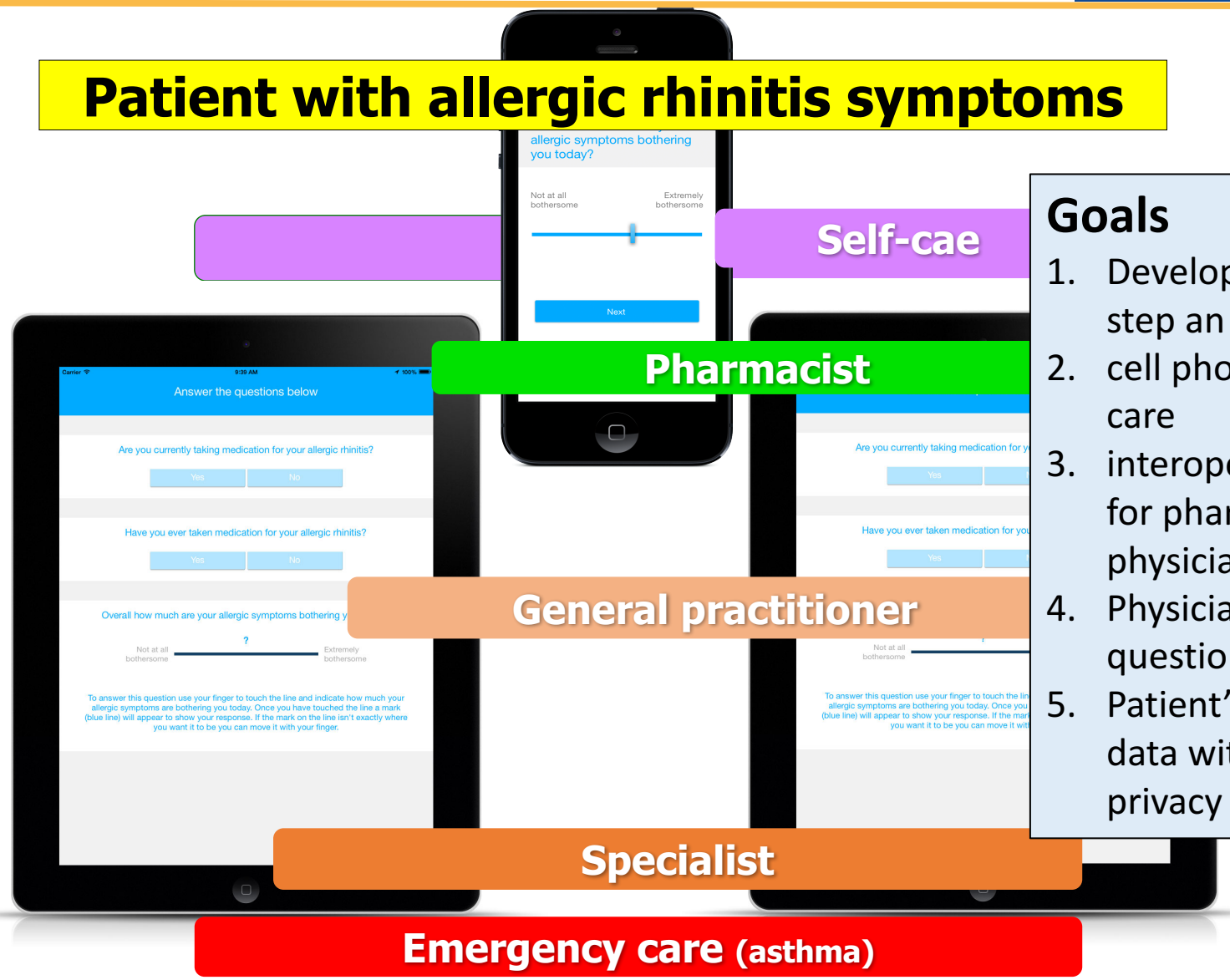
GARD

eit Health

EIP ON AHA

MASK mHealth approach for ICPs





Goals

1. Develop for each step an mHealth tool
2. cell phone for self-care
3. interoperable tablet for pharmacists and physicians
4. Physicians's questionnaire
5. Patient's personal data with maintained privacy (GPDR)

MASK (Mobile Airways Sentinel Network)

1- The goals

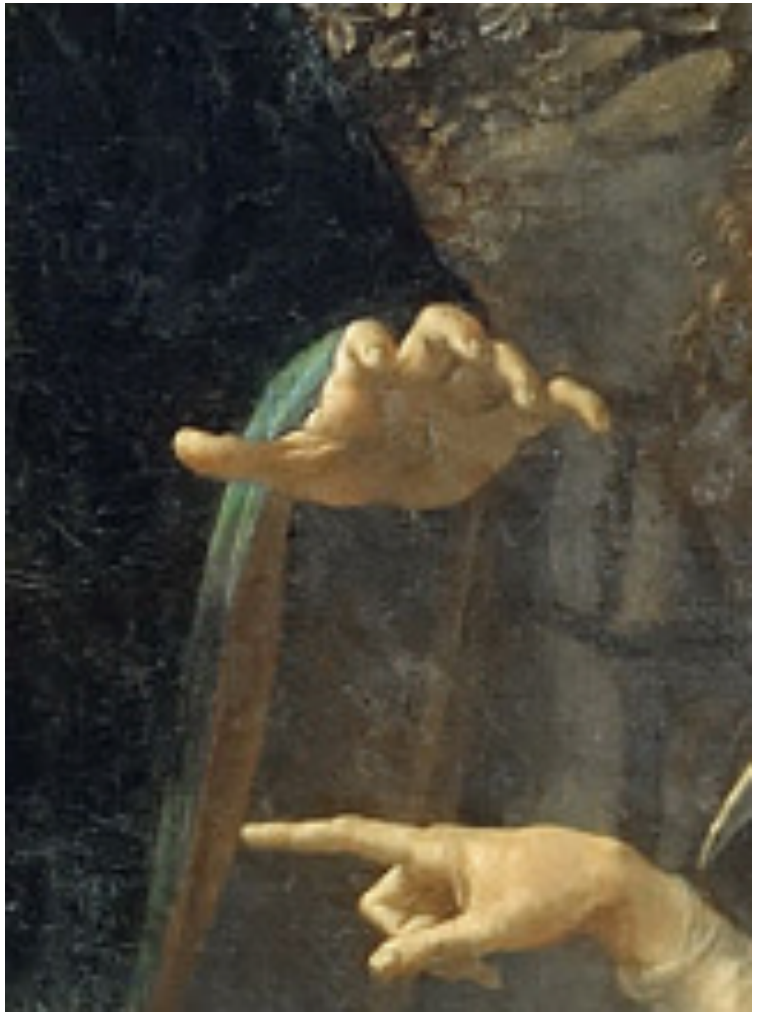
2- The cell phone (The Allergy Diary)

The finger approach to manage allergic rhinitis

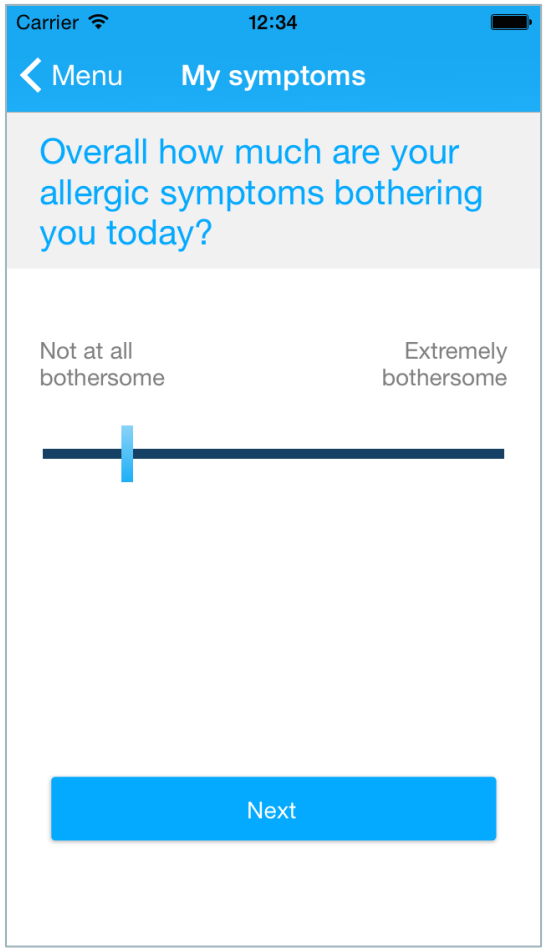
Not at all bothersome

VAS

Extremely bothersome



The Allergy Diary



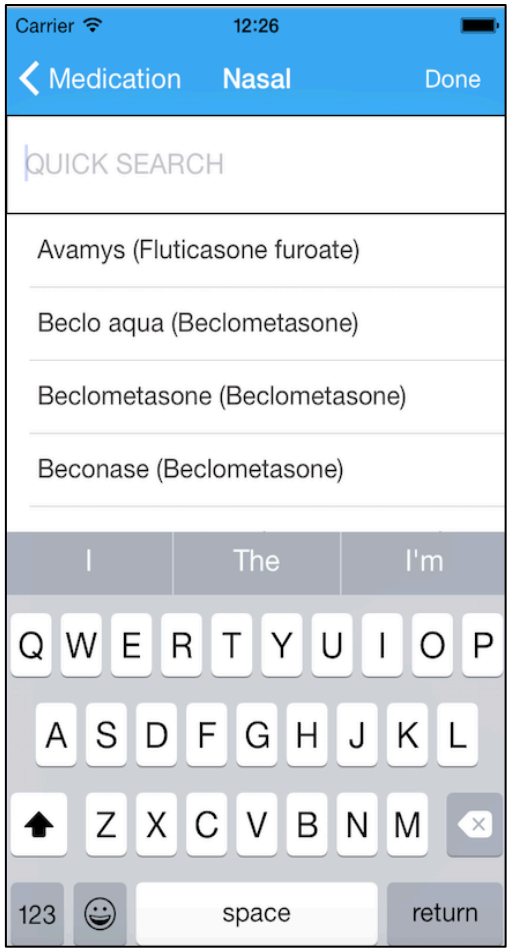
How much are your nose symptoms bothering you today?

How much are your eye symptoms bothering you today?

How much are your asthma symptoms bothering you today?

23 countries (+3)
17 languages
23,500 users
160,000 VAS days

GPDR (May 25, 2018)



Free on Android and IOS

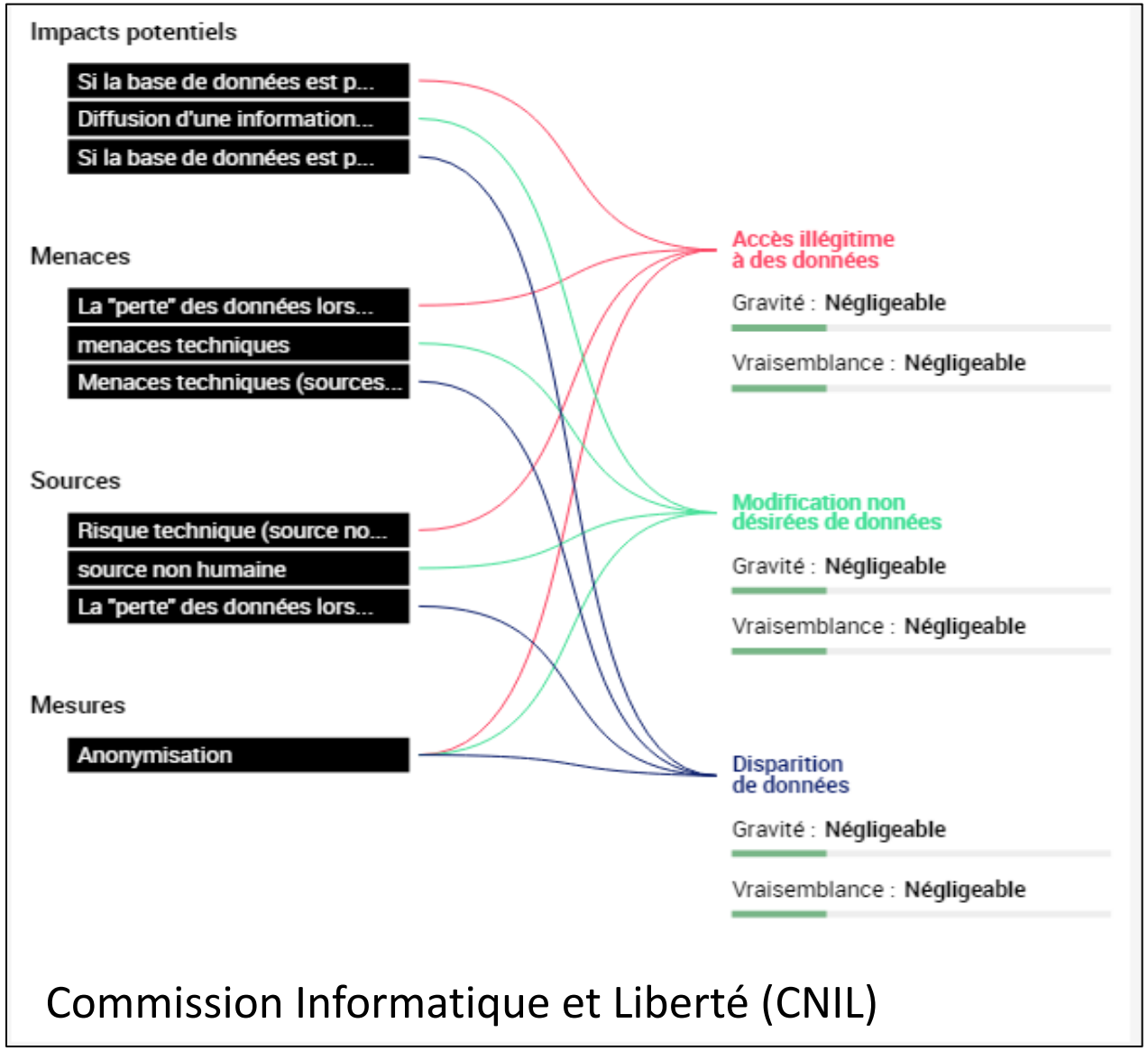
European Commission

Home > Law > Law by topic > Data protection > Data protection in the EU

Data protection in the EU

Data protection in the EU

The General Data Protection Regulation (GDPR), the Data Protection Law Enforcement Directive and other rules concerning the protection of personal data



Commission Informatique et Liberté (CNIL)

Bousquet *et al. Clin Transl Allergy (2017) 7:37*
DOI 10.1186/s13601-017-0173-8

Clinical and Translational Allergy

REVIEW Open Access

CHRODIS criteria applied to the MASK (MACVIA-ARIA Sentinel NetworK) Good Practice in allergic rhinitis: a SUNFRAIL report

J. Bousquet[1,2,102*], G. L. Onorato[1], C. Bachert[3], M. Barbolini[4], A. Bedbrook[1], L. Bjermer[5], J. Correia de Sousa[6], N. H. Chavannes[7], A. A. Cruz[8,9], E. De Manuel Keenoy[10], P. Devillier[11], J. Fonseca[12,13], S. Hun[14], T. Kostka[15], P. W. Hellings[16], M. Illario[17], J. C. Ivancevich[18], D. Larenas-Linnemann[19], J. Millot-Keurinck[20], D. Ryan[21], B. Samolinski[22], A. Sheikh[23], A. Yorgancioglu[24,25], I. Agache[26], S. Arnavielhe[27], M. Bewick[28], I. Annesi-Maesano[29], J. M. Anto[30,31,32,33], K. C. Bergmann[34,35], C. Bindslev-Jensen[36], S. Bosnic-Anticevich[37,43], J. Bouchard[38,39], D. P. Caimmi[40,41], P. Camargos[42], G. W. Canonica[40], V. Cardona[44], A. M. Carriazo[45], C. Cingi[46], E. Colgan[47], A. Custovic[48], R. Dahl[8,9], P. Demoly[41], G. De Vries[49], W. J. Fokkens[50], J. F. Fontaine[51], B. Gemicioğlu[52], N. Guldemond[53], Z. Gutter[54], T. Haahtela[55], B. Hellqvist-Dahl[56], E. Jares[57], G. Joos[58], J. Just[59,60], N. Khaltaev[61], T. Keil[62,63], L. Klimek[64], M. L. Kowalski[65], I. Kull[66], P. Kuna[67], V. Kvedariene[68], D. Laune[27], R. Louis[69], A. Magnan[70], J. Malva[71,72], E. Mathieu-Dupas[27], E. Melén[73], E. Menditto[74], M. Morais-Almeida[75], R. Mösges[76], J. Mullol[77], R. Murray[78], H. Neffen[79], R. O'Hehir[80,81], S. Palkonen[82], N. G. Papadopoulos[83,84], G. Passalacqua[85], J. L. Pépin[86], F. Portejoie[1], D. Price[87,88,89], B. Pugin[16], F. Raciborski[22], F. E. R. Simons[90], M. Sova[91], O. Spranger[92], C. Stellato[93], A. Todo Bom[94], P. V. Tomazic[95], M. Triggiani[93], A. Valero[96], E. Valovirta[96], O. VandenPlas[97], A. Valiulis[97], M. van Eerd[49], M. T. Ventura[98], M. Wickman[73], I. Young[99], T. Zuberbier[34,35], A. Zurkuhlen[100] and A. Senn[101]

Data storage, transfer and analysis

1- Data storage

- Crypted transfer of data form user' smartphone to data base
- Secure database –with restricted access- to store data in E.U. (no transfer outside EU)

2- Data transfer

- Post treatment of geolocation data to follow GDPR in respect of users 'privacy
- Transfer of data only when protocol detailing analyses is signed
- Data freely available for MASK participants (per country), fee for others

3- Data analysis

- Epidemiologic data
- Assessment of treatment efficacy and adherence
- Pharmaco-economic impact of allergic diseases (including EQ-5D and work)

4- Integration of data

- Integrated print process from user's smartphone to user or physician's PC
- Interoperability of data exported into medical databases: linking to patient's record
- Possible integration to contextual data (e.g.: pollution data)

Completion of the m-health tool

- Profile complement (tobacco)
- Complement of daily survey-sleep and sleepiness questions added
- Complement questionnaires (Epworth)

POLLAR

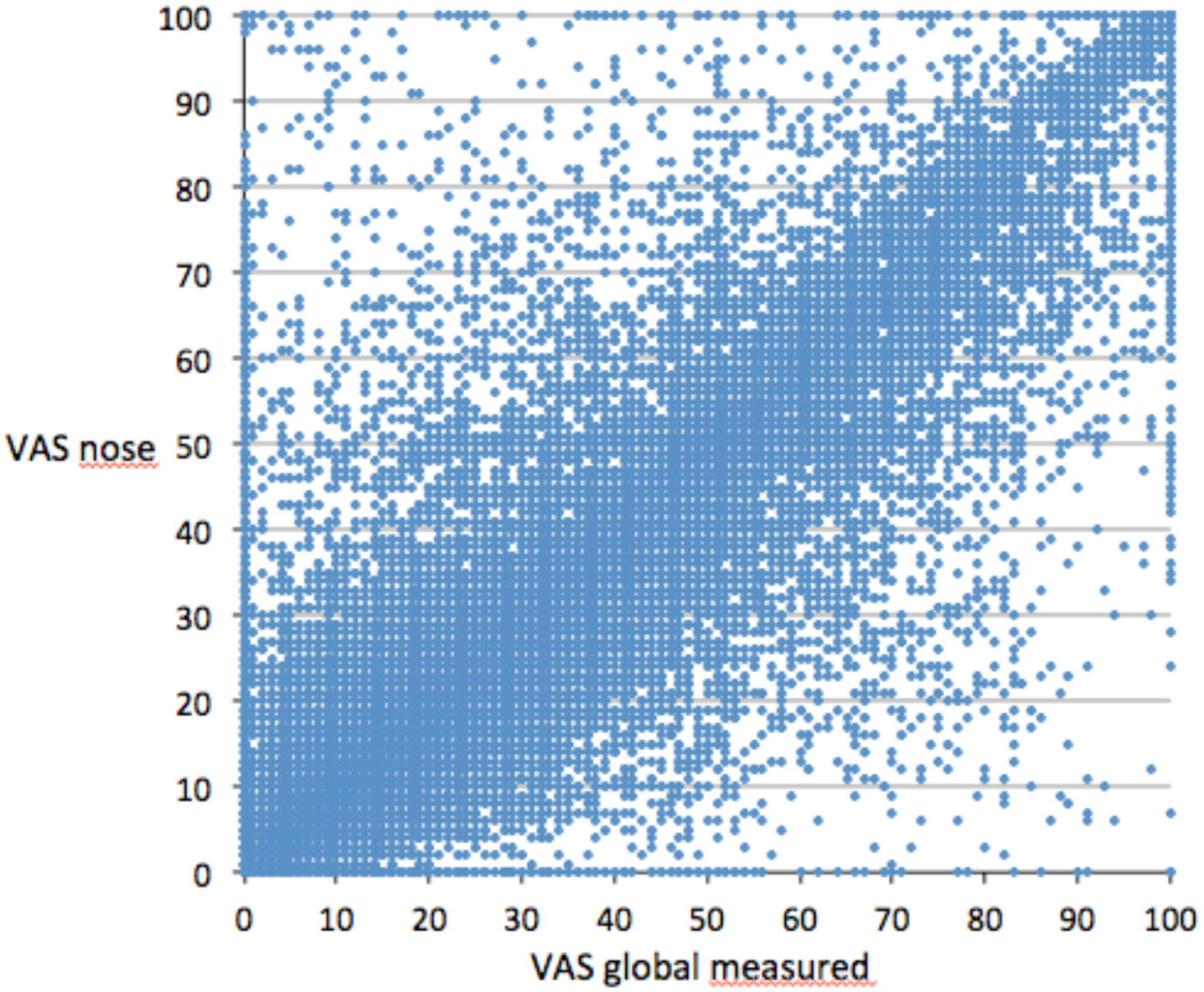
MASK (Mobile Airways Sentinel Network)

1- The goals

2- The cell phone

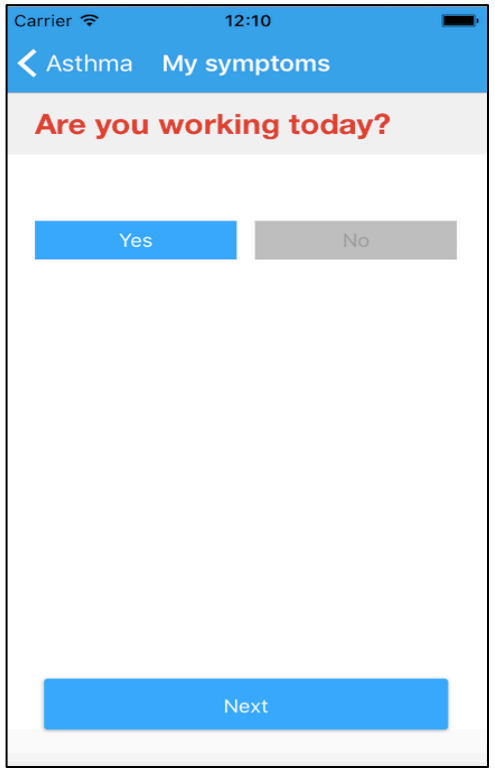
3- Innovation in epidemiology (research)

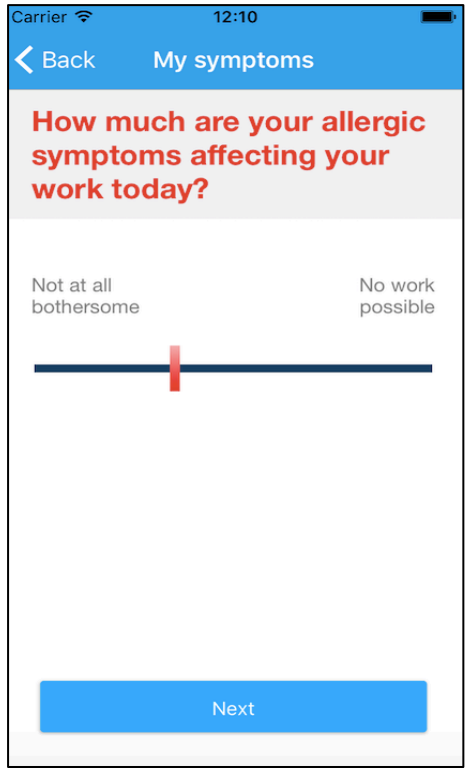
Correlation between global and nasal VAS



N= 41,872 days
R= 0.87

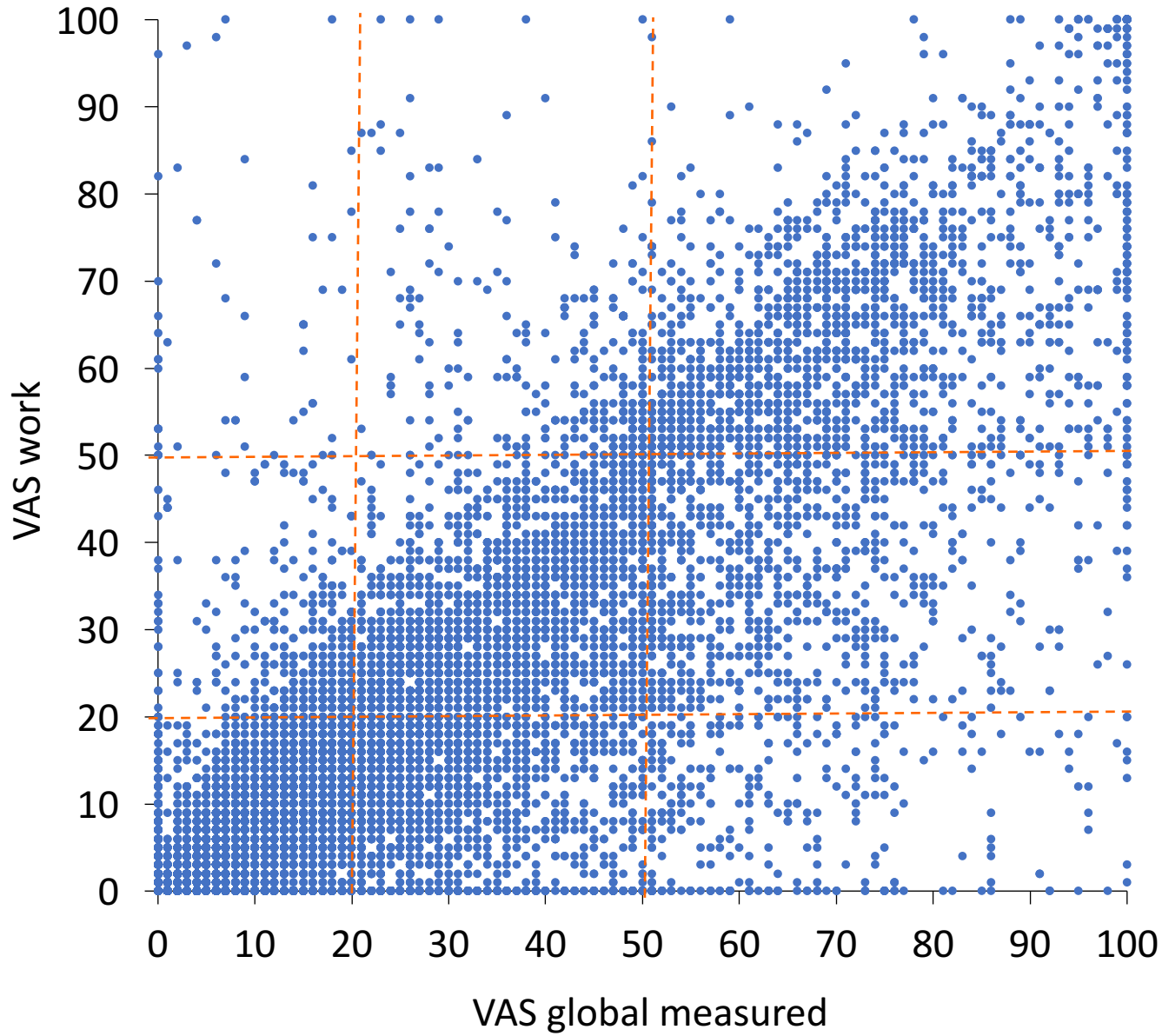
VAS work





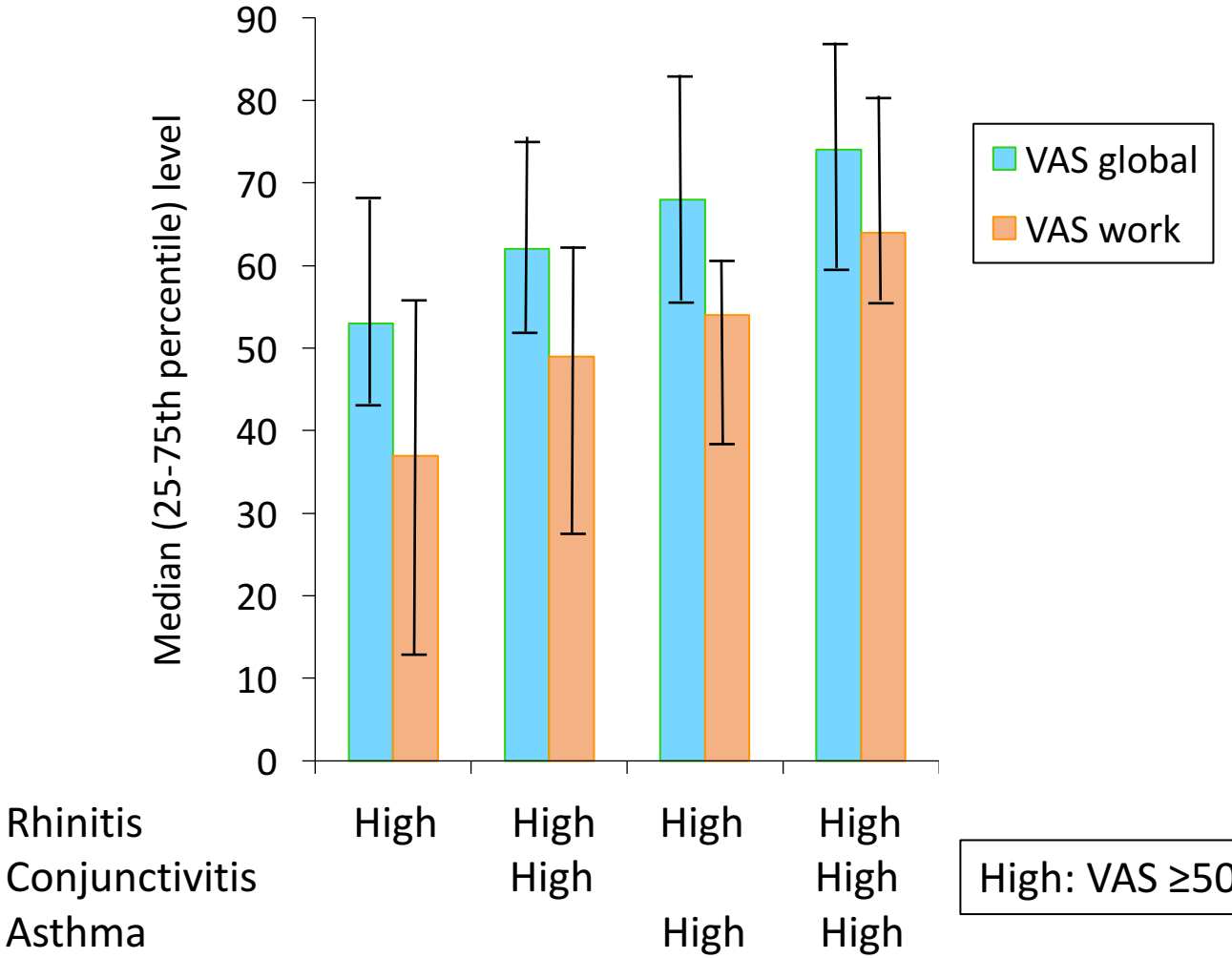
N = 16,925 days
20 countries
15 languages

Global VAS: r=0.82
Rhinitis: r=0.77
Conjunctivitis: r=0.69
Asthma: r=0.60



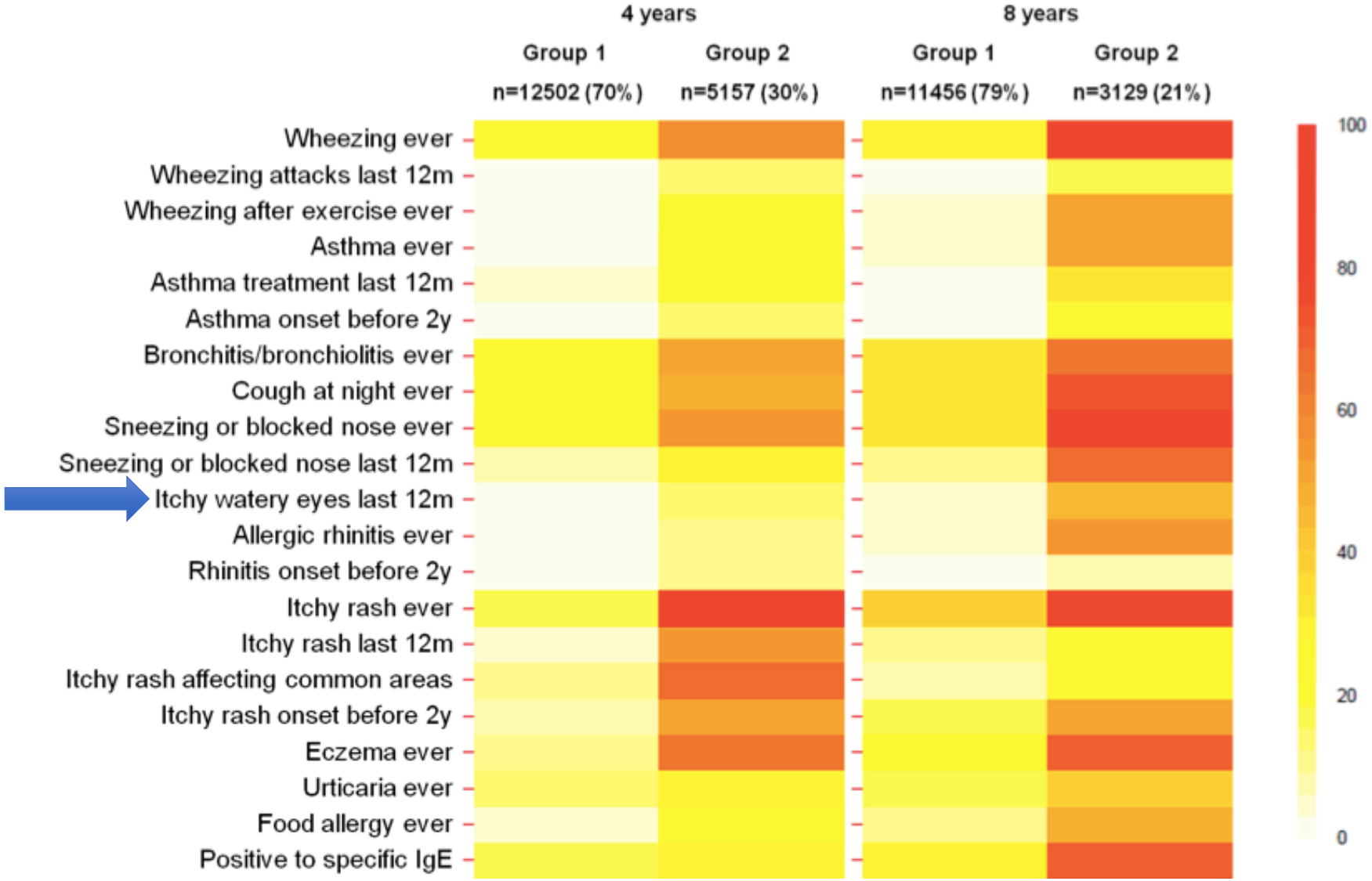
Novel patterns of multimorbidity (days)

Visual Analogue Scale levels depending on allergic multimorbidities



MeDALL novel phenotypes

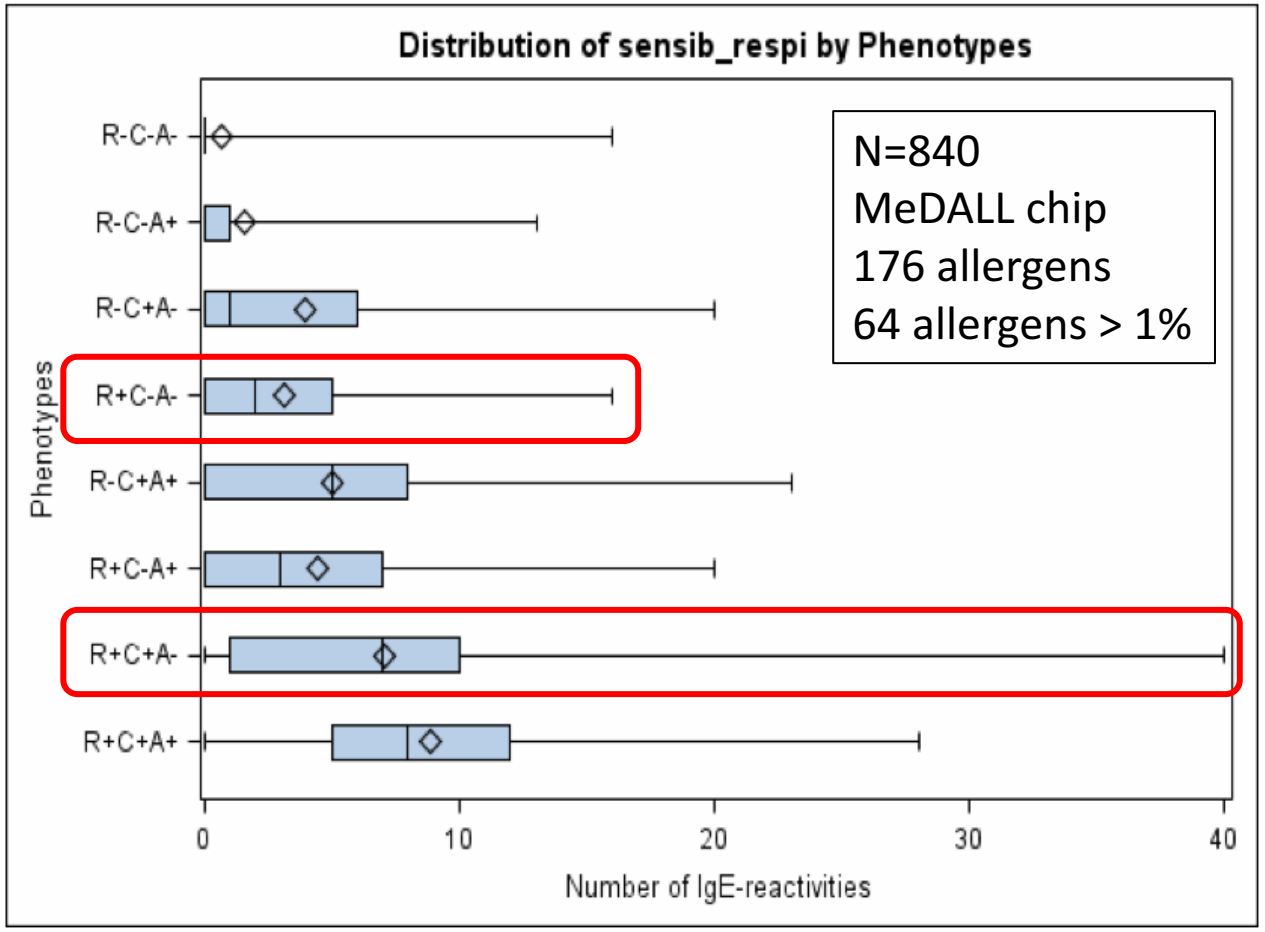
Garcia-Aymeric et al, Allergy 2015



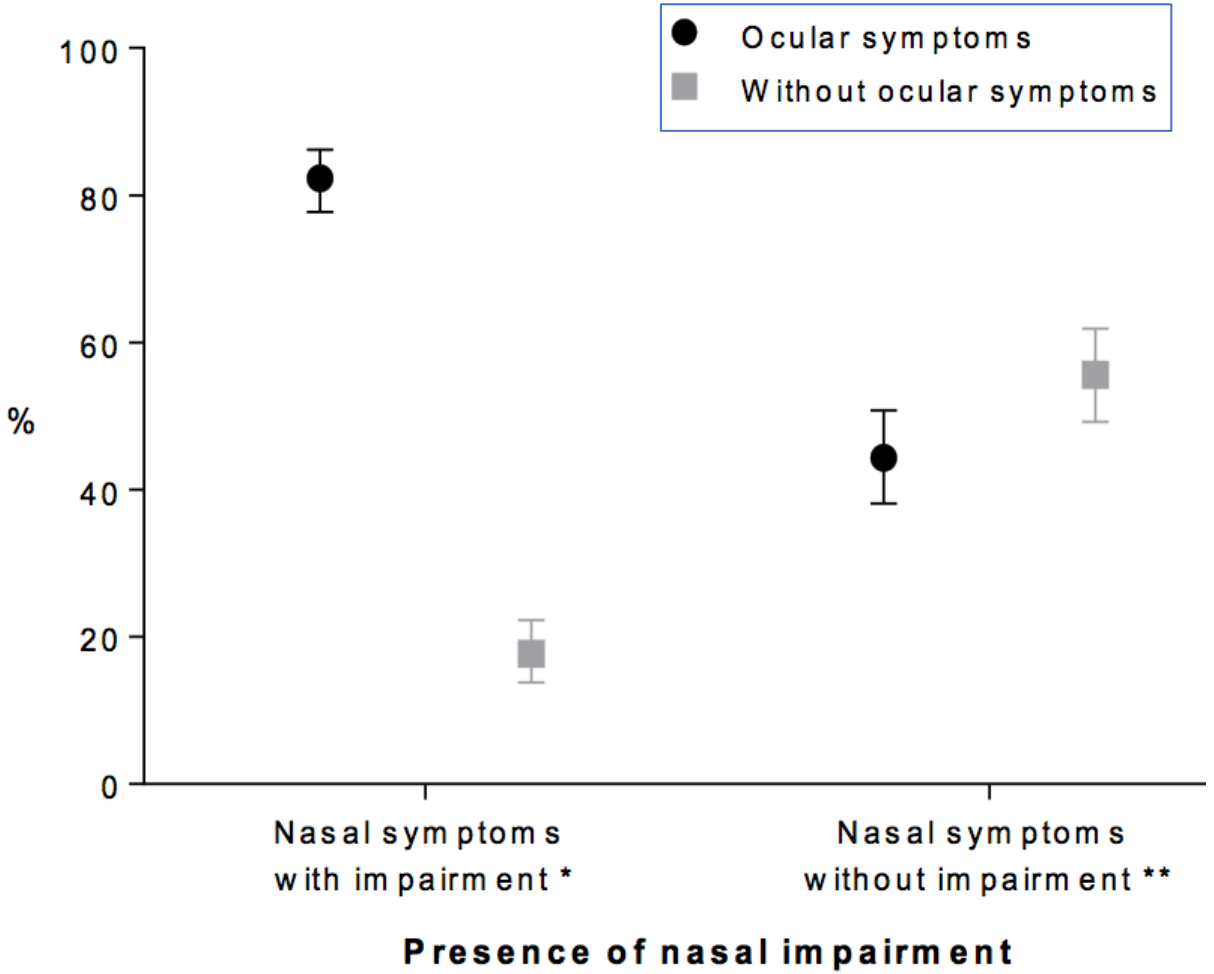
Phenotypes in epidemiologic studies

EGEA
Étude épidémiologique des facteurs Génétiques et Environnementaux de l'Asthme, l'hyperréactivité bronchique et l'atopie
Epidemiological study on the Genetics and Environment of Asthma, bronchial hyperresponsiveness and atopy

Boudier, Siroux, Bousquet



Portuguese national cohort Amaral et al



Phenotyp ic studies

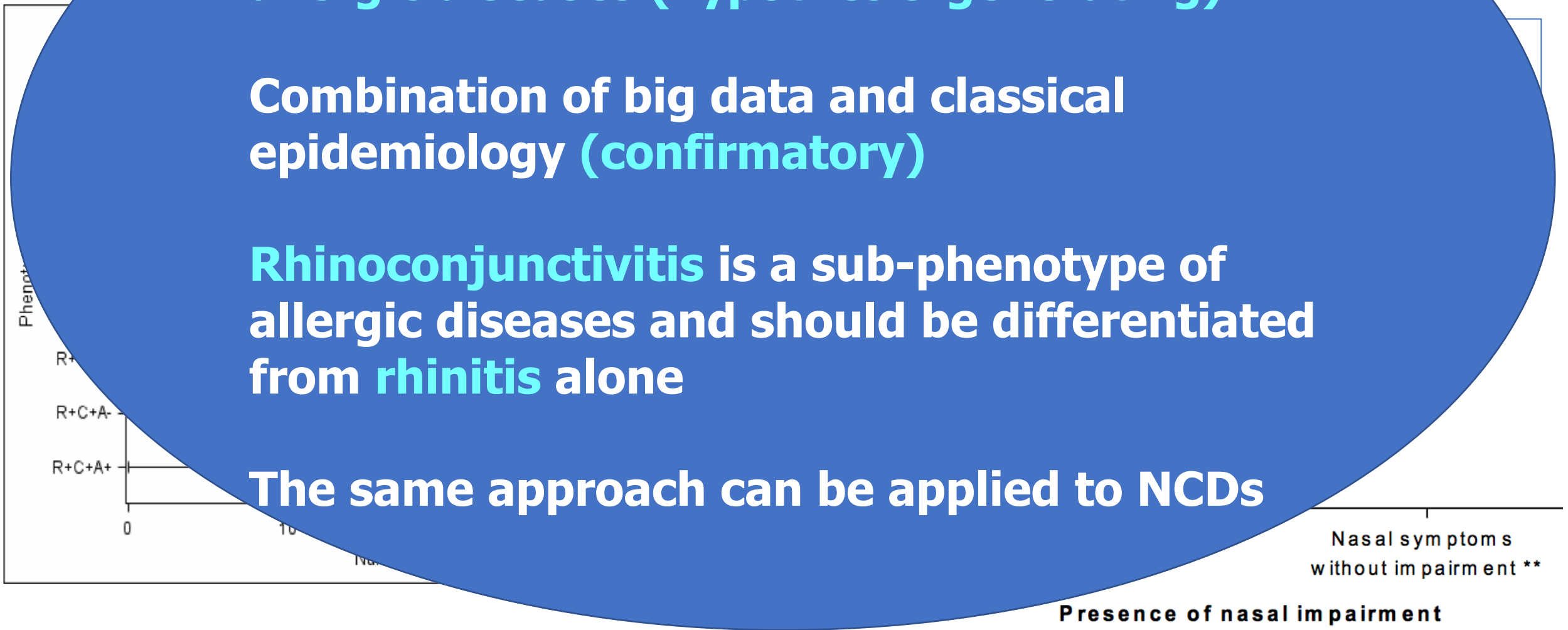
aral et al

An App without any information on patient characteristics suggested to re-classify allergic diseases (hypothesis-generating)

Combination of big data and classical epidemiology (confirmatory)

Rhinoconjunctivitis is a sub-phenotype of allergic diseases and should be differentiated from rhinitis alone

The same approach can be applied to NCDs



Air pollution

Linking pollution, pollen and allergy symptoms

Xavier Basagaña, Annabelle Bedard

ISGlobal Barcelona Institute for Global Health

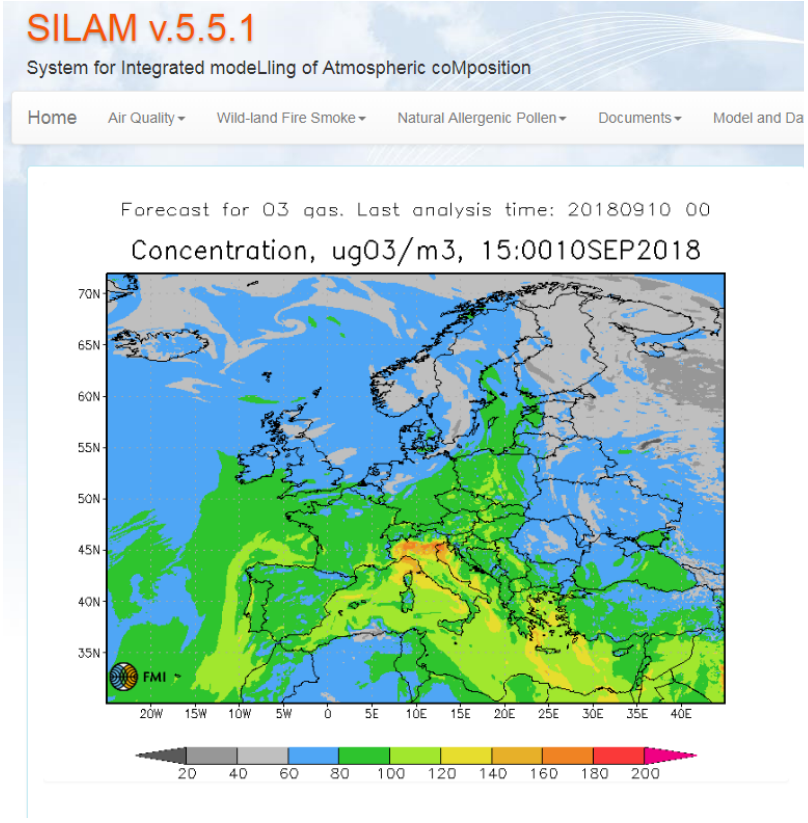
Barcelona Biomedical Research Park

Allergy Diary

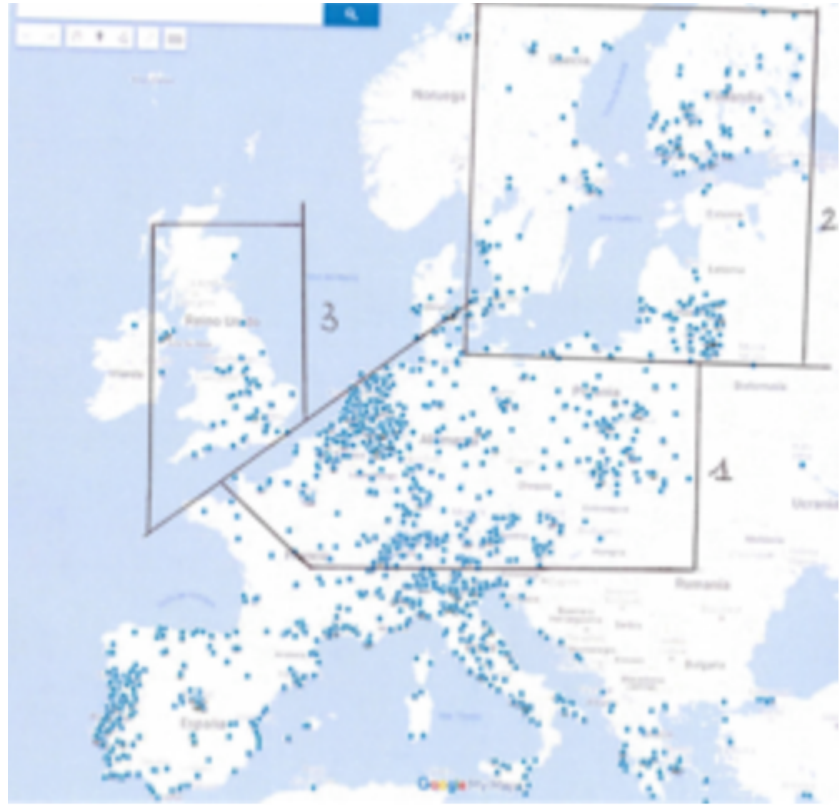
1- Establishment of “severe rhinitis” and “asthma” for 2016 and 2017
Bedard, submitted

2- Analysis of 28,300 days reported by Allergy Diary in 2017

Air pollution



Pollen season (GTs)



MASK (Mobile Airways Sentinel Network)

1- The goals

2- The cell phone

3- Innovation in epidemiology

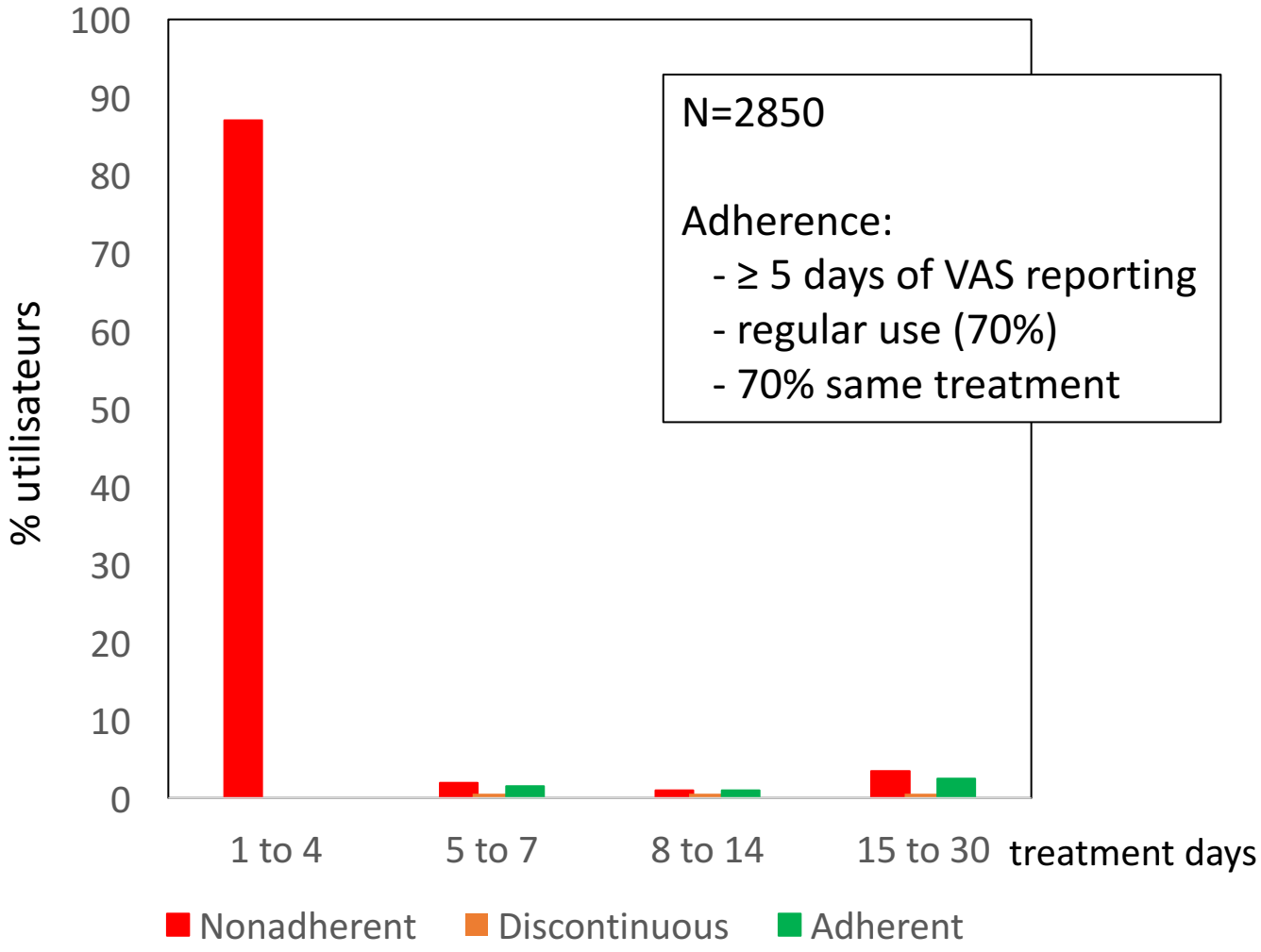
4- Innovation in management

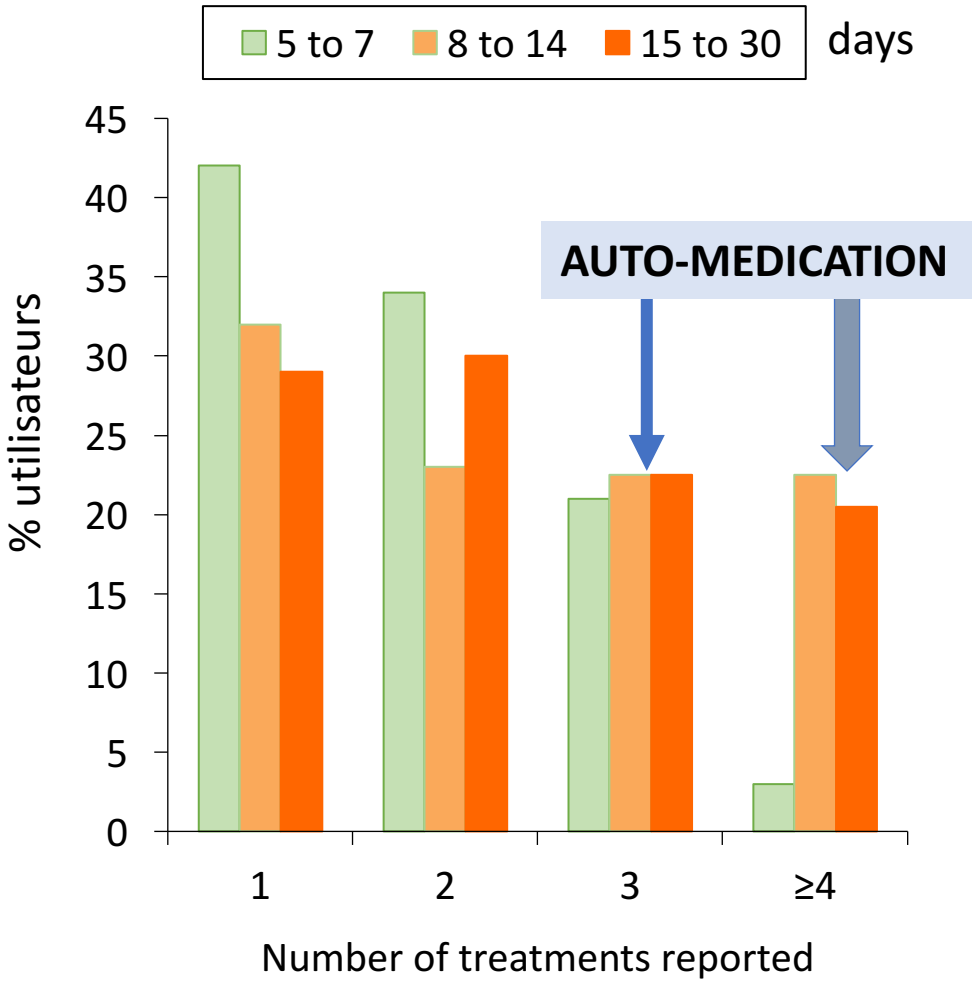
Limitations of mobile technology studies

- Users self-identified as having AR without confirmation of diagnosis
- No information except age, sex, country, location (Privacy)
- Mobile app users are not representative of the general population
- Adherence is difficult to analyze,
- Users may not report all medications used
- Longitudinal data capture is very challenging:
  - Treatment trajectories are specific for almost each user
  - Most users have gaps in treatment days when they are well-controlled
  - Cross-sectional analysis of days may be performed instead

Adherence to treatment

Bousquet J et al, 2018





Medical prescriptions (ARIA members)

There is a major disconection between physicians' prescriptions and patients' behavior

Guidelines are not used by patients

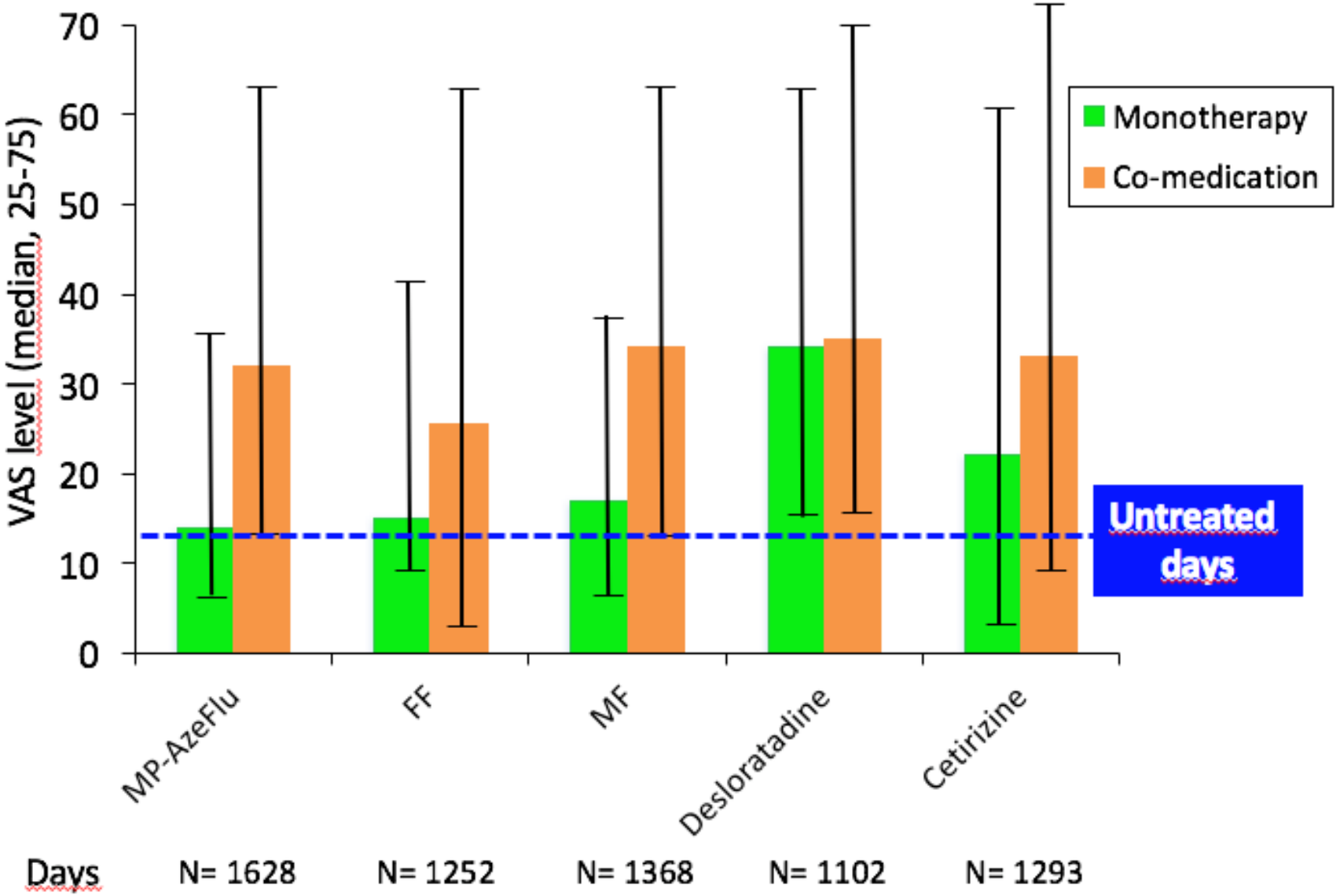
Allergic physicians behave like patients

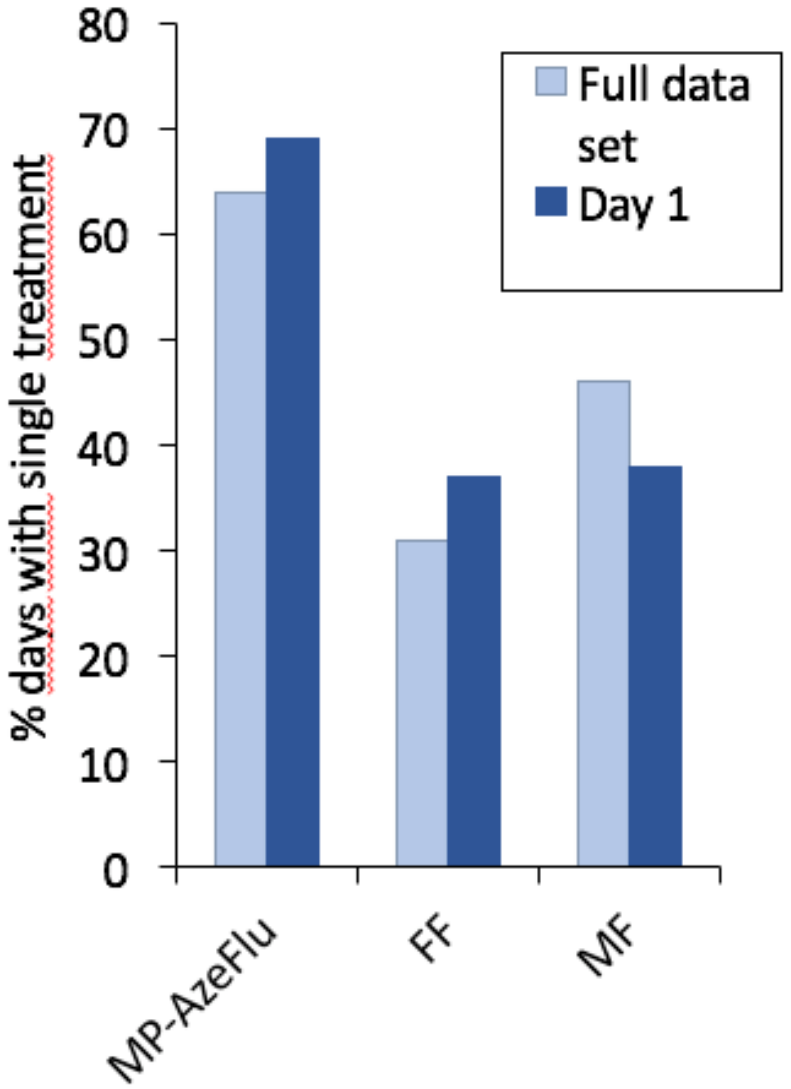
N = 201

...e indoor

Treatments received in MASK

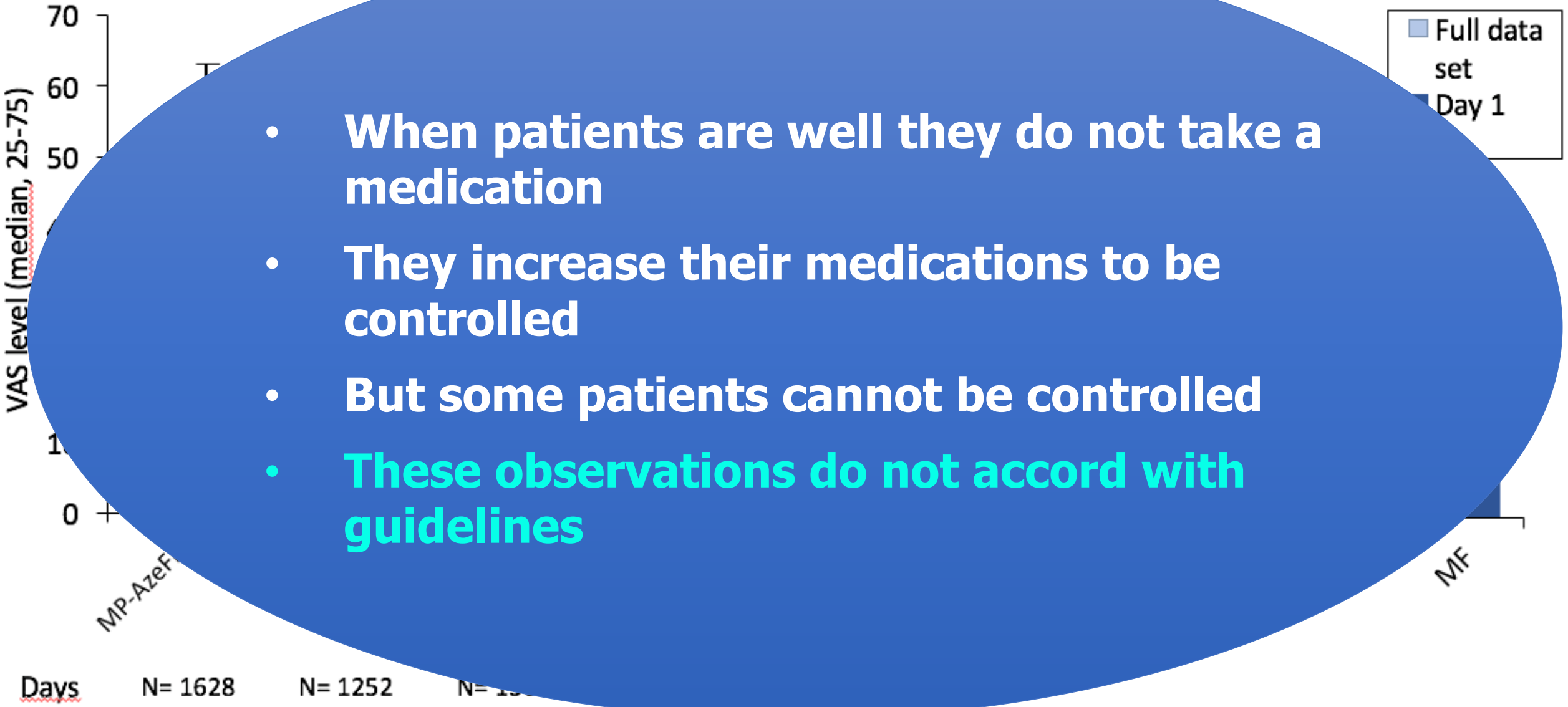
Bousquet J et al, Allergy 2018





Treatments received in MASK

Bousquet J et al, Allergy 2018



- When patients are well they do not take a medication
- They increase their medications to be controlled
- But some patients cannot be controlled
- These observations do not accord with guidelines

MASK (Mobile Airways Sentinel Network)

1- The goals

2- The cell phone

3- Innovation in epidemiology

4- Innovation in management

5- Next-generation care pathways

Next-generation integrated care pathways for allergic rhinitis and asthma multi-morbidity

A model for non-communicable diseases

POLLAR (eit Health)

GARD demonstration project (WHO Alliance)

ARIA-Euforea-Ga2len 2019

ACAAI

EAACI

EFA

ERS

ERS (Rhinology)

IPCRG

POLLAR

EHH

RNSA and MedUni Vienna

RSCN of the European Innovation Partnership on Active and Healthy Ageing az

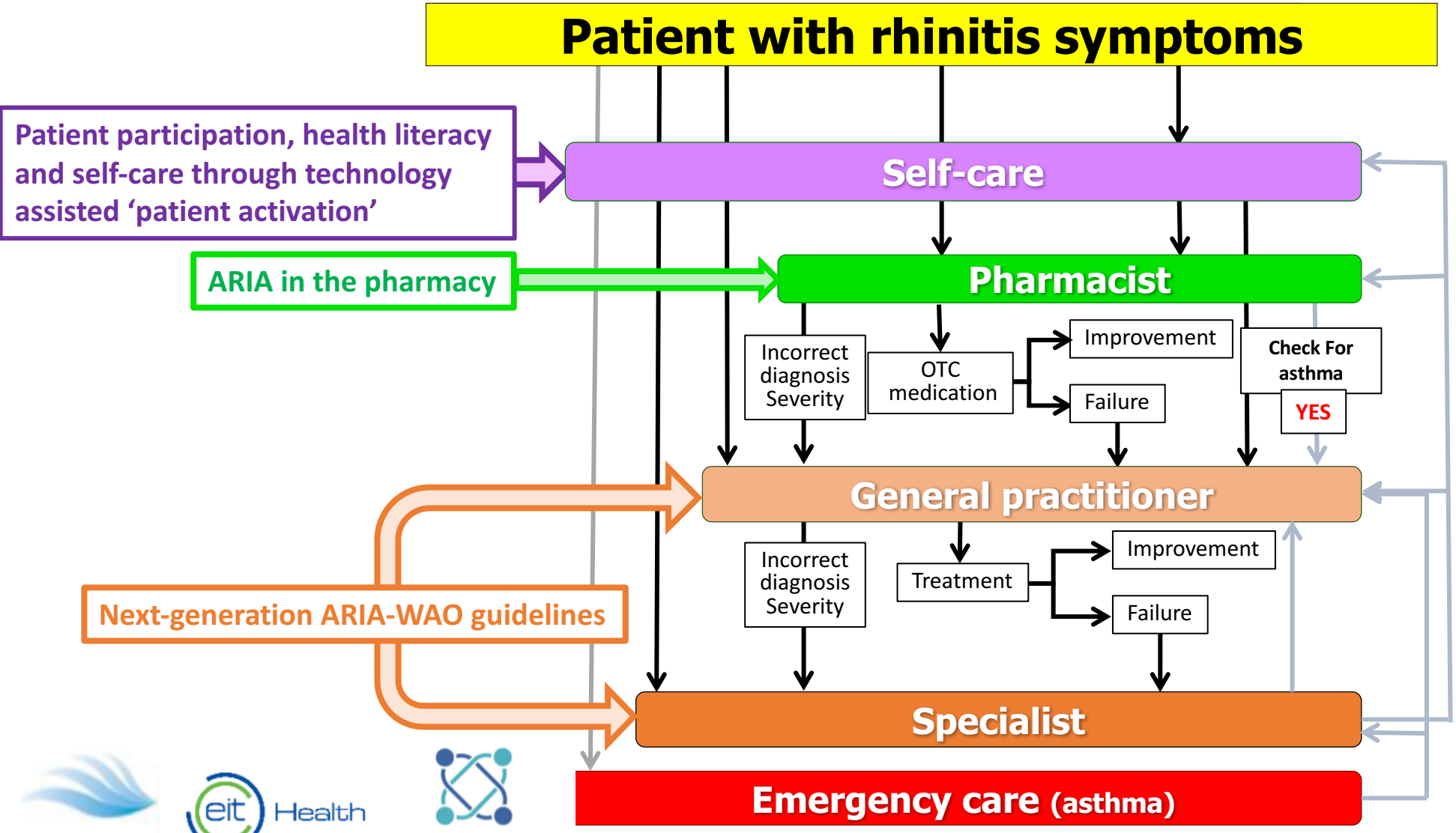
WAO

European Innovation Partnership on Active and Healthy Ageing
REFERENCE SITE

eit Health

GARD

Next-generation care pathways



Goals

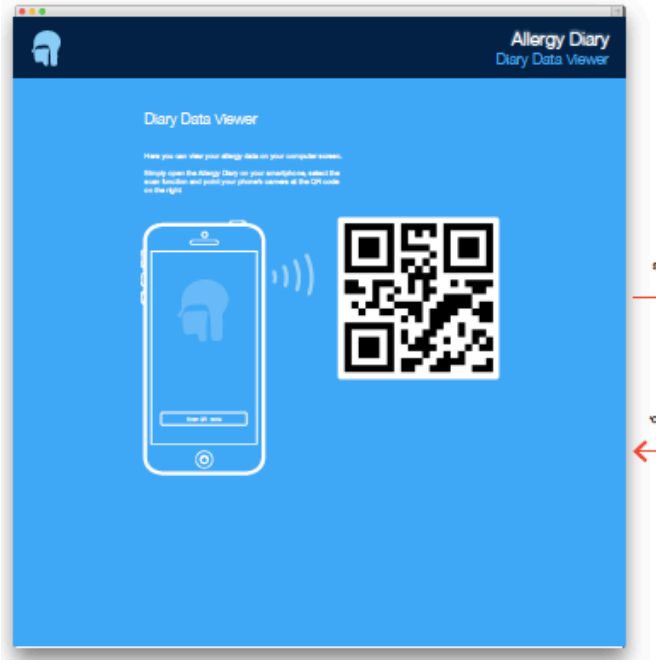
1. Develop for each step a document with a 4-pages pocket-guide
2. Include mHealth for each step
3. From one step to the next one
4. When to go to the next step
5. Stepwise approach for management
6. Develop machine learning to optimize ICPs

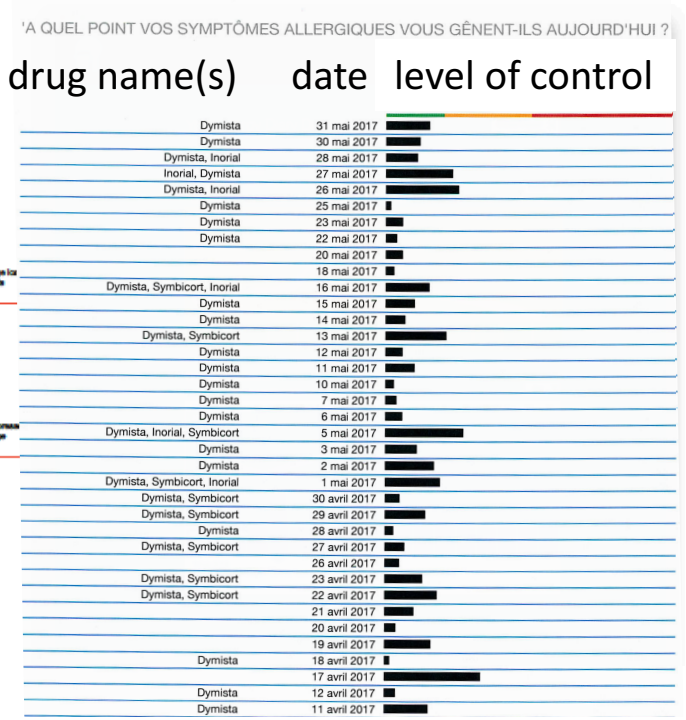
GARD

eit Health

EIP ON AHA

Transfer of data to HCP



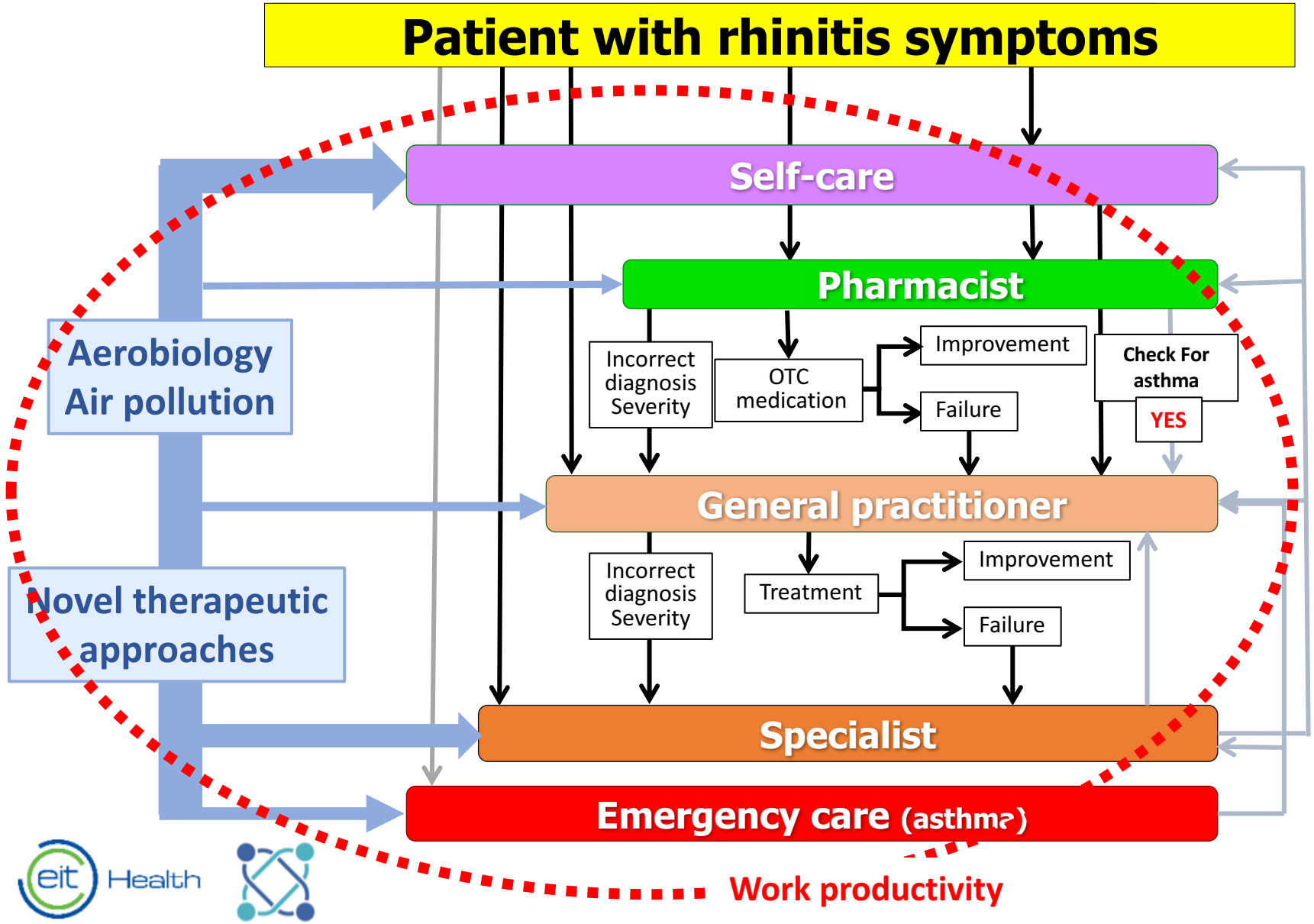


Goals

1. Patient's personal data with privacy
2. The patient cannot send to the HCP any electronic form
3. The patient can show his(her) data

Bousquet et al, Allergy 2018

Embedding environment in next-generation ICPs



Goals

1. Embedding environmental data
2. Prevention of symptoms and asthma (self-care)
3. Assess if severity of symptoms is associated with allergens or pollution
4. Predict emergency care visits
5. Develop machine learning to optimize ICPs

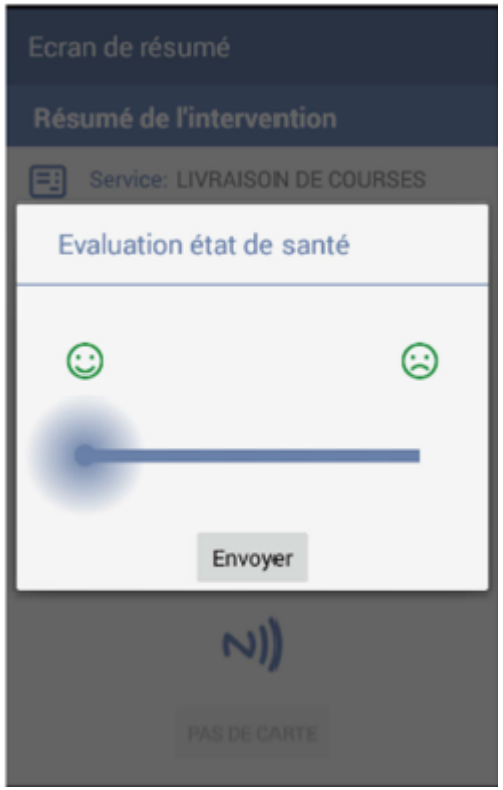
GARD eit Health

MASK future

Pilot study
in 500 patients
completed

The Airways Diary (with COPD)

- IPAG questionnaire
- Daily evaluation
  - VAS Dyspnea
  - VAS Exercise
  - Pulmonary function



Home services

- Alert system
- Pilot study completed
- Major clinical alerts
- Clinical alerts
- Social alerts

Multimorbidity App

- For diagnosed disease NOT for screening
- Based on *The Airways Diary*
- Diseases: those commonly associated with COPD
- User with a diagnosis of the disease
- Simple questionnaire for the diagnosis of the disease
- Risk factors
- Daily evaluation
  - Most important symptom
  - Objective measurements