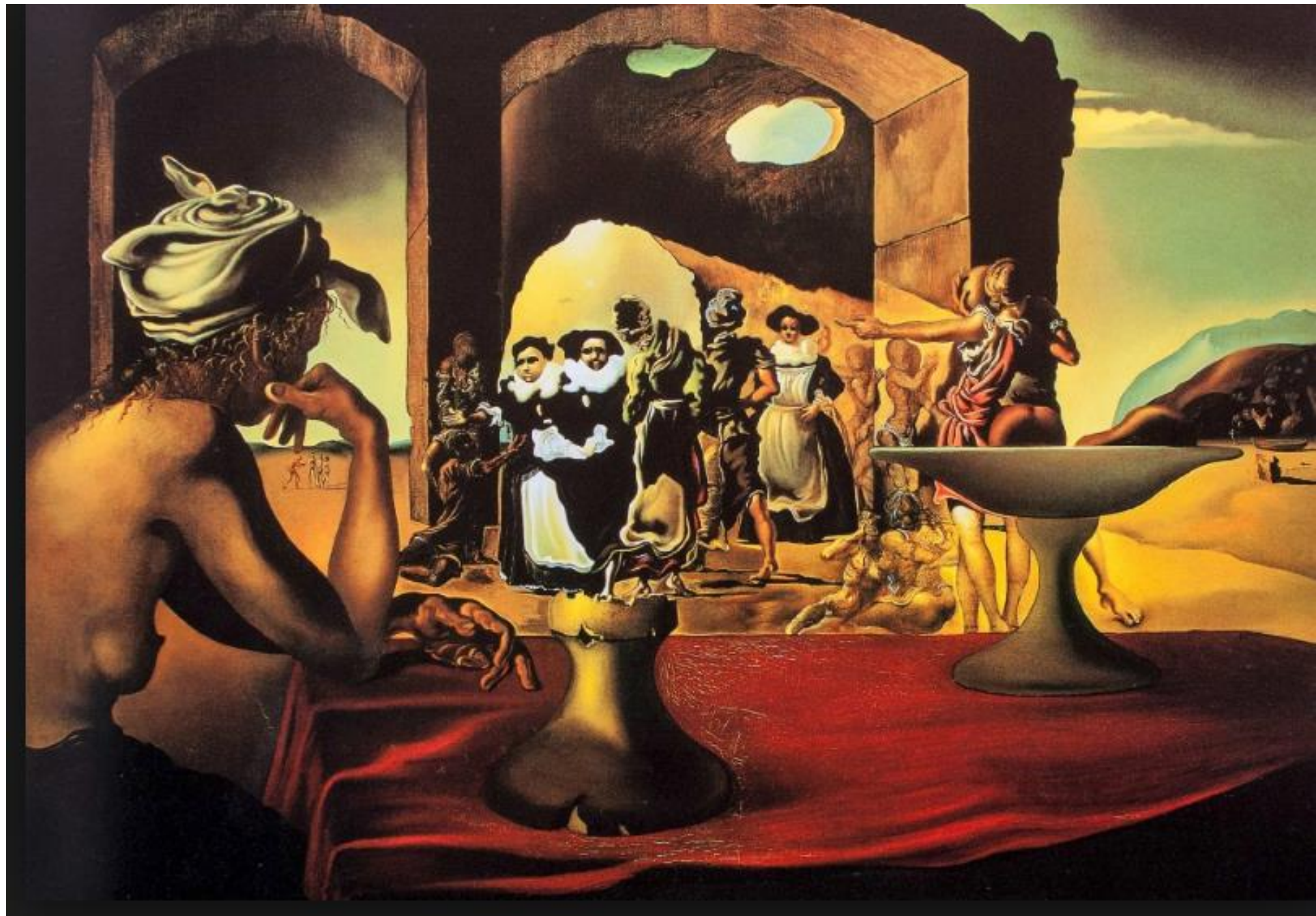


# Disclosure

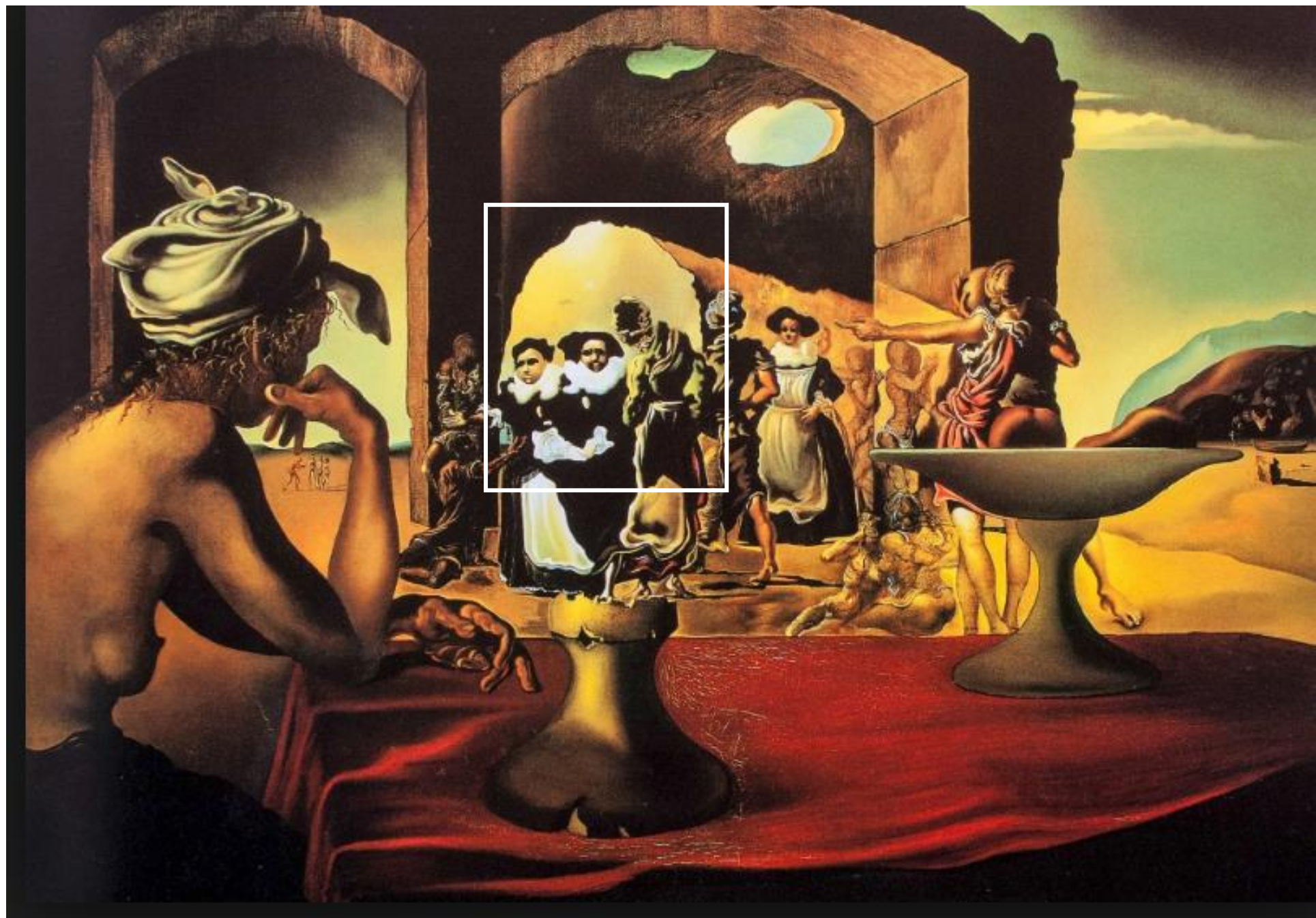
In relation to this presentation, I declare the following, real or perceived conflicts of interest:

Type	Company
Employment full time / part time	None
Research Grant (P.I., collaborator or consultant; pending and received grants)	Mylan
Other research support	Mylan
Speakers Bureau / Honoraria	Mylan, Novartis, Sanofi, Teva, Uriach
Ownership interest (stock, stock-options, patent or intellectual property)	Kyomed
Consultant / advisory board	Mylan, Novartis, Sanofi, Teva, Uriach

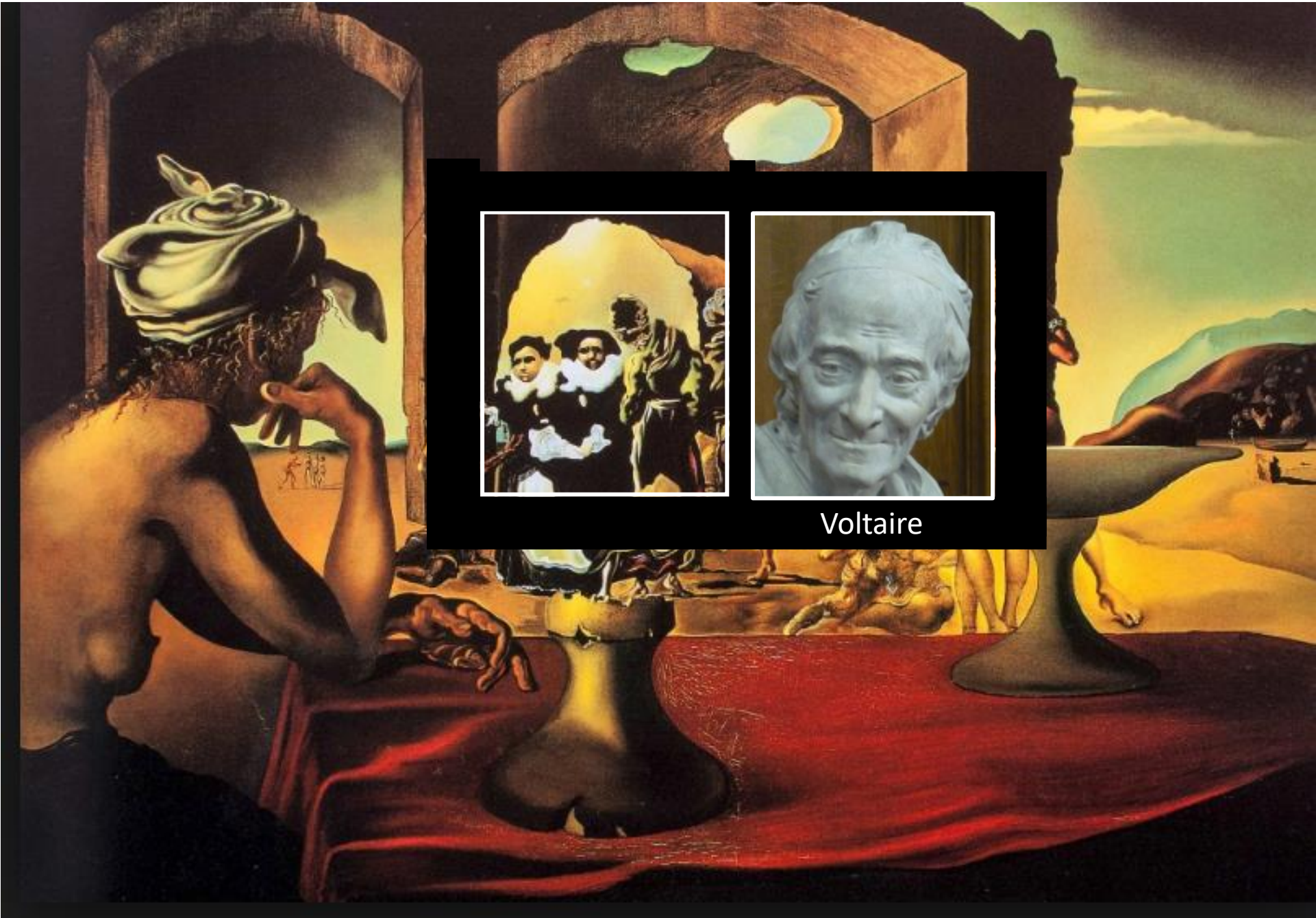
A conflict of interest is any situation in which a speaker or immediate family members have interests, and those may cause a conflict with the current presentation. Conflicts of interest do not preclude the delivery of the talk, but should be explicitly declared. These may include financial interests (eg. owning stocks of a related company, having received honoraria, consultancy fees), research interests (research support by grants or otherwise), organisational interests and gifts.











Voltaire

# **Next-generation care pathways**

**1- ICPs in real life**

**2- The cell phone (The Allergy Diary)**

**3- Innovation in epidemiology**

**4- Innovation in management**

**5- Next-generation care pathways**

# Next-generation care pathways

## 1- ICPs in real life

ICPs differ from practice guidelines as

- they are utilized by a **multidisciplinary team**
- have a focus on the quality and co-ordination of care
- ICPs need to have a mechanism for recording **variations**/deviations from planned care
- An ICP is intended to act as a guide to treatment.  
Clinicians are free to exercise their own professional judgments as appropriate. However, **any alteration to the practice identified within this ICP must be noted as a variance**
- The resulting analysis can be used to **amend the ICP itself** if, for the majority of patients, the practice is different to the pathway

**Any alteration to the practice identified with the guideline or ICP must be noted as a variance.**

- **ARIA classification:** severity (mild vs moderate/severe) is linked with quality of life (RQLQ)
- **ARIA classification:**
  - Persistence is not associated with RQLQ
  - Persistence is associated with prediction of efficacy
  - Persistence is associated with duration of treatment
  - Persistence is associated with asthma comorbidity
- **Most patients consulting in primary or secondary care**
  - Have moderate/severe disease
  - Receive ICS + antihistamines



# 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

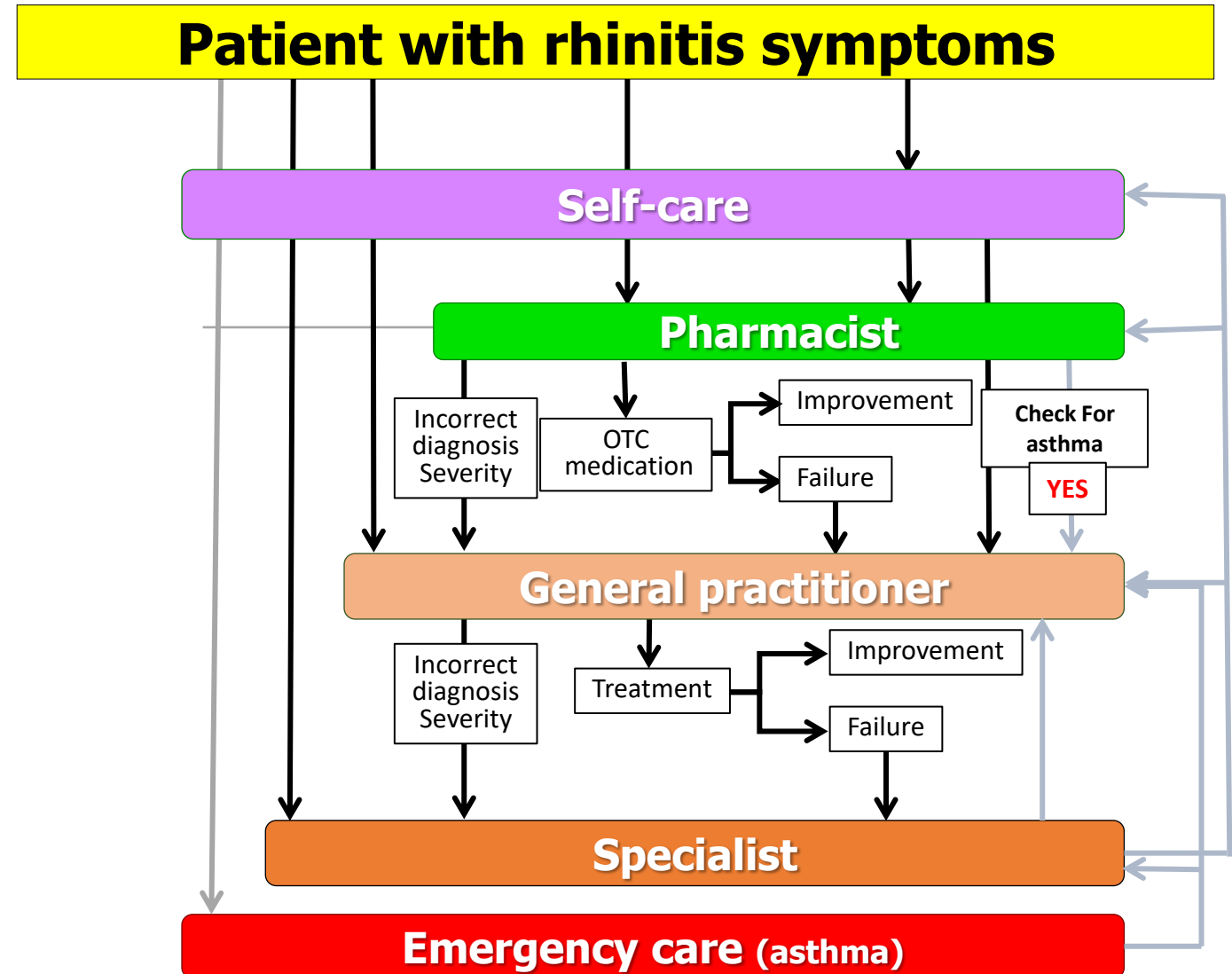
J. Bousquet, P. W. Hellings, I. Agache, A. Bedbrook, C. Bachert, K. C. Bergmann, M. Bewick, C. Bindeslev-Jensen, S. Bosnic-Anticevitch, C. Bucca, D. P. Caimmi, P. A. M. Camargos, G. W. Canonica, T. Casale, N. H. Chavannes, A. A. Cruz, G. De Carlo, R. Dahl, P. Demoly, P. Devillier, J. Fonseca, W. J. Fokkens, N. A. Guldmond, 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. Arnau, A. Asanoj, H. Arshad, F. Avolio, I. Baiardini, C. Barbara, M. Barbagallo, E. D. Bateman, B. Begh , E. H. Bel, K. S. Bennoor, M. Benson, A. Z. Bialoszewski, T. Bieber, L. Bj rmer, 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. Dubakienė, 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. Gemicio lu, J. E. Gereda, R. Gerth van Wijk, S. Gonz lez Diaz, I. Grisle, L. Grouse, Z. Gutter, M. A. Guzm n, 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. Mel n, E. Melo-Gomes, E. O. Meltzer, J. Mercier, H. Merk, N. Miculinic, F. Mihaltan, B. Milenkovic, J. Millot-Keurink, Y. Mohammad, I. Momas, R. M sge, 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-Sch ll, 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. Rodr guez-Ma as, C. Rolland, M. Roman Rodr guez, A. Romano, J. Rosado-Pinto, N. Rosario, M. Rottem, M. Sanchez-Borges, J. Sastre-Dom nguez, G. K. Scadding, N. Scichilone, P. Schmid-Grendelmeier, E. Serrano, M. Shields, V. Siroux, J. C. Sisul, I. Skrindo, H. A. Smit, D. Sol , 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 H ge, 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. Yiallourous, O. M. Yusuf, A. Zaidi, H. J. Zar, M. E. Zernotti, L. Zhang, N. Zhong, M. Zidani

# 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<sup>1-9</sup>, A. Addis<sup>7,10</sup>, I. Adcock<sup>11</sup>, I. Agache<sup>4,12,13</sup>, A. Agusti<sup>14</sup>, A. Alonso<sup>15</sup>, I. Annesi-Maesano<sup>4</sup>, J.M. Anto<sup>3,16</sup>, C. Bachert<sup>3,4,17,18</sup>, C.E. Baena-Cagnani<sup>4,19</sup>, C. Bai<sup>20,21</sup>, A. Baigenzhin<sup>22</sup>, C. Barbara<sup>7,23</sup>, P.J. Barnes<sup>11</sup>, E.D. Bateman<sup>4,24</sup>, L. Beck<sup>25</sup>, A. Bedbrook<sup>24</sup>, E.H. Bel<sup>26</sup>, O. Benezet<sup>2</sup>, K.S. Bennoor<sup>4,27</sup>, M. Benson<sup>28</sup>, M. Bernabeu-Wittel<sup>29,30</sup>, M. Bewick<sup>31</sup>, C. Bindeslev-Jensen<sup>4,32</sup>, H. Blain<sup>1,2,8</sup>, F. Blasi<sup>33</sup>, M. Bonini<sup>4,34</sup>, S. Bonini<sup>4,35</sup>, L.P. Boulet<sup>4,36</sup>, A. Bourdin<sup>1,2,8,37</sup>, R. Bourret<sup>1,2</sup>, P.J. Bousquet<sup>4</sup>, C.E. Brightling<sup>38</sup>, A. Briggs<sup>39</sup>, J. Brozek<sup>4,40</sup>, R. Buhl<sup>41</sup>, A. Bush<sup>4,42</sup>, D. Caimmi<sup>1,2,4</sup>, M. Calderon<sup>43,44</sup>, P. Calverley<sup>45</sup>, P.A. Camargos<sup>4,46</sup>, T. Camuzat<sup>2</sup>, G.W. Canonica<sup>4,47</sup>, K.H. Carlsen<sup>4,48,49</sup>, T.B. Casale<sup>50</sup>, M. Cazzola<sup>51</sup>, A.M. Cepeda Sarabia<sup>4,52,53</sup>, A. Cesarino<sup>54</sup>, Y.Z. Chen<sup>54</sup>, E. Chkhartishvili<sup>55</sup>, N.H. Chavannes<sup>4,56,57</sup>, R. Chiron<sup>1,2,4</sup>, A. Chuchalin<sup>4,58,59</sup>, K.F. Chung<sup>11</sup>, L. Cox<sup>4,60</sup>, G. Crooks<sup>61</sup>, M.G. Crooks<sup>62</sup>, A.A. Cruz<sup>4,58,63</sup>, A. Custovic<sup>4,5,64</sup>, R. Dahl<sup>4,65</sup>, S.E. Dahlen<sup>65</sup>, F. De Blay<sup>4,66,67</sup>, T. Dedeu<sup>68</sup>, D. Deleau<sup>4,69</sup>, P. Demoly<sup>1,2,4,5,7,8</sup>, P. Devillier<sup>4,70</sup>, A. Didier<sup>71,72</sup>, A.T. Dinh-Xuan<sup>73</sup>, R. Djukanovic<sup>74</sup>, D. Dokic<sup>4,75</sup>, H. Douagui<sup>4,76</sup>, R. Dubakiene<sup>4,77,78</sup>, S. Eglin<sup>79</sup>, F. Elliot<sup>80</sup>, R. Emuzyte<sup>4,77,78</sup>, L. Fabbri<sup>81</sup>, A. Fink Wagner<sup>82</sup>, M. Fletcher<sup>58,83</sup>, W.J. Fokkens<sup>4,84,85</sup>, J. Fonseca<sup>4,23,85,86</sup>, A. Franco<sup>87</sup>, P. Frith<sup>88</sup>, A. Furber<sup>89</sup>, M. Gaga<sup>90</sup>, J. Garcés<sup>91,92</sup>, J. Garcia-Aymerich<sup>3,16</sup>, A. Gamkrelidze<sup>4,93</sup>, S. Gonzales-Diaz<sup>4,52</sup>, F. Gouzi<sup>1,37</sup>, M.A. Guzmán<sup>4,94</sup>, T. Haahela<sup>3,4,95</sup>, D. Harrison<sup>96</sup>, M. Hayot<sup>1,2,8</sup>, L.G. Heaney<sup>97</sup>, J. Heinrich<sup>9</sup>, P.W. Hellings<sup>4,5,98</sup>, J. Hooper<sup>99</sup>, M. Humbert<sup>71</sup>, M. Hyland<sup>100</sup>, G. Iaccarino<sup>101-103</sup>, D. Jakovenko<sup>7</sup>, J.R. Jardim<sup>104</sup>, C. Jeandel<sup>1,2,8</sup>, C. Jenkins<sup>105</sup>, S.L. Johnston<sup>4,106</sup>, O. Jonquet<sup>1,2,8</sup>, G. Joos<sup>17</sup>, K.S. Jung<sup>107</sup>, O. Kalayci<sup>4,5,108,109</sup>, S. Karunanithi<sup>110</sup>, T. Keil<sup>3,111,112</sup>, N. Khaltaev<sup>4,58</sup>, V. Koles<sup>113</sup>, M.L. Kowalski<sup>114</sup>, I. Kull<sup>1,115</sup>, P. Kuna<sup>4,7,58,116,117</sup>, V. Kvedariene<sup>4,5,77,118</sup>, L.T. Le<sup>4,58,119</sup>, K.C. Lodrup Carlsen<sup>3,4,68,69</sup>, R. Louis<sup>120</sup>, W. MacNee<sup>121</sup>, A. Mair<sup>122</sup>, I. Majer<sup>123</sup>, P. Manning<sup>124</sup>, E. de Manuel Keenoy<sup>4,125</sup>, M.R. Masjedi<sup>126</sup>, E. Melen<sup>3,4,115</sup>, E. Melo-Gomes<sup>7,23</sup>, A. Menzies-Gow<sup>127</sup>, G. Mercier<sup>1,2,8</sup>, J. Mercier<sup>1,2,7,8</sup>, J.P. Michel<sup>128</sup>, N. Miculinic<sup>129</sup>, F. Mihaltan<sup>4,132,130</sup>, B. Milenkovic<sup>131-133</sup>, M. Molimard<sup>134</sup>, I. Momas<sup>135</sup>, A. Montilla-Santana<sup>29</sup>, M. Morais-Almeida<sup>136,137</sup>, M. Morgan<sup>138</sup>, M. N'Diaye<sup>139</sup>, S. Nafti<sup>4,140</sup>, K. Nekam<sup>4</sup>, A. Neou<sup>142,143</sup>, L. Nicod<sup>144</sup>, R. O'Hehir<sup>145</sup>, K. Ohta<sup>4,146</sup>, P. Paggiaro<sup>147</sup>, S. Palkonen<sup>148</sup>, S. Palmer<sup>149</sup>, N.G. Papadopoulos<sup>4,5,64,150</sup>, A. Papi<sup>151</sup>, G. Passalacqua<sup>4,47</sup>, I. Pavord<sup>152</sup>, B. Pigeiras<sup>153</sup>, D. Plavec<sup>154</sup>, D.S. Postma<sup>3,155</sup>, D. Price<sup>4,54,156</sup>, K.F. Rabe<sup>157</sup>, F. Radier Pontal<sup>2</sup>, J. Redon<sup>4,158</sup>, S. Rennard<sup>159</sup>, J. Roberts<sup>160</sup>, J.M. Robine<sup>2,161</sup>, J. Roca<sup>16</sup>, N. Roche<sup>162</sup>, F. Rodenas<sup>91,92</sup>, A. Roggeri<sup>163</sup>, C. Rolland<sup>164</sup>, J. Rosado-Pinto<sup>4,7,23,58</sup>, D. Ryan<sup>4,56,165,166</sup>, B. Samolinski<sup>1,177,167</sup>, M. Sanchez-Borges<sup>168</sup>, H.J. Schünemann<sup>40</sup>, A. Sheikh<sup>166,169</sup>, M. Shields<sup>170</sup>, N. Siafakas<sup>171</sup>, Y. Sibille<sup>172</sup>, T. Similowski<sup>173-176</sup>, I. Small<sup>177</sup>, O. Sola-Morales<sup>178</sup>, T. Sooronbaev<sup>4,58,179,180</sup>, R. Stelmach<sup>181</sup>, P.J. Sterk<sup>4</sup>, T. Stinns<sup>182,183</sup>, P. Sud<sup>184</sup>, V. Tellier<sup>185</sup>, T. To<sup>58</sup>, A. Todo-Bom<sup>186</sup>, M. Triggiani<sup>192</sup>, R. Valenta<sup>4,187</sup>, A.L. Valero<sup>14</sup>, A. Valiulis<sup>4,77,78,188</sup>, E. Valovirta<sup>189</sup>, E. Van Ganse<sup>190</sup>, O. Vandenplas<sup>4,174</sup>, T. Vasankari<sup>191</sup>, J. Vestbo<sup>192,193</sup>, G. Vezzani<sup>194</sup>, G. Viegi<sup>195</sup>, L. Visier<sup>1,2,8</sup>, C. Vogelmeier<sup>196</sup>, T. Vontetsianos<sup>197</sup>, R. Wagstaff<sup>198</sup>, U. Wahn<sup>142</sup>, B. Wallaert<sup>46,199</sup>, B. Whalley<sup>100</sup>, M. Wickman<sup>3,4,195</sup>, D.M. Williams<sup>200</sup>, N. Wilson<sup>201</sup>, B.P. Yawn<sup>4,202</sup>, P.K. Yiallourou<sup>4,203</sup>, A. Yorgancioglu<sup>4,108</sup>, O.M. Yusuf<sup>58,204</sup>, H.J. Zar<sup>205</sup>, N. Zhong<sup>206</sup>, M. Zidarn<sup>4,207</sup> and T. Zuberbier<sup>142,143</sup>



# MASK mHealth approach for ICPs

**Patient with allergic rhinitis symptoms**

**Self-care**

**Pharmacist**


**General practitioner**

**Specialist**

**Emergency care (asthma)**

## 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)

 **USERS**

### Add User

**Name \***  **First name \***

**Mail \***

**Language**  **Country**  **Region \***

**Specialty \***



# Next-generation care pathways

1- ICPs in real life

**2- The cell phone (The Allergy Diary)**

# The finger approach to manage allergic rhinitis



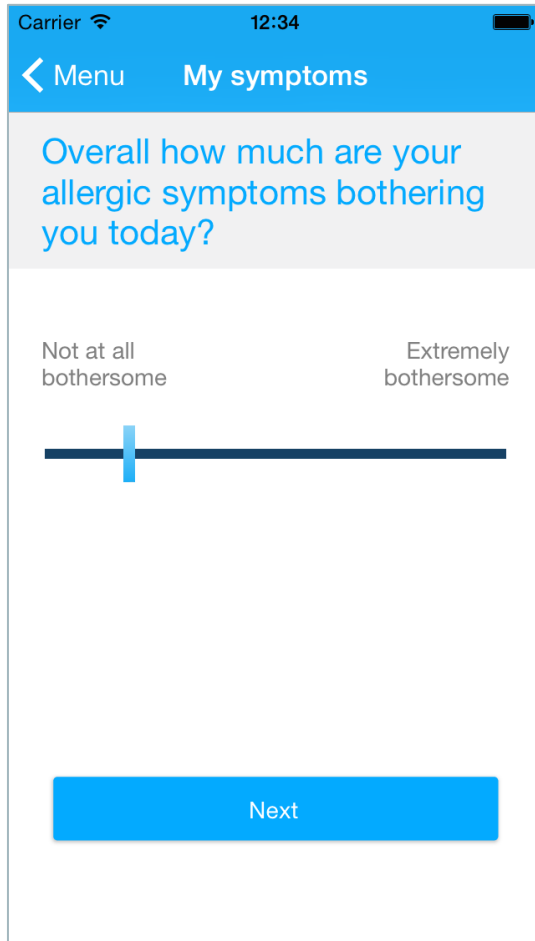
Not at all  
bothersome

**VAS**

Extremely  
bothersome



# The Allergy Diary

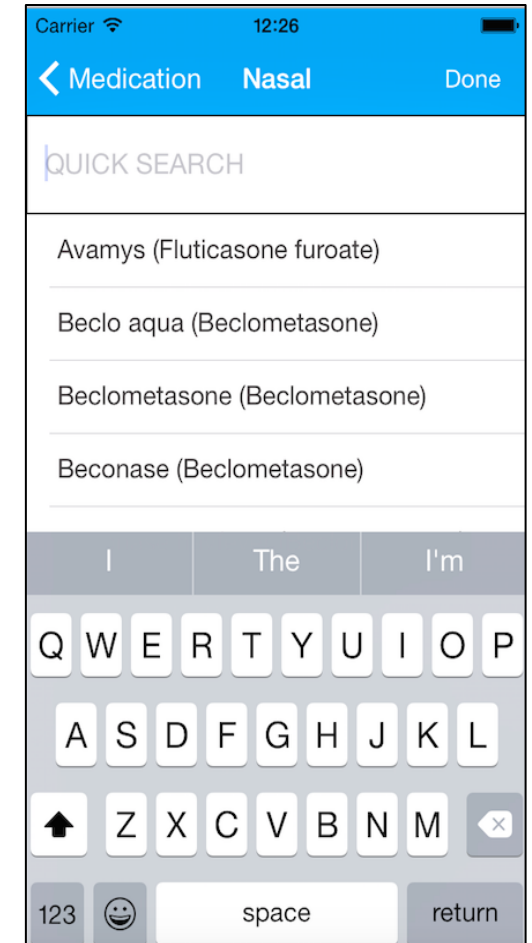


How much are your nose symptoms bothering you today?

How much are your eye symptoms bothering you today?

How much are your asthma symptoms bothering you today?

**23 countries (+3)**  
**17 languages**  
**25,000 users**  
**180,000 VAS days**  
**GPDR (May 25, 2018)**



**Free on Android and IOS**



# 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

### Impacts potentiels

Si la base de données est p...  
Diffusion d'une information...  
Si la base de données est p...

### Menaces

La "perte" des données lors...  
menaces techniques  
Menaces techniques (sources...

### Sources

Risque technique (source no...  
source non humaine  
La "perte" des données lors...

### Mesures

Anonymisation

Accès illégitime  
à des données

Gravité : Négligeable

Vraisemblance : Négligeable

Modification non  
désirées de données

Gravité : Négligeable

Vraisemblance : Négligeable

Disparition  
de données

Gravité : Négligeable

Vraisemblance : Négligeable

Commission Informatique et Liberté (CNIL)

ORIGINAL RESEARCH

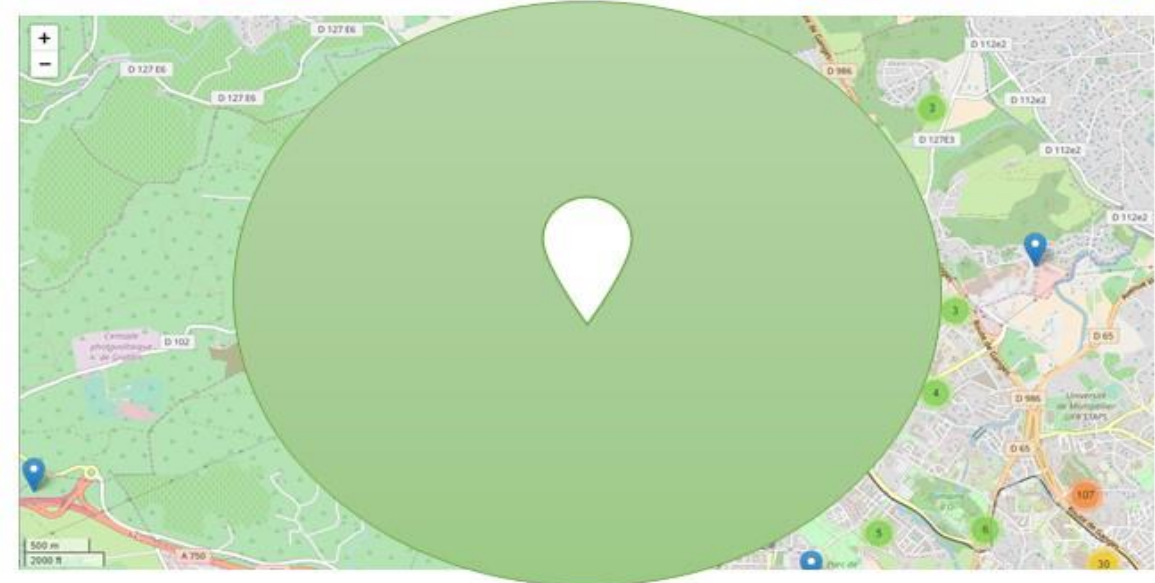
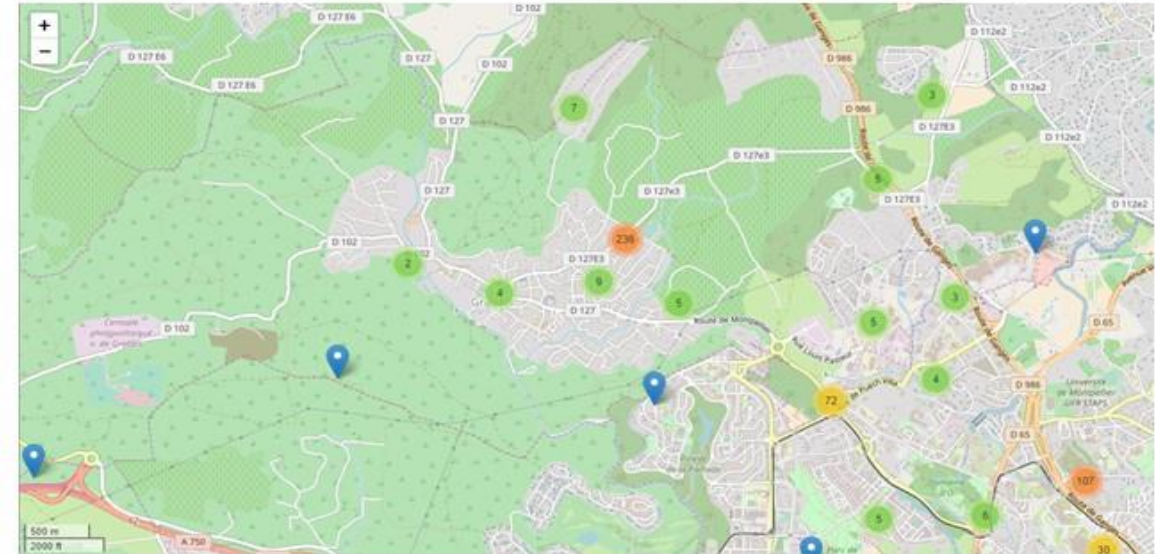
Open Access



## Geolocation with respect to personal privacy for the Allergy Diary app - a MASK study

D. Samreth<sup>1</sup>, S. Arnavielhe<sup>1</sup>, F. Ingenrieth<sup>2</sup>, A. Bedbrook<sup>3</sup>, G. L. Onorato<sup>3</sup>, R. Murray<sup>4</sup>, R. Almeida<sup>5</sup>, M. A. Mizani<sup>6</sup>, J. Fonseca<sup>5</sup>, E. Costa<sup>7</sup>, J. Malva<sup>8</sup>, M. Morais-Almeida<sup>9</sup>, A. M. Pereira<sup>10</sup>, A. Todo-Bom<sup>11</sup>, E. Menditto<sup>12</sup>, C. Stellato<sup>13</sup>, M. T. Ventura<sup>14</sup>, D. Larenas-Linnemann<sup>15</sup>, J.-M. Fuentes-Pérez<sup>16</sup>, Y. R. Huerta-Villalobos<sup>16</sup>, A. A. Cruz<sup>17</sup>, R. Stelmach<sup>18</sup>, J. da Silva<sup>19</sup>, R. Emuzyte<sup>20</sup>, V. Kvedariene<sup>21</sup>, A. Valiulis<sup>22,23</sup>, I. Annesi-Maesano<sup>24</sup>, I. Bosse<sup>25</sup>, P. Demoly<sup>26</sup>, P. Devillier<sup>27</sup>, J. F. Fontaine<sup>28</sup>, P. Kuna<sup>29</sup>, B. Samolinski<sup>30</sup>, L. Klimek<sup>31</sup>, R. Mösges<sup>32,33</sup>, O. Pfaar<sup>31,34</sup>, S. Shamaï<sup>32,33</sup>, M. Bewick<sup>35</sup>, D. Ryan<sup>36,37</sup>, A. Sheikh<sup>6</sup>, J. M. Anto<sup>38,39,40,41</sup>, V. Cardona<sup>42</sup>, J. Mullol<sup>43</sup>, A. Valero<sup>44</sup>, N. H. Chavannes<sup>45</sup>, W. J. Fokkens<sup>46</sup>, S. Reitsma<sup>46</sup>, R. E. Roller-Wirnsberger<sup>47</sup>, P. V. Tomazic<sup>48</sup>, T. Haahtela<sup>49</sup>, S. Toppila-Salmi<sup>49</sup>, E. Valovirta<sup>50</sup>, M. Makris<sup>51,52</sup>, N. G. Papadopoulos<sup>51,52</sup>, E. P. Prokopakis<sup>53</sup>, F. Psarros<sup>54</sup>, B. Gemicioğlu<sup>55</sup>, A. Yorgancioglu<sup>56</sup>, C. Bindeslev-Jensen<sup>57</sup>, E. Eller<sup>57</sup>, I. Kull<sup>58</sup>, M. Wickman<sup>59</sup>, C. Bachert<sup>60</sup>, P. W. Hellings<sup>61,62,63</sup>, B. Pugin<sup>63</sup>, S. Bosnic-Anticevich<sup>64</sup>, R. E. O'Hehir<sup>65,66</sup>, V. Kolek<sup>67</sup>, M. Sova<sup>67</sup>, K. Wehner<sup>68</sup>, G. De Vries<sup>69</sup>, M. van Eerd<sup>69</sup>, D. Laune<sup>1</sup>, J. Wittmann<sup>2</sup>, J. Bousquet<sup>63,70,71\*</sup>, P. Poncelet<sup>72</sup>, the MASK study group

k-anonymity



REVIEW

Open Access



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

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



## 1- Data storage

- Crypted transfer of data from user's 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)

# Next-generation care pathways

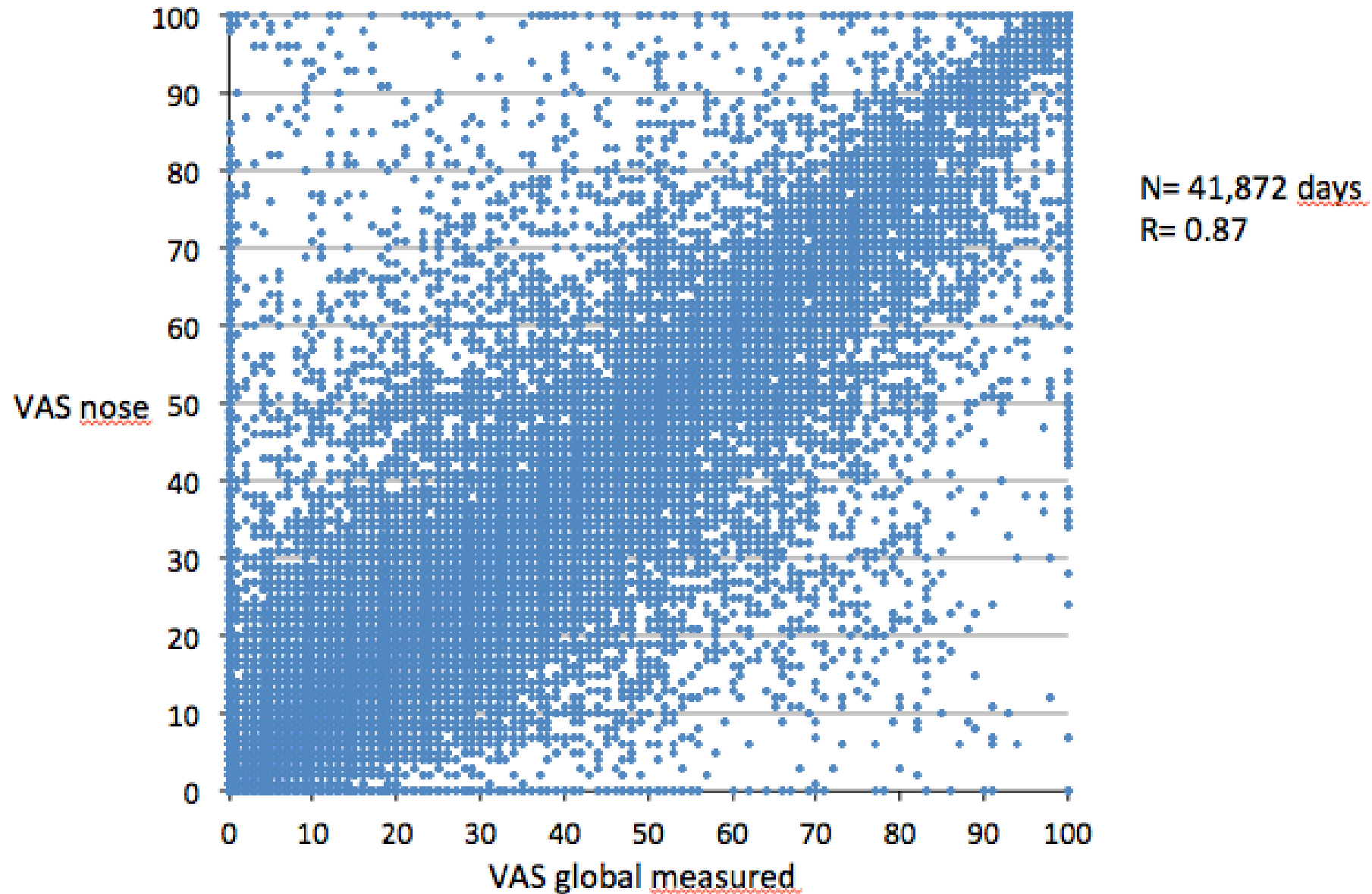
1- ICPs in real life

2- The cell phone

**3- Innovation in epidemiology (research)**



# Correlation between global and nasal VAS







# VAS work

Carrier 12:10

< Asthma My symptoms

**Are you working today?**

Yes No

Next

Carrier 12:10

< Back My symptoms

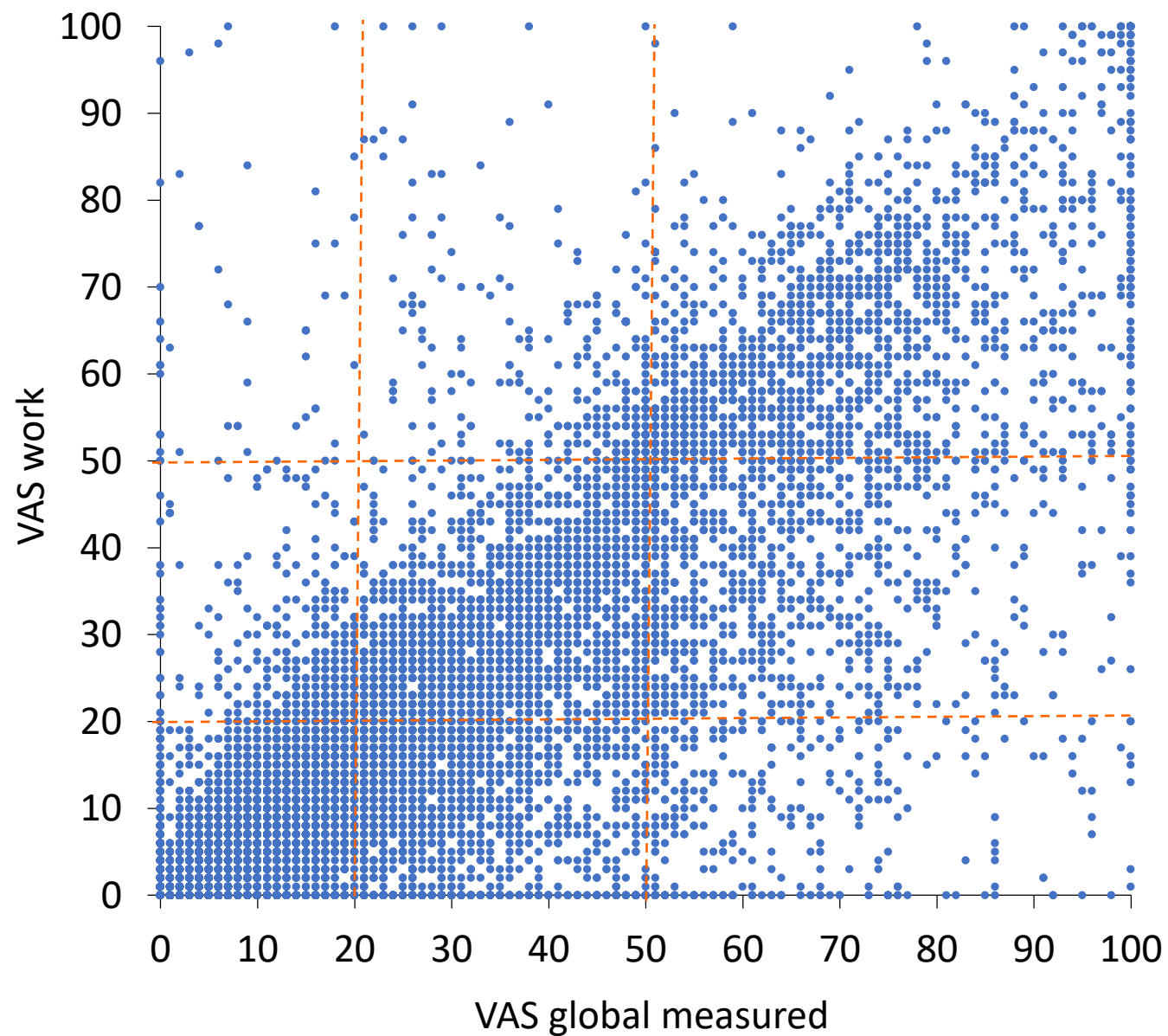
**How much are your allergic symptoms affecting your work today?**

Not at all bothersome No work possible

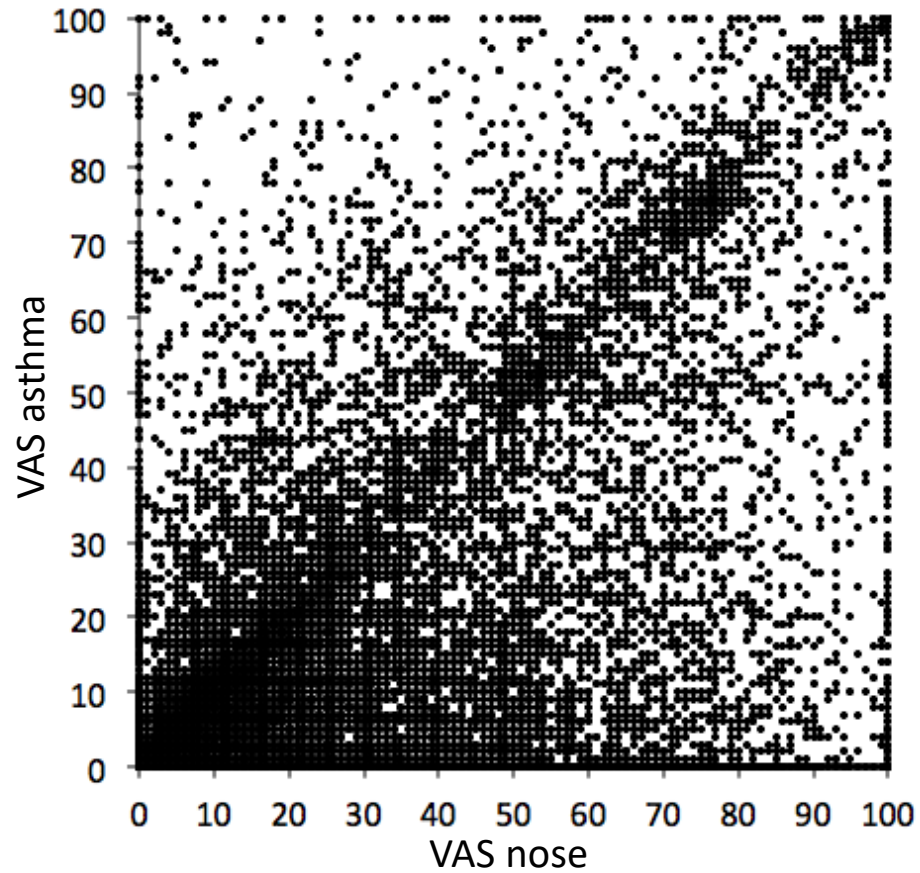
Next

N = 16,925 days  
20 countries  
15 languages

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



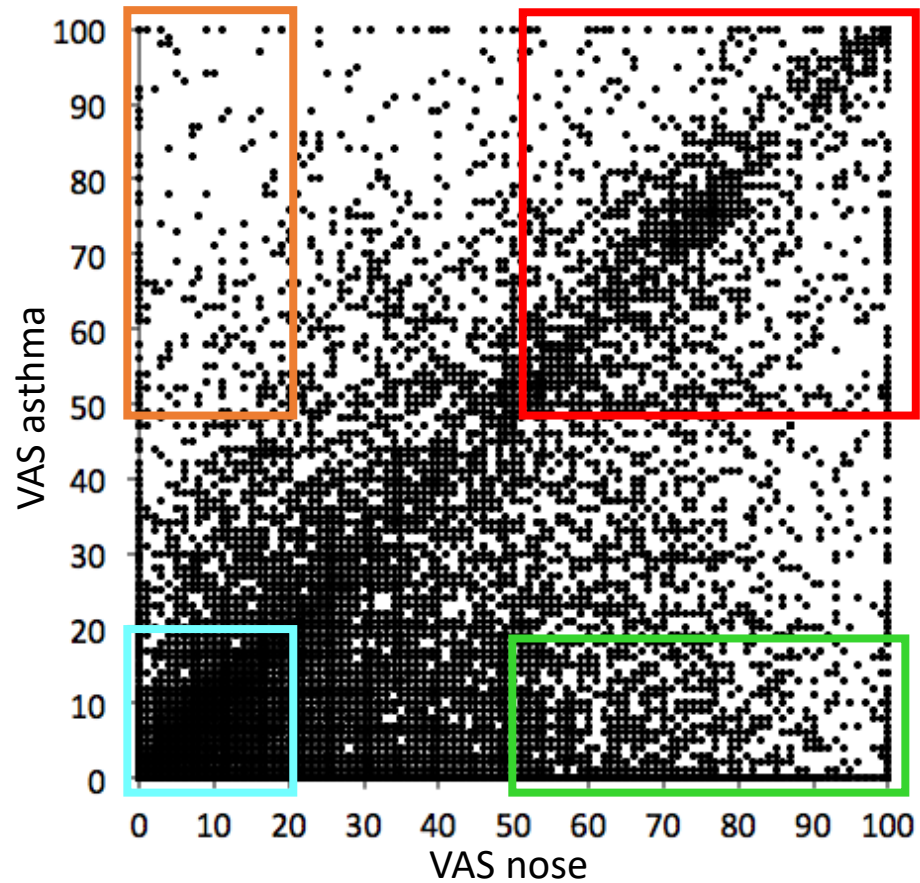
## VAS asthma



N= 32,095 days

Rho=0.50

## VAS asthma



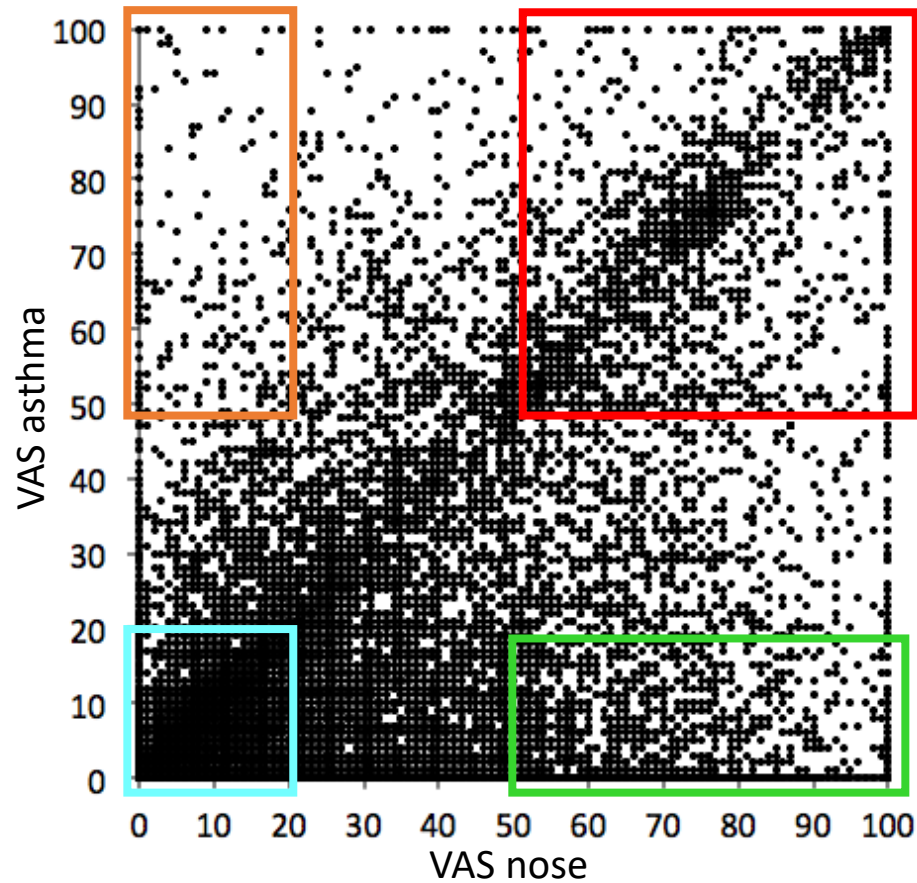
A or C Low-R Low  
A or C High-R Low  
A or C Low-R High  
A or C High-R High

N= 32,095 days

Rho=0.50

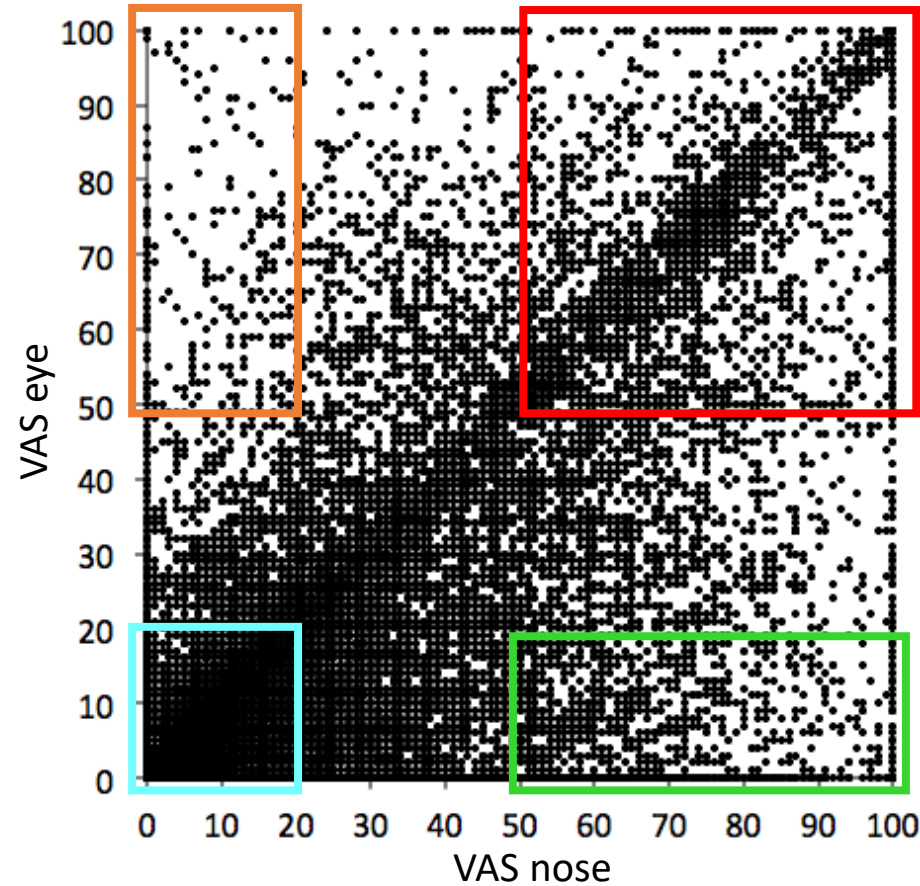
# Patterns of allergic symptom **days** (VAS 0-100)

**VAS asthma**



N= 32,095 days  
Rho=0.50

**VAS eye**



N= 32,585 days  
Rho=0.63

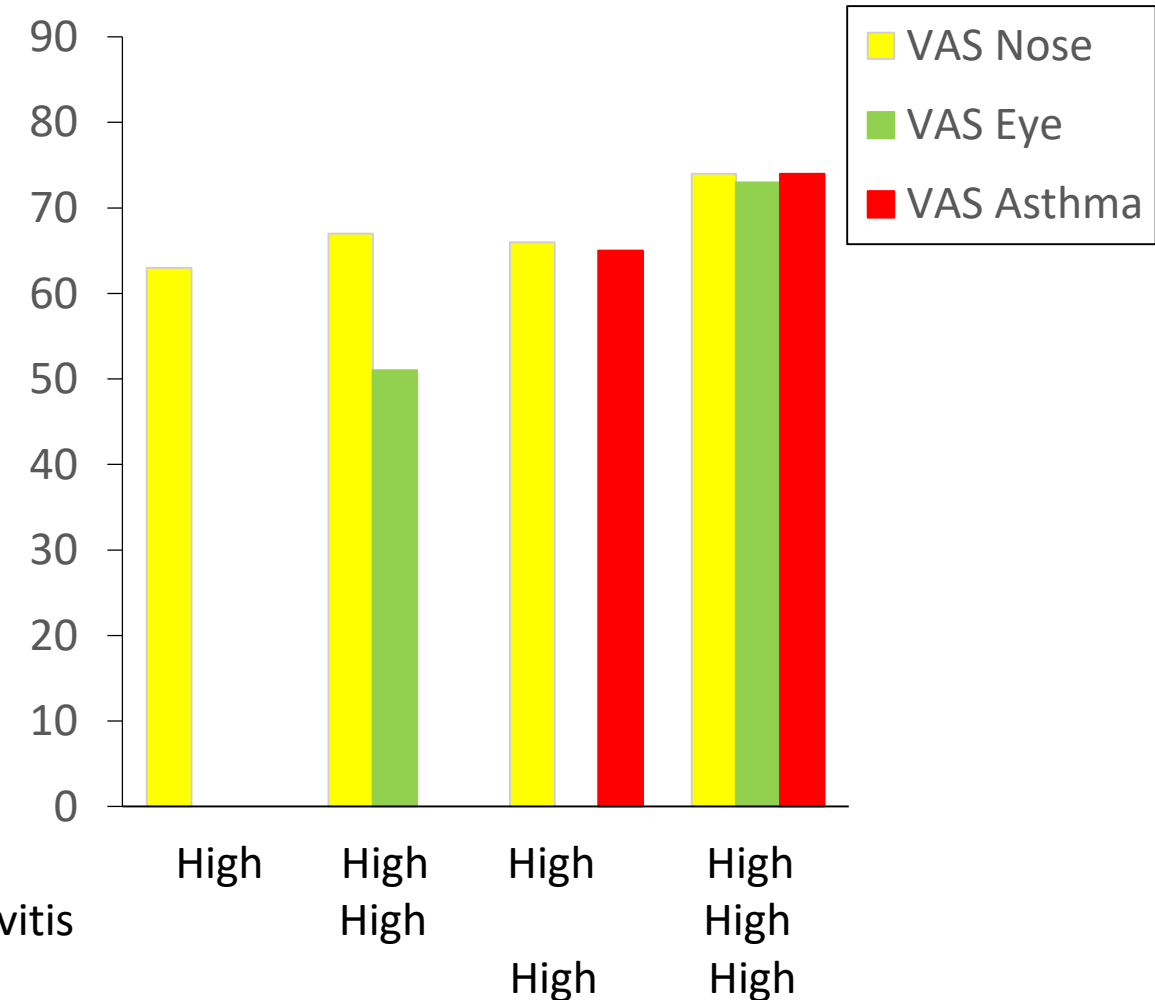
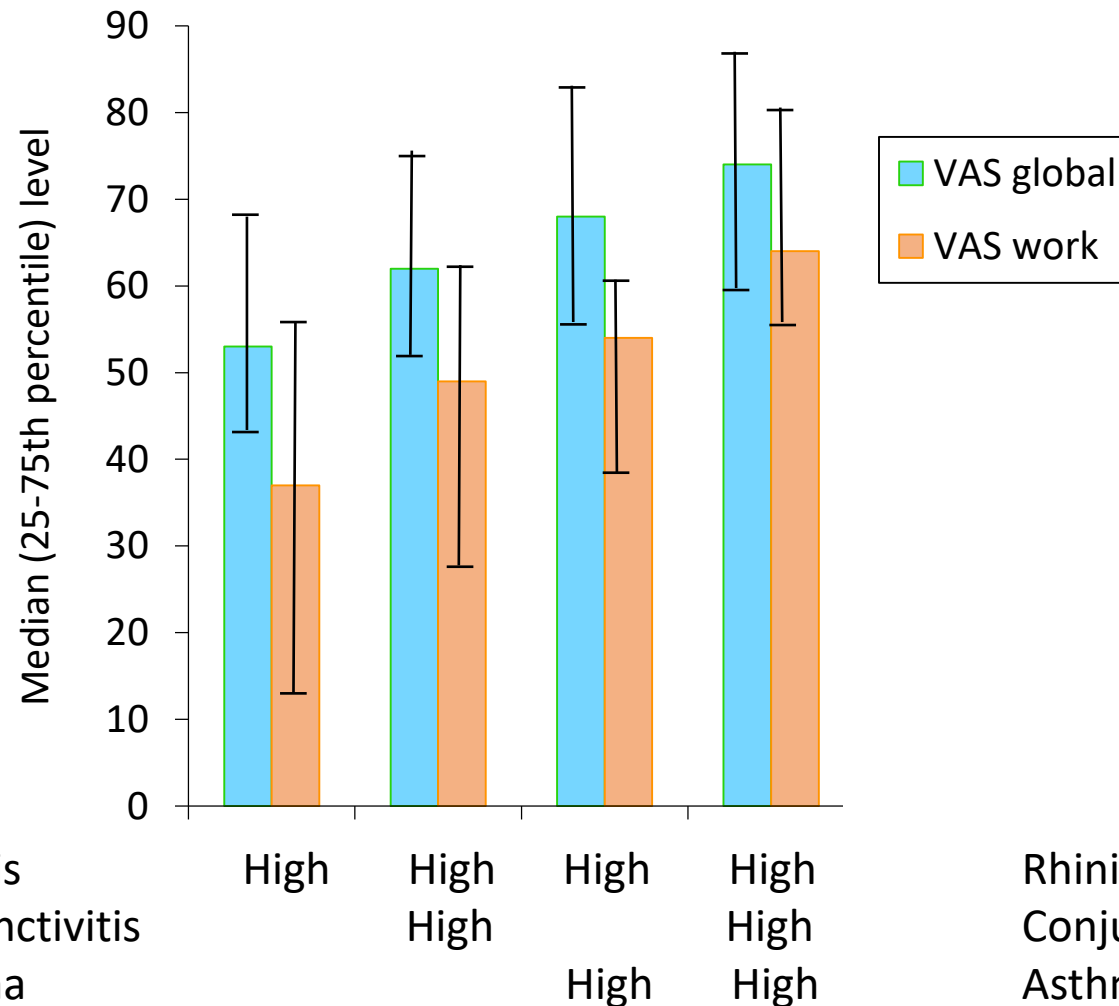
A or C Low-R Low  
A or C High-R Low  
A or C Low-R High  
A or C High-R High



# Novel patterns of multimorbidity

## Visual Analogue Scale levels depending on allergic multimorbidities

High: VAS  $\geq 50/100$



# Multimorbidity profiles

# Change

# Allergic multimorbidity MORE COMPLEX than one airway-one disease

# Eye symptoms are part of the multimorbidity

# The number of diseases is important to consider

## Non-allergic multimorbidity is another important component

Cluster Free  
multimorbidity-related mea



# Mechanisms of the Development of ALLergy

Allergy

## REVIEW ARTICLE

### MeDALL (Mechanisms of the Development of ALLergy): an integrated approach from phenotypes to systems medicine

J. Bousquet<sup>1,2,\*</sup>, J. Anto<sup>3,4,5,6\*</sup>, C. Auffray<sup>7</sup>, M. Akdis<sup>8,\*</sup>, A. Cambon-Thomsen<sup>9,\*</sup>, T. Keil<sup>10,\*</sup>, T. Haahtela<sup>11,\*</sup>, B. N. Lambrecht<sup>12,\*</sup>, D. S. Postma<sup>13</sup>, J. Sunyer<sup>3,4,5,6,\*</sup>, R. Valenta<sup>14,\*</sup>, C. A. Akdis<sup>8,\*</sup>, I. Annesi-Maesano<sup>15,16</sup>, A. Arno<sup>17</sup>, C. Bachert<sup>18,\*</sup>, F. Ballester<sup>19</sup>, X. Basagana<sup>3,4,5,\*</sup>, U. Baumgartner<sup>20</sup>, C. Bindslev-Jensen<sup>21,\*</sup>, B. Brunekreef<sup>22,\*</sup>, K. H. Carlsen<sup>23,\*</sup>, L. Chatzi<sup>24</sup>, R. Cramer<sup>8,\*</sup>, E. Eveno<sup>7</sup>, F. Forastiere<sup>25</sup>, J. Garcia-Aymerich<sup>3,4,5,6,\*</sup>, S. Guerra<sup>3,4,5,26</sup>, H. Hammad<sup>12,\*</sup>, J. Heinrich<sup>27,\*</sup>, D. Hirsch<sup>28</sup>, B. Jacquemin<sup>2,29</sup>, F. Kauffmann<sup>2,29,\*</sup>, M. Kerkhof<sup>30</sup>, M. Kogevinas<sup>3,4,5,31,\*</sup>, G. H. Koppelman<sup>32</sup>, M. L. Kowalski<sup>33,\*</sup>, S. Lau<sup>34,\*</sup>, K. C. Lodrup-Carlsen<sup>23,\*</sup>, M. Lopez-Botet<sup>35,36</sup>, J. Lotvall<sup>37,\*</sup>, C. Lupinek<sup>14,\*</sup>, D. Maier<sup>38</sup>, M. J. Makela<sup>11,\*</sup>, F. D. Martinez<sup>26</sup>, J. Mestres<sup>39</sup>, I. Momas<sup>40</sup>, M. C. Nawijn<sup>41</sup>, A. Neubauer<sup>20</sup>, S. Oddie<sup>42,43</sup>, S. Palkonen<sup>44,\*</sup>, I. Pin<sup>45</sup>, C. Pison<sup>7,46</sup>, F. Rancé<sup>47</sup>, S. Reitamo<sup>11,\*</sup>, E. Rial-Sebbag<sup>48</sup>, M. Salapatas<sup>44,\*</sup>, V. Siroux<sup>49</sup>, D. Smagghe<sup>28,\*</sup>, M. Torrent<sup>50,51,52</sup>, E. Toskala<sup>53,\*</sup>, P. van Cauwenberge<sup>54,\*</sup>, A. J. M. van Oosterhout<sup>41</sup>, R. Varraso<sup>2,29</sup>, L. von Hertzen<sup>11,\*</sup>, M. Wickman<sup>55,\*</sup>, C. Wijmenga<sup>56</sup>, M. Worm<sup>57,\*</sup>, J. Wright<sup>42</sup> & T. Zuberbier<sup>57,58,\*</sup>



MeDALL is a collaborative project supported by the European Commission under the Health Cooperation Work Programme of the 7th Framework programme.

Accepted for publication 1 December 2010

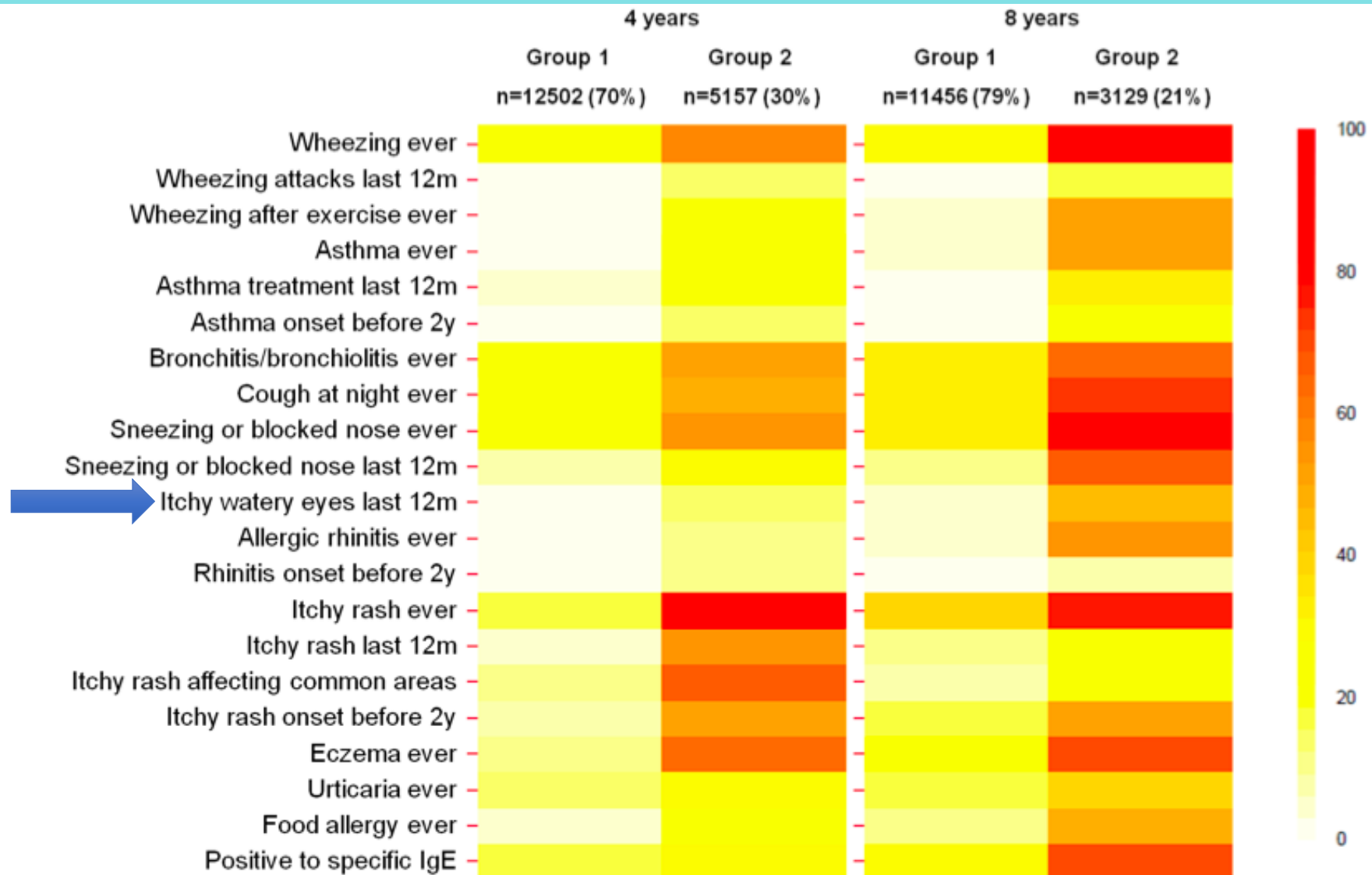
Allergy 2011; DOI: 10.1111/j.1398-9985.2010.02534.x





# MeDALL novel phenotypes

Garcia-Aymeric et al, Allergy 2015



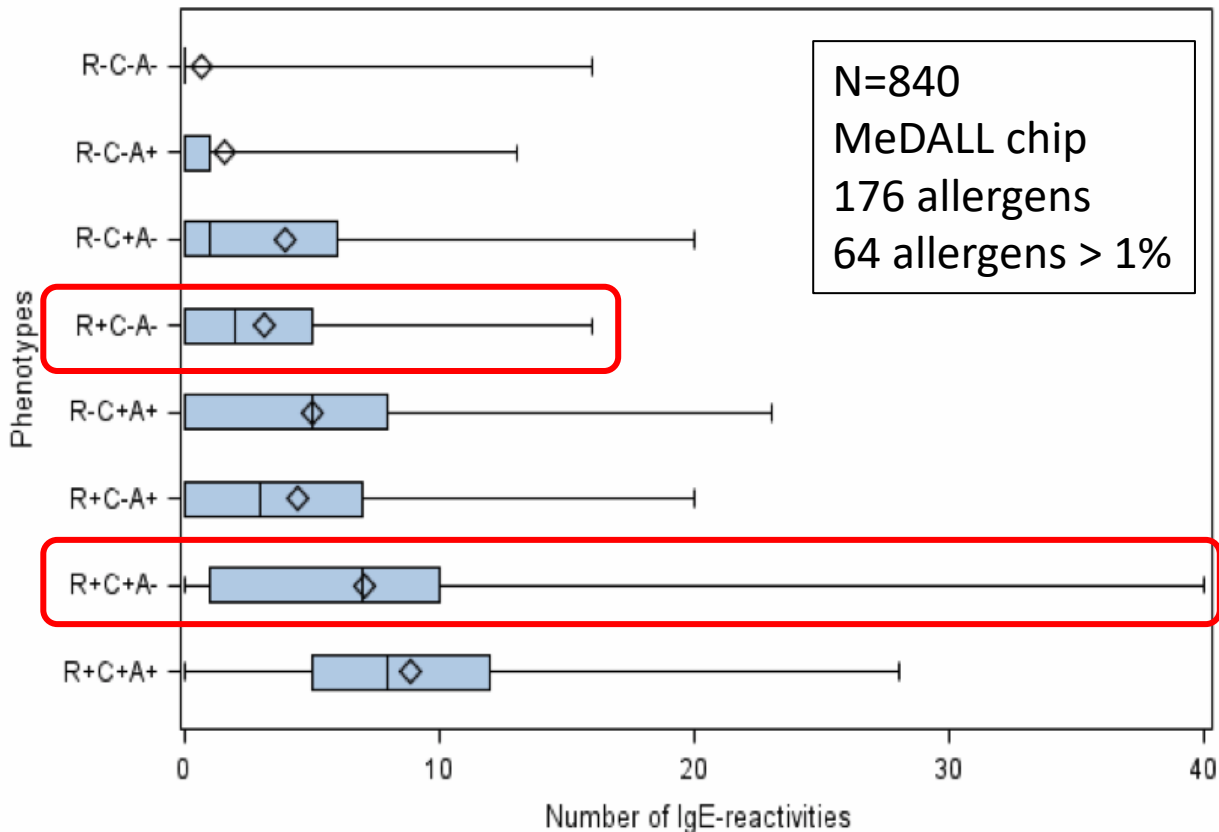


# Phenotypes in epidemiologic studies



Boudier, Siroux, Bousquet

Distribution of sensib\_respi by Phenotypes



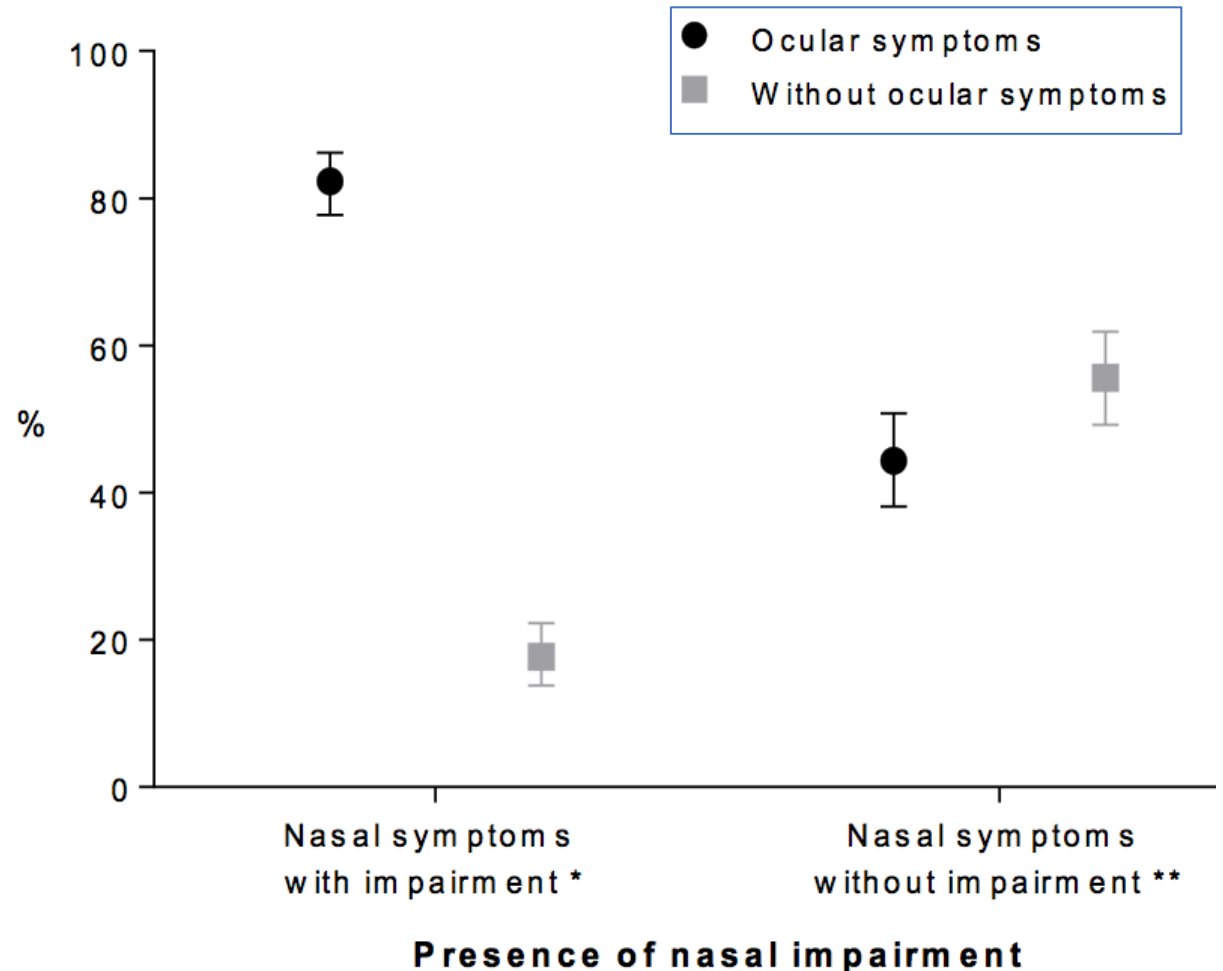
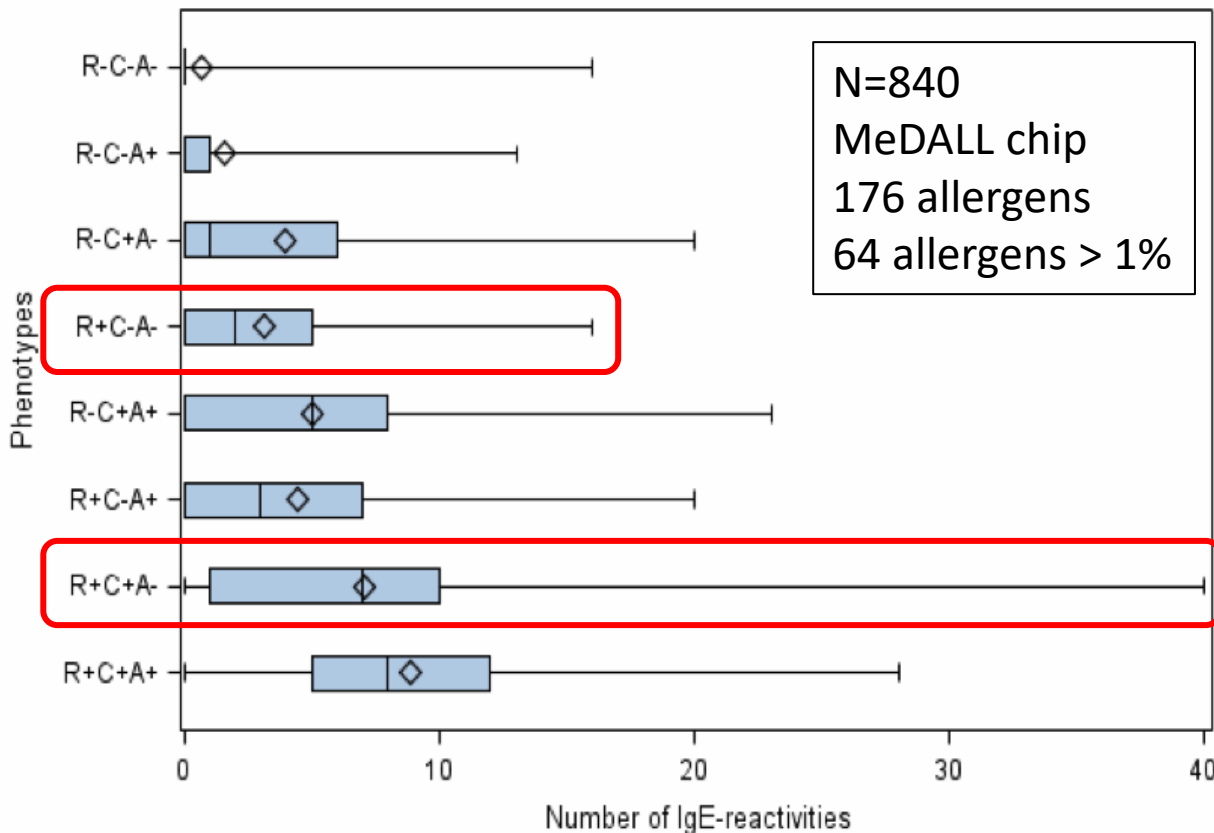
# Phenotypes in epidemiologic studies



Boudier, Siroux, Bousquet

Portuguese national cohort Amaral et al

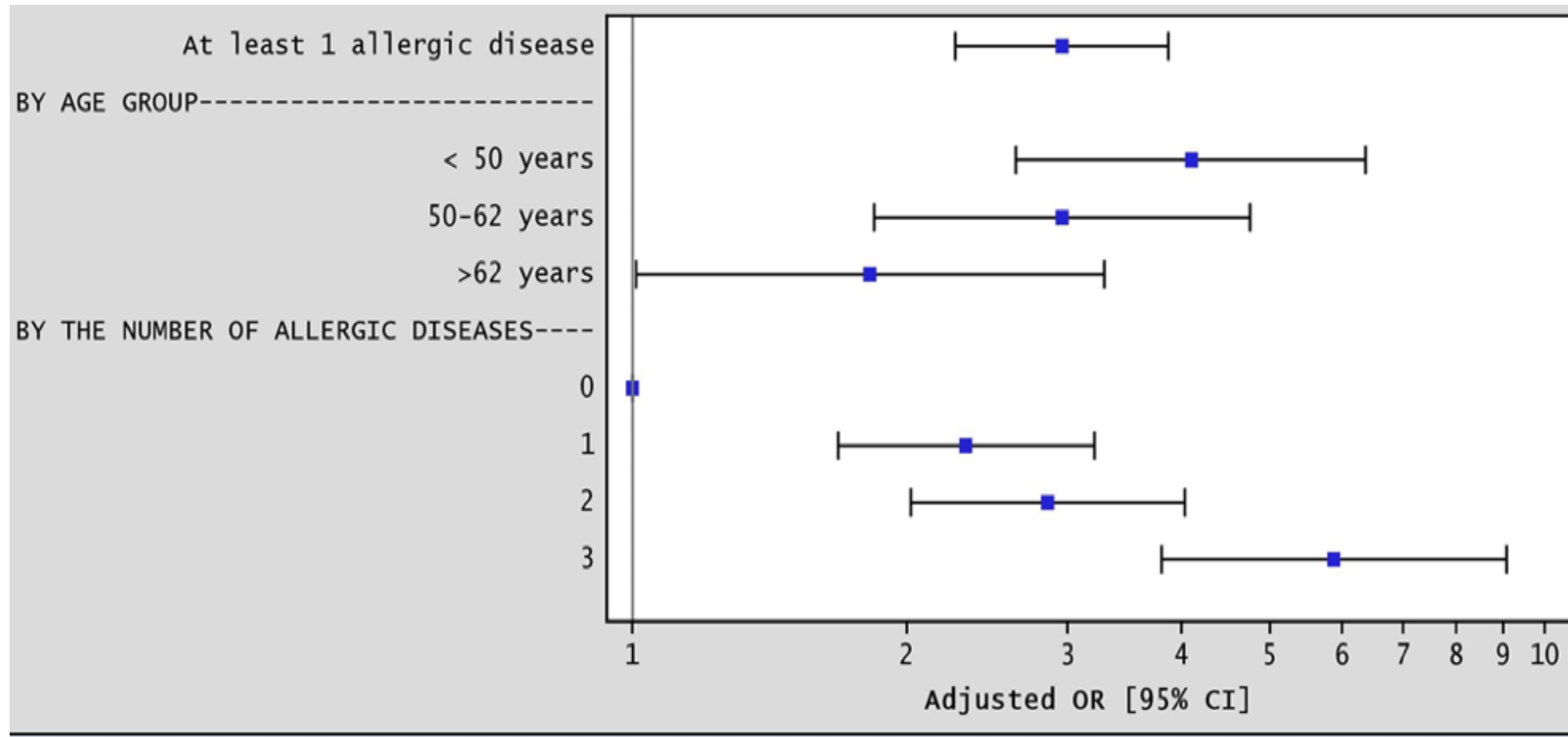
Distribution of sensib\_respi by Phenotypes



# Allergic multi-morbidity is associated with an increased risk of asthma in adults: a population-based case control study



Sanna Toppila-Salmi<sup>1,2</sup>, Sebastien Chanoine<sup>3,4,5</sup>, Jussi Karjalainen<sup>6</sup>, Juha Pekkanen<sup>7,8</sup>, Jean Bousquet<sup>9</sup>, Valérie Siroux<sup>3</sup>



**Figure 2. Adjusted OR and 95% CI of association between allergic disease(s) with adult onset asthma, according to age groups and the number of allergic diseases. OR values were estimated by conditional logistic regression,**

**Allergic multimorbidity MORE COMPLEX than one  
airway-one disease**

**Eye symptoms are part of the multimorbidity**

**The number of diseases is important to consider**

**ICPs will need to consider multimorbidity**

**Figure 2. Allergic disease(s) with adult onset asthma and the number of allergic diseases. OR values were estimated by conditional logistic regression,**



# Next-generation care pathways

1- ICPs in real life

2- The cell phone

3- Innovation in epidemiology

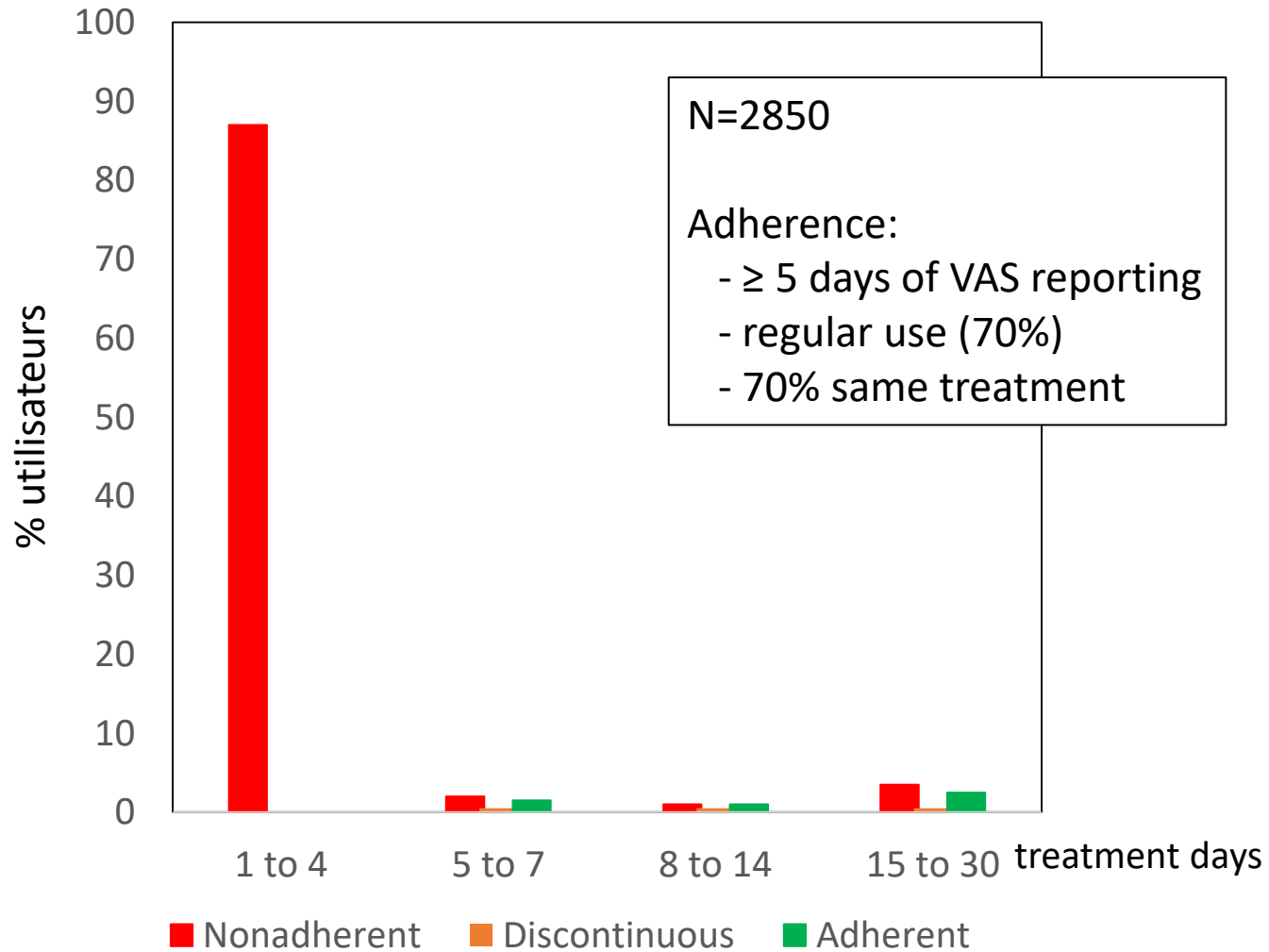
**4- Innovation in management**

# 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

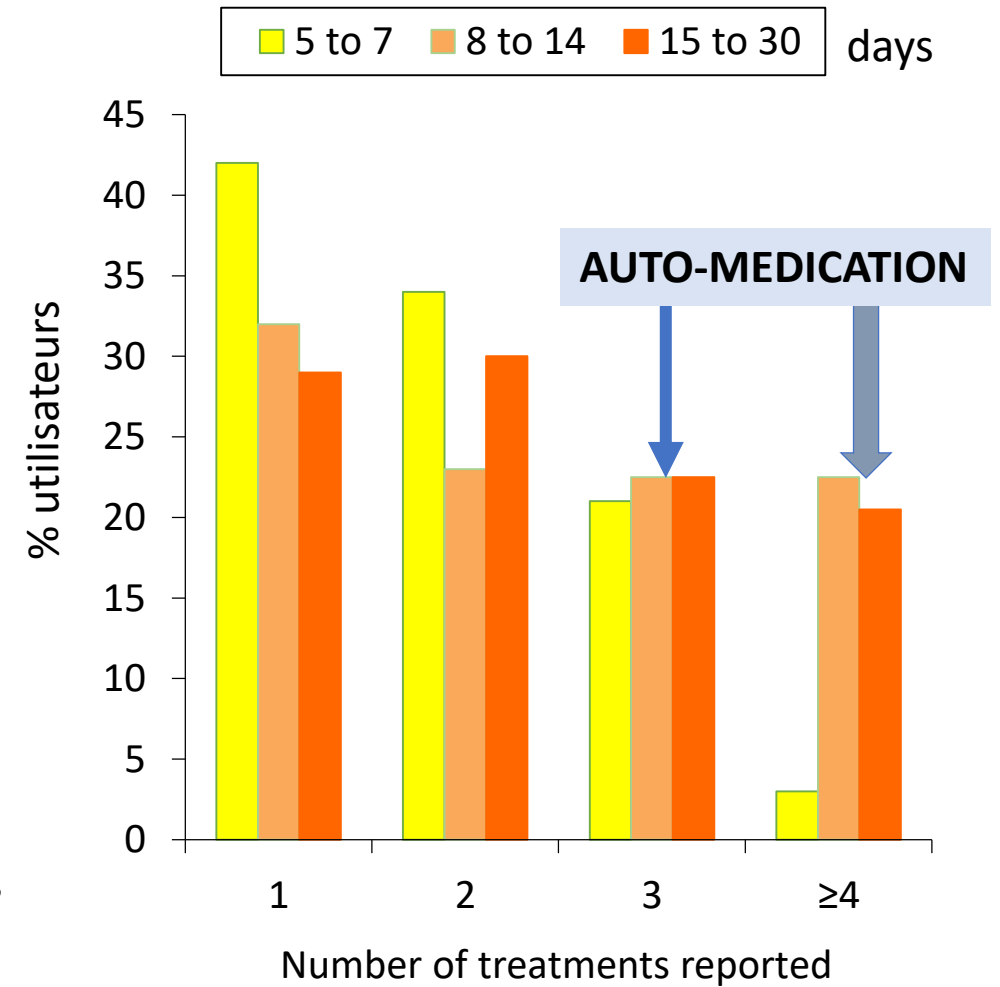
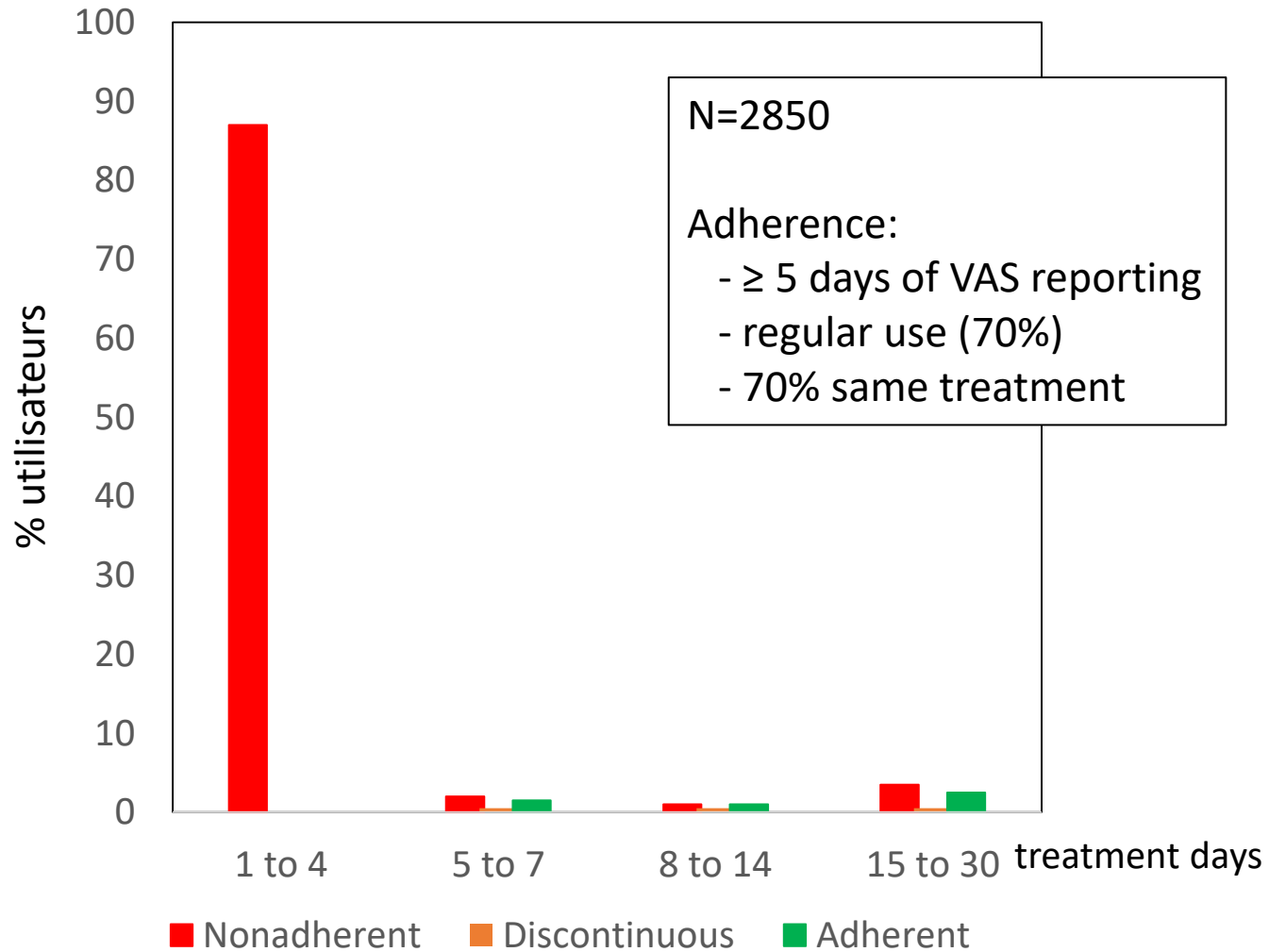
# Adherence to treatment

Bousquet J et al, 2018



# Adherence to treatment

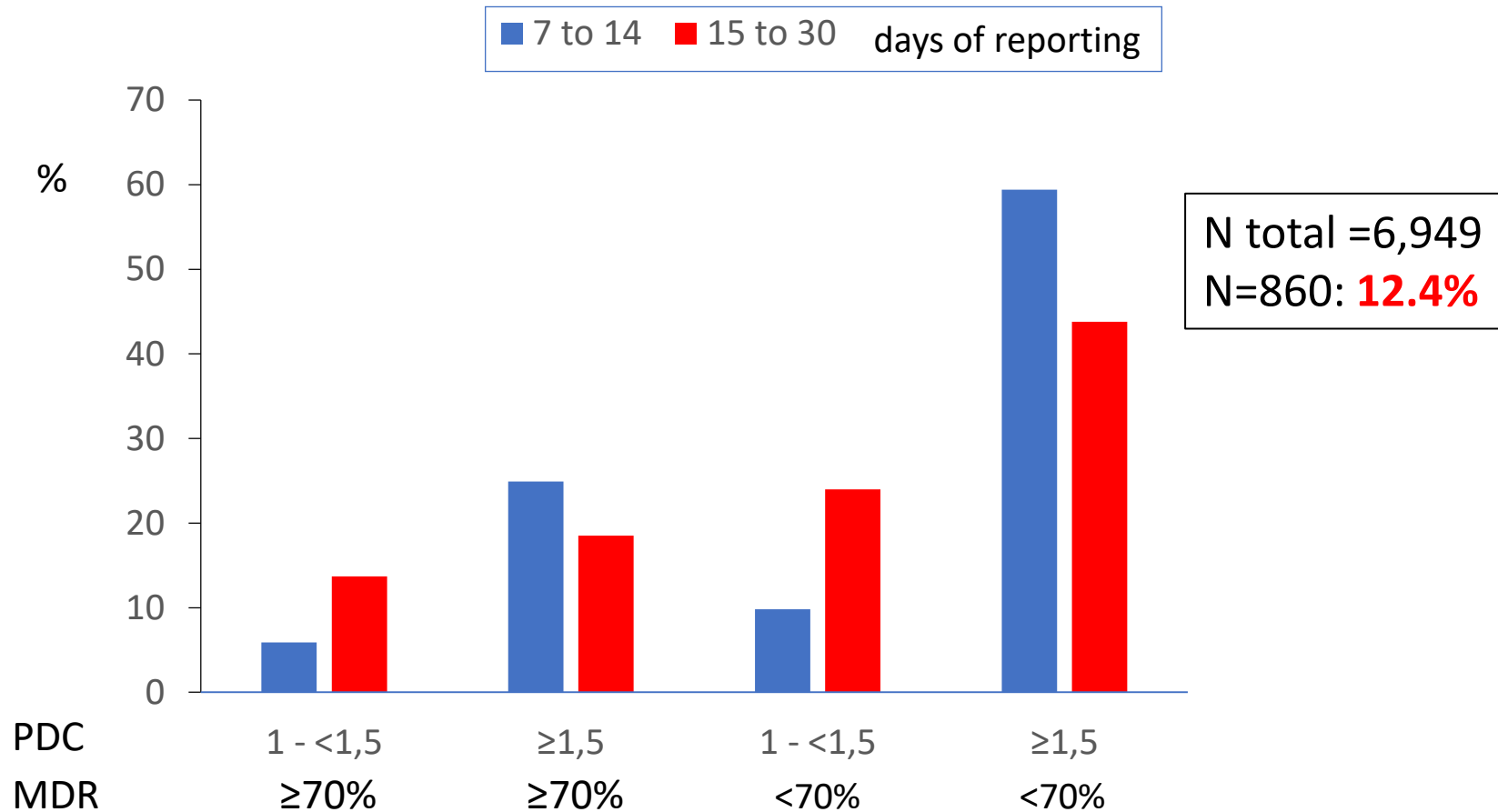
Bousquet J et al, 2018





# Adherence to treatment

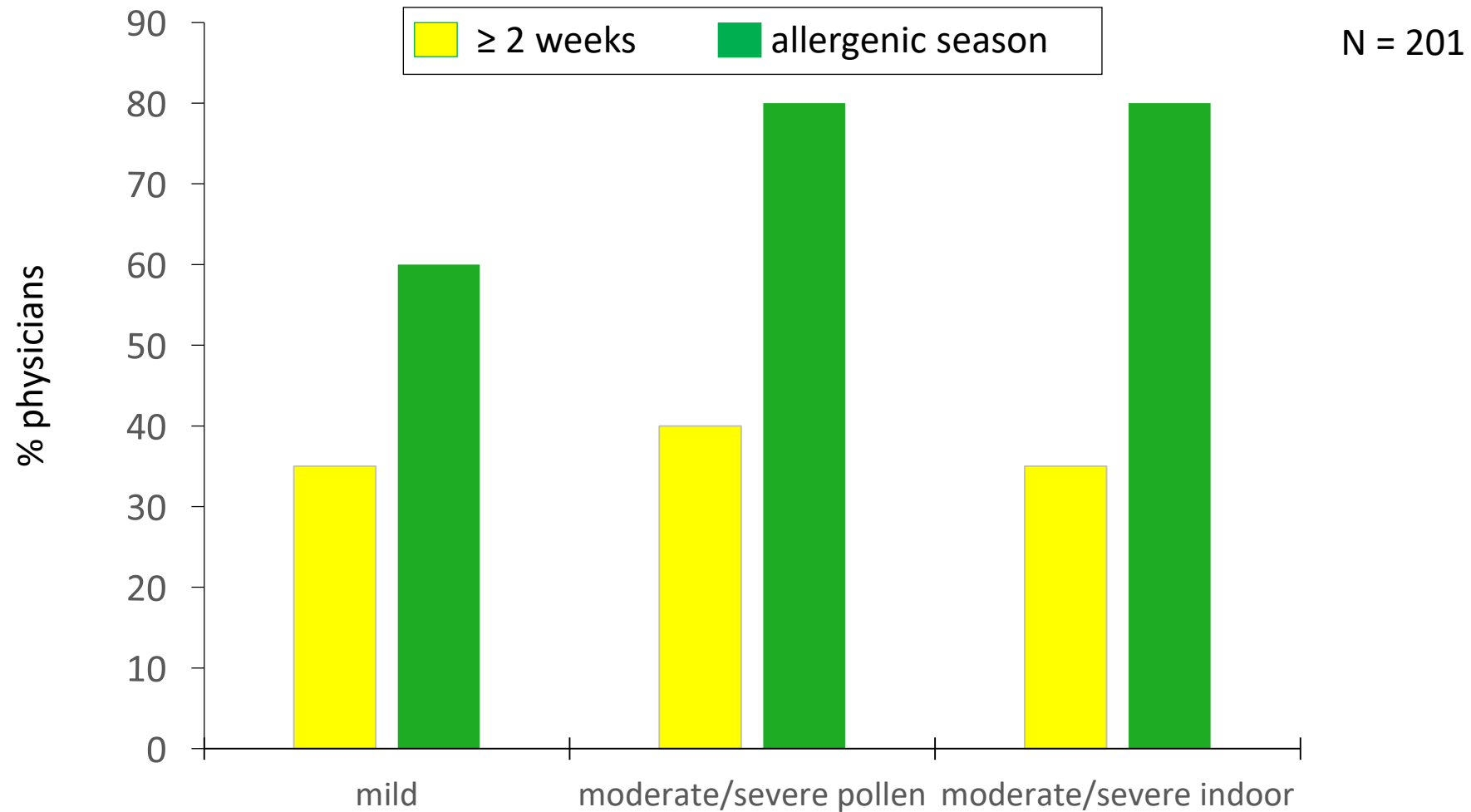
Menditto et al, submitted



- **Proportion of medication possession ratio (modified MPR):** ratio of days medication reported to days in a given time interval
- **Proportion of days covered over a time interval (modified PDC):** ratio of days medication reported to days in the time interval between the first and the last record considered



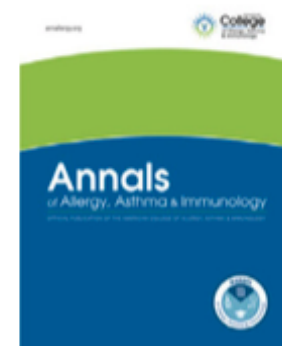
# Medical prescriptions (ARIA members)





ELSEVIER

Contents lists available at [ScienceDirect](#)



Letters

## The allergic allergist behaves like a patient

### Responses Obtained during the Meeting

- Total number of respondents to a generic questionnaire on allergy: 248
- Number of respondents answering the question: "How many of you have allergic rhinitis?": 102
- Number of respondents answering the question: "How many of you use a regular medication during the entire pollen season?": 0

Jean Bousquet, MD, PhD\*

Ruth Murray, PhD†

David Price, MD‡

David Somekh, MD§

Lars Münter, PhD¶

Jim Phillips, PhD||

Wienia Czarlewski, MD#



# Medical prescriptions (ARIA members)

**There is a major disconnection  
between physicians' prescriptions  
and patients' behavior**

N = 201

**Guidelines are not used by patients**

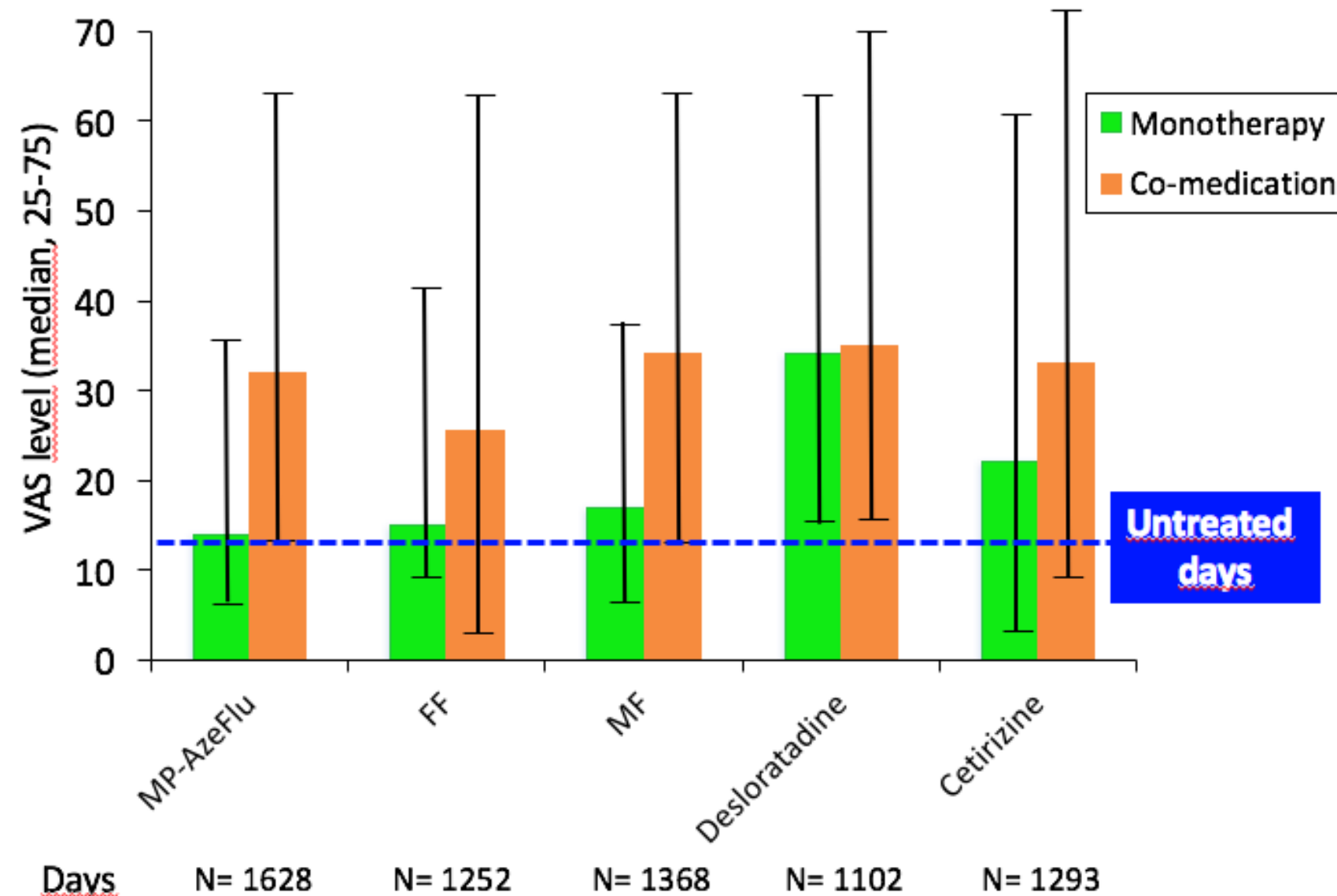
**Allergic physicians behave like  
patients**

are indoor



# Treatments received in MASK

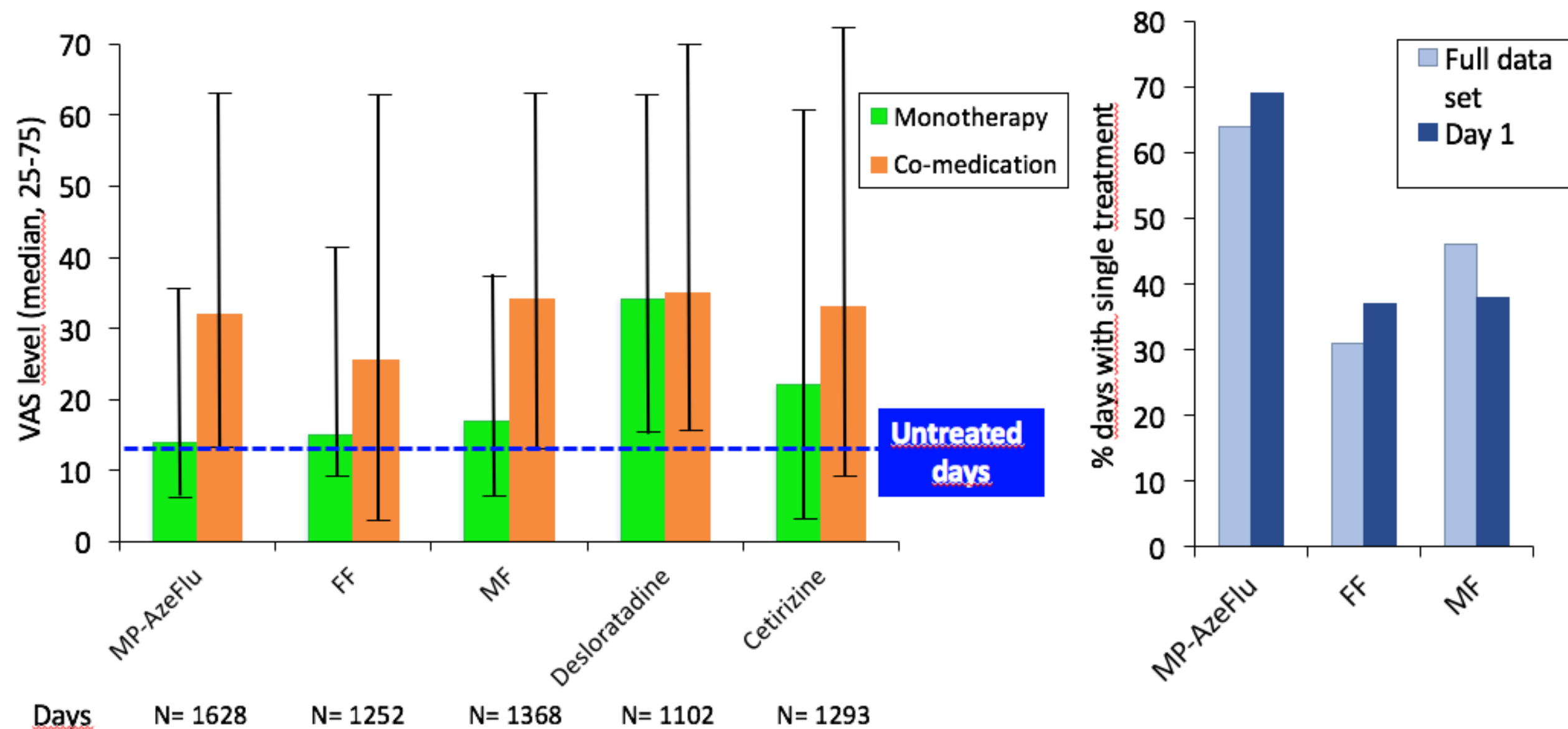
Bousquet J et al, Allergy 2018





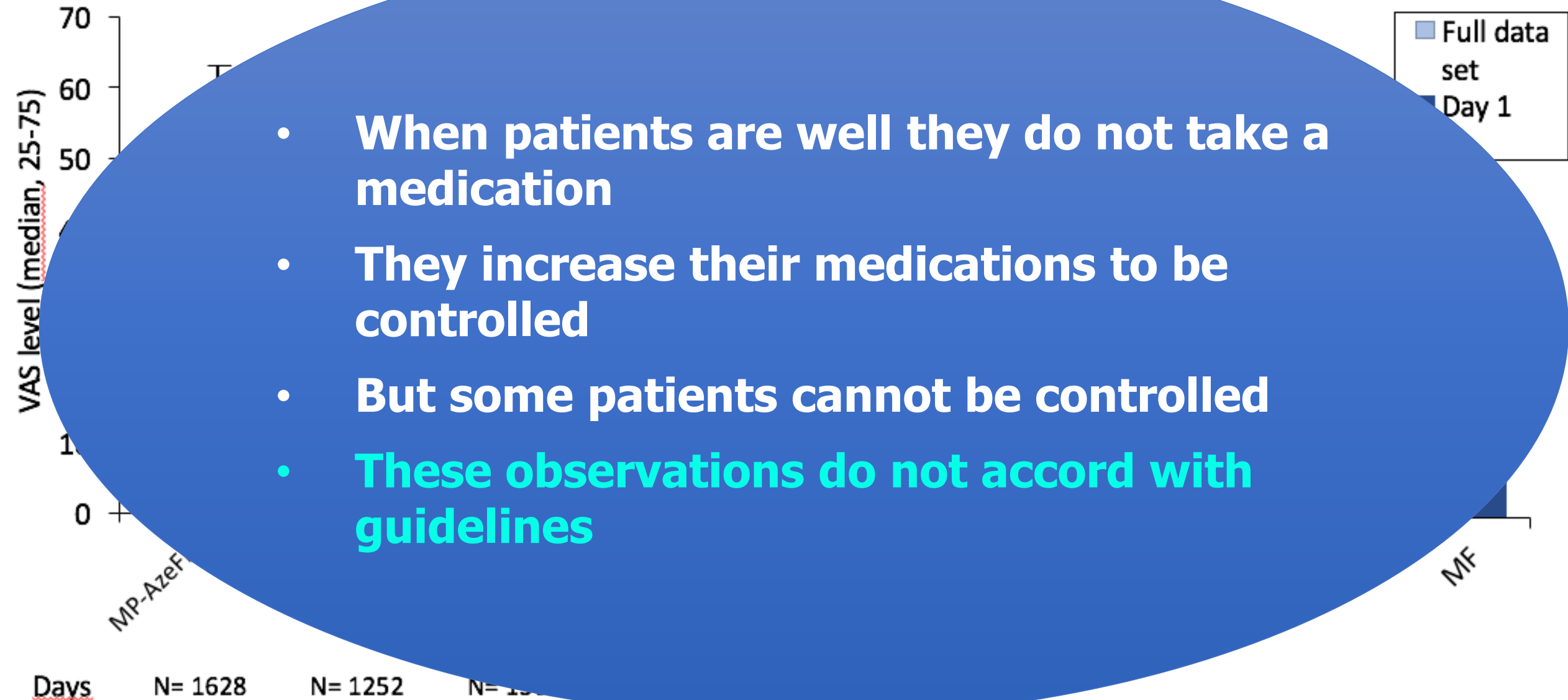
# Treatments received in MASK

Bousquet J et al, Allergy 2018



# Treatments received in MASK

Bousquet J et al, Allergy 2018



# Next-generation care pathways

1- ICPs in real life

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



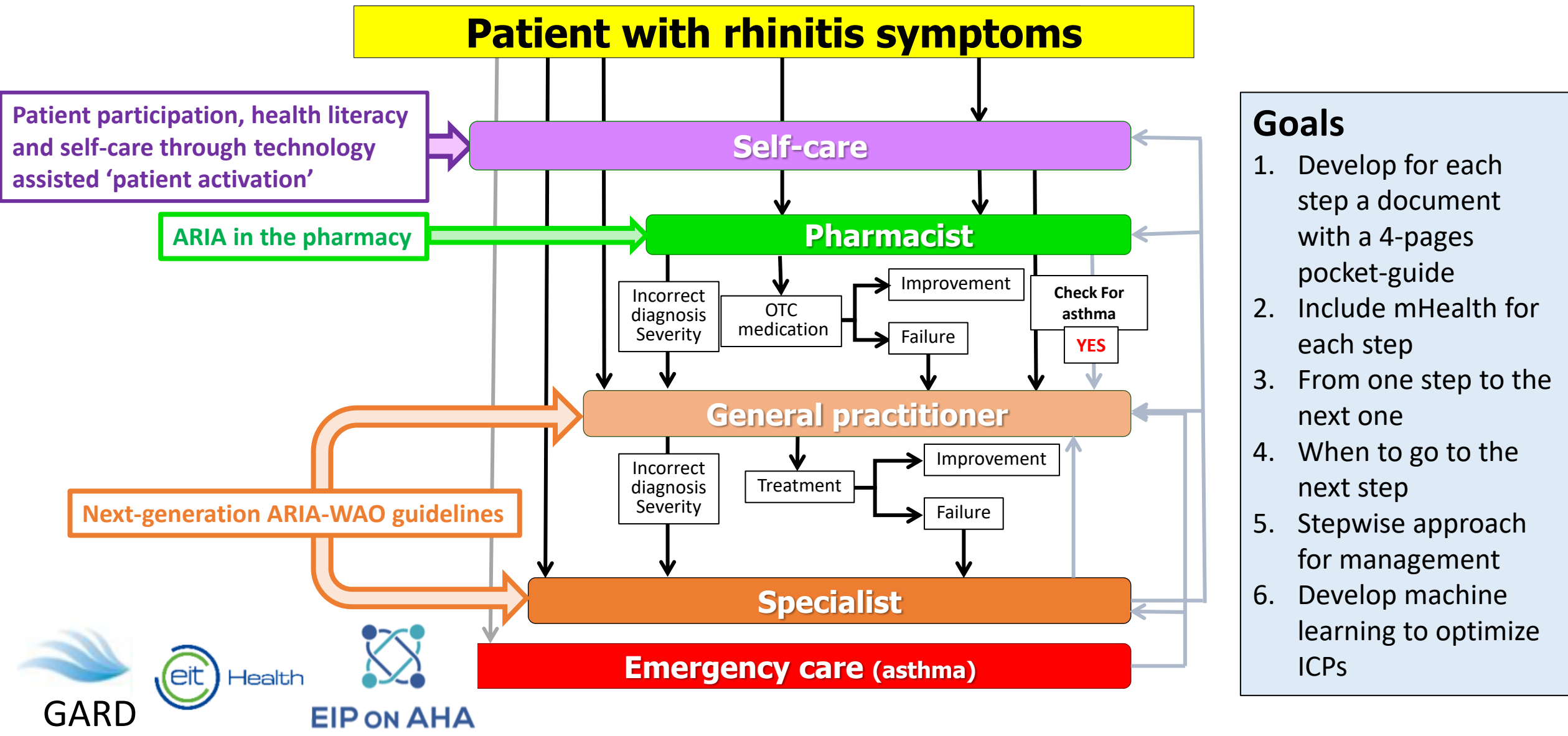
European Innovation  
Partnership on Active  
and Healthy Ageing

REFERENCE SITE

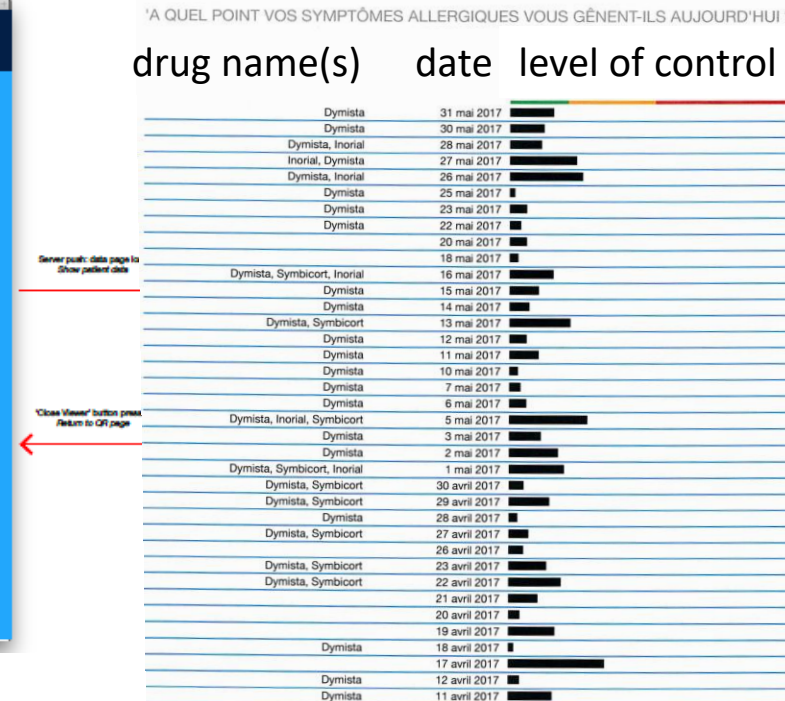
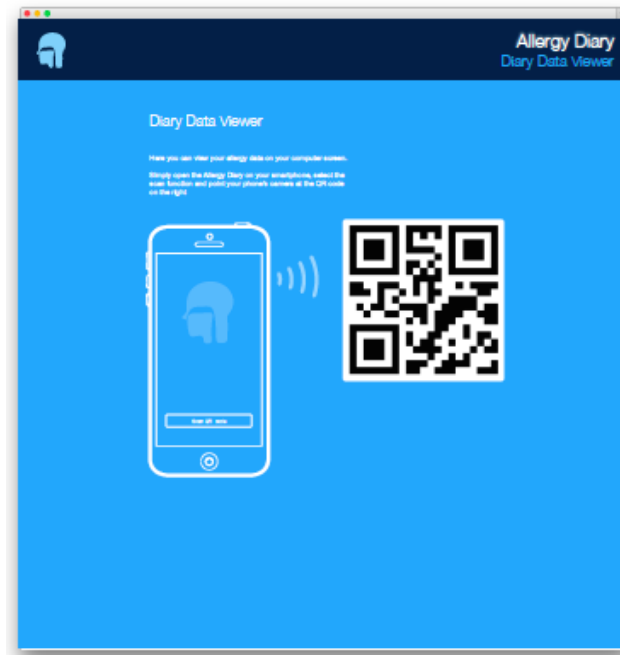




# Next-generation care pathways



# Transfer of data to HCP

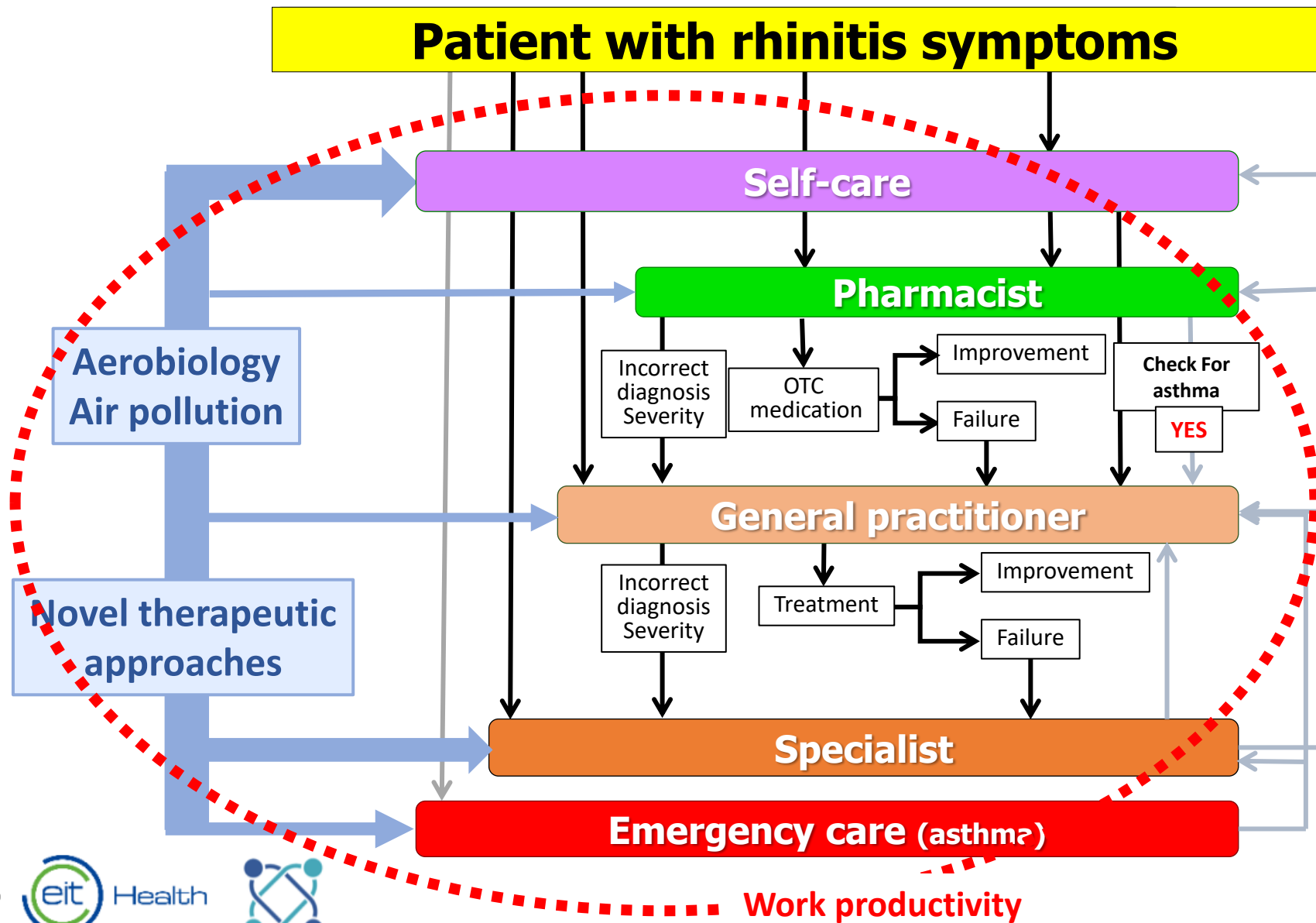


## Goals

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



# 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



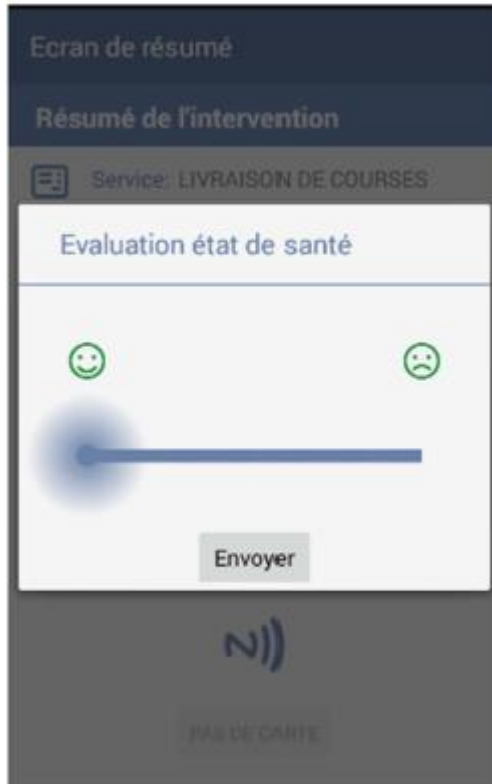
- MASK (Mobile Airways Sentinel Network) has been selected by DG SANTE as a Good Practice in the field of **digitally-enabled, integrated, person-centred care**.
- In the context of implementing the **Communication on the digital transformation of health and care**, specifically in relation to chapter 5 – "digital tools for citizen empowerment and for person-centred care", DG SANTE supports the scaling-up and wider implementation of good practices
- DG SANTE in collaboration with the Commission's Joint Research Centre will organise a "marketplace" workshop with The Joint Research Centre in Ispra. for representatives from Member States and other countries participating in the 3<sup>rd</sup> Health Programme to **learn more about a selected number (12) of good practices and key policy initiatives** in the domain of digitally-enabled, integrated, person-centred care, with a view to **possible transfer and replication** of the presented practices.



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