

INFLUENZANET INDICATORS FOR ECDC

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# Part 1. General considerations

The following document describes the main features of the calculation method for every indicator the Influenzanet consortium proposes to send to the European Centre for Disease Prevention and Control (ECDC). This document specifies the parameters and algorithms needed.

We propose some values for these parameters, based on different simulations realized, and on studies previously published in peer-reviewed journals by Influenzanet members. These choices can of course be discussed between European partners.

General Influenzanet data analysis guidelines can be found in Annex I.

For a better understanding, the description of the indicator I1 is given in part 3, after the description of the indicator I2.

These indicators can be visualized on the Influenzanet webpage: <http://influenzanet.info/#page/home>.

Analyses run on Wednesday (6-8 am), Thursday 6-8 am) and Friday (8 am). No analyses run between Friday 8am and Wednesday 6 am.

# Part 2. Indicator I2: weekly influenza like illness incidences

## General considerations

Incidence data can be visualized for every country and several combinations of parameters at the following link: <http://shiny.sentiweb.fr/ifn/>

On the website, in the tab “Docs” you will find names and explanations about the different parameters explored. The adjustment is done on age (3 categories: 0-20, 21-64, 65 +) only. When you change parameters, please click on “Update graphs” button on the left side of the window.

## Incidence computation method

The method used to compute incidences is the one published by Guerrisi et al in 2018 (1).

You will find in Table 1 the name of the parameters used in this document and on the website <http://shiny.sentiweb.fr/ifn/> .

Raw weekly incidence rates are computed as the ratio between the number of Influenzanet participants declaring an episode in a given week and the total number of participants registered in the cohort from the beginning of the season until the week considered. These raw incidences rates are then corrected on several criteria:

- A “first survey exclusion” parameter adjusts Influenzanet incidence rates by removing the result of the first symptoms survey of newly enrolled participants (i.e. only the first symptoms survey of the first year of participation is discarded) (2-5), as participants are more prone to report symptoms at their first report following enrolment (3, 6). *Note:* about past influenza seasons, we have to decide how to proceed for countries on which we have no historic data about participants of previous season, in order to know how to apply the “ignore.first” parameter during the first year with data. One of the option is to consider that every participant of the first season for which we have data is a new participant, and therefore remove the first questionnaire of everybody for this year;

- To account for the lack of validation by a general practitioner, the “episodes merging” criterion considers ILI/ARI episodes experienced within 2 weeks of previous ILI/ARI episodes to be part of the same illness episode (5, 7);

- We considered inclusion criteria accounting for heterogeneous participation. We implemented a minimum number m of symptoms reports per individual throughout the season (m = 2 reports or m = 3 reports, including the first survey) to discard those with rare participation (3);

- For the denominator, instead of the raw total number of participants registered in the cohort from the beginning of the season until the week considered, we considered the inclusion criterion of a participation window of n weeks around the reporting week (n = 0, 1, 2, 3, 4) to account for non-continuous participation. If n = 0 each participant is counted only in the week of reporting; if n = 1 each participant is considered to be part of the cohort in the week of reporting and also in the week before and the week after that, assuming e.g. that they forgot to connect online (analogously for n > 1). These criteria are combined in a stepwise progression;

- Incidence time series computed on these datasets are adjusted to account for the non-representative nature of the Influenzanet population. The strata used for adjustment has to be set up.

The detail of the different steps of the code can be found in Annex II.

Table 1. Name of the parameters used in this document and on the website <http://shiny.sentiweb.fr/ifn/>

|  |  |
| --- | --- |
| **Name of the parameter** | **Name used on** [**http://shiny.sentiweb.fr/ifn/**](http://shiny.sentiweb.fr/ifn/) |
| first survey exclusion | ig1st |
| exclude same | exSame |
| minimum number of survey | s |
| window size of n week | w |

## Parameters chosen for I2 computation

Following this procedure, several parameters have to be set up. We describe below all parameters that, in our mind, are relevant to discuss to compute incidences at a European level.

**ILI case definition**

According to the Guerrisi et al publication, the ILI ECDC definition correlates well with acute respiratory infections (ARI) surveillance data in France (1). At the European level, this definition correlates also well with other surveillance systems (8). As this is the definition used by Influenzanet since the beginning of the project, as well as the definition used by ECDC, we propose to use this definition (defined below).

More restrictive definitions (in which for example fever is mandatory, or a certain level of fever is mandatory) are not satisfying in several country (Spain for example) as the signal becomes too low.

ILI definition (ECDC) = sudden occurrence of symptoms and/or fever AND (fever or chills or asthenia or headache or muscular/articular pain) AND (sore throat or cough or dyspnea)

Headache or muscular/articular pain are part of the definition only for age over 5, to exclude inconsistencies. For people under 5, the definition used is: sudden occurrence of symptoms and/or fever AND (fever or chills or asthenia) AND (sore throat or cough or dyspnea).

In Annex II and on <http://shiny.sentiweb.fr/ifn/> this definition is named *ari.ecdc*.

More definitions could be added to the code to produce other weekly incidences, not transmitted to ECDC but used by Influenzanet, or by some countries. For example, we plan to work on the use of a different definition for every country, which match at best the definition used by each national surveillance system. This may be set up at a later stage (also not to create confusion).

**Window size of n week(s)**

Consider as active participants all participants with at least one weekly survey in *n* weeks before and *n* weeks after the current week (noted w). Weeks where each participant is considered as active are between **[ w - n ; w + n ]**, w is the week for which incidence is computed.

The actual plan is to send, on Mondays, the estimation of the incidence of the previous week to the ECDC. As a consequence, if we include in our analyses a window of n weeks before AND after the considered week, to compute the denominator, the weekly incidences will have to be consolidated.

Other possibilities, if we don’t want a consolidation, are to set up n at 0, or to use a window of n weeks only before the considered week (and not before AND after). On the website <http://shiny.sentiweb.fr/ifn/> , this is the parameter w = 2b or w=1b. The interval becomes [w - n ; w ].

Based on the results of Guerrisi et al (1), and looking at European data, the best choice that we would like to suggest is to use n = 1. The results for n = 2 and n = 1 are quite close, but choosing the smallest window appears better for countries with a small number of participants.

active.week.before = 1

active.week.after = 1

The setup of this parameter at 1 implies that a consolidation will occur one week after the considered week (week w).

Because of this window, incidences will not be produced for the first and the last surveillance week of influenza season, for every country.

As explained below, indicator I1 will not be produced for the two first weeks of every season. In order to be consistent, I2 will as well not be produced for the two first weeks of every season.

Delay before sending I2 = 2 weeks

**Minimum of survey s**

Participant is active only if he has at least [s] weekly surveys over all the season.

In Guerrisi et al paper (1), s = 2 and s = 3 has shown good correlations with other French surveillance data. When looking at European data, the results are not very different for s = 2 or s = 3. We chose to use s = 2 because of the little participation in some of the countries.

active.min.surveys = 2

Because of the “Minimum of survey” setting, a (minor) consolidation occurs throughout the season: a person who filled only one questionnaire is at first not taken into account for incidence computation. If several weeks later he/she fills a second questionnaire, he/she becomes an active participant, and his/her second questionnaire is included in calculation, but also his/her first questionnaire (if it is not his/her first season of participation, otherwise this first questionnaire is not fully taken into account because of the ignore.first setting).

The advantages of this setting are that it excludes sporadic participants, who will participate only one time during the season, and that it is a “historic” feature, already used in almost all works and publications realized by the Influenzanet consortium. The disadvantage is that data will be consolidated during the entire season, and final data will be obtained only at the end of the season. We assessed this on previous seasons for Influenzanet countries, and the impact of this parameter does not appear to be major, we observe only minor differences.

**Adjustment**

Data were not adjusted on gender, as this is not a risk factor for ILI commonly reported in literature.

In Guerrisi et al paper (1), data were adjusted on big French regions (5 different regions) (1). We tried to use this level of adjustment on Influenzanet data, but the signal was too much noisy, in particular for countries with few participants.

In Guerrisi et al paper, data were also adjusted on 4 age categories. We tried to use this adjustment on Influenzanet data, but the signal was too noisy as well. Therefore we used only 3 categories for this adjustment. The breakdown we used (20y and 65y) are different from the one used by ECDC (15y, 65y), because there are few participants between 0 and 15 in Influenzanet, which is not optimal for adjustment (adding 5 more years in that age group increases the corresponding number of participants).

The results with no adjustment do not look good, and we know that Influenzanet population is not representative of general population (9, 10).

The age of every participant is calculated at the day of the opening of the current surveillance season, based on the birthdate given in the last intake.

Set of strata considered for adjustment = age ([0, 20], [21, 64], ≥ 65)

**Summary**

This combination of settings can be visualized on <http://shiny.sentiweb.fr/ifn/> selecting the combination of parameters “s=2 w=1 ig1st exSame”.

# Part 3. Indicator I1: weekly number of active users

The weekly number of active users is the denominator used to compute weekly incidences.

As for weekly incidences, a consolidation occurs throughout the season. The main part of the consolidation will occur after one week, but minor changes can occur throughout the season.

*Note 1:* We count the number of different participants (named global\_id in the database, person\_id in the code). If several people participate on the same Influenzanet account, they are counted separately, as different participants.

*Note 2:* For some countries and on certain years, there are some intake questionnaires with no global\_id (between 0 and 2 257; the max is 2 257 intake questionnaires for UK in 2017-2018 season). Therefore, there are some weekly questionnaires with no intake questionnaire for the considered season. For these weekly questionnaires, we search for intake questionnaires filled during previous seasons. If we find one, we use this intake for age calculation and adjustment. If we do not find an intake questionnaire filled during a previous season, we discard these weekly questionnaires, because their data cannot be adjusted. For example, in 2017-2018 in UK this is the case for 45 participants. For other countries (and for other years in UK), the number of discarded participants is much lower.

We propose to start sending this parameter only a few weeks after the beginning of the season, once participation starts to be stable. Maybe two weeks after the beginning of the season (on week 3, week 1 being the week of the launching).

Delay before sending I1 = 2 weeks

# Part 4. Indicator I2b (optional): weekly ILI incidences at a province level

GrippeNet.fr team tried to compute incidences in France at a province level, but results were not convincing, the signal is too noisy (see also above the discussion on adjustment by region). This problem will probably be even more pronounced for countries with a small number of participants.

A study about regional incidences, realized at a European level, should be undertaken before communicating this indicator to ECDC. We suggest therefore not to transmit this indicator for the winter season 2019-2020.

# Part 5. Indicator I3: cumulative percentages of ILI cases in contact with health care

## General considerations

Some of I3 data can be visualized for different seasons and countries in Annex IV.

## Synthesis of all information included in the weekly questionnaires of a same episode

This indicator requires to synthetize all information included in the weekly questionnaires belonging to a same episode. The procedure used to define episodes has been published in 2017 (11) and is detailed in annex III.

These different steps has to be completed:

- Identification of the syndrome in weekly questionnaires;

- Identification of episodes (determination of the starting and ending date of each episode);

- Summary of all weekly questionnaires corresponding to a same episode.

Some aspects of the procedure are more complete than the procedure used for incidence calculation, which was published in another work (1). In particular, they refer to (i) treatment of data inconsistency, (ii) definition of ILI episode (including when it ends).

## Definition of “contact with health care”

The question of the core questionnaire used to explore “contact with health care” is the following:

**Q7 weekly**

**Because of your symptoms, did you VISIT (see face to face) any medical services?**

o No **0**  
o GP or GP's practice nurse **1**

o Hospital accident & emergency department / out of hours service **3**

o Hospital admission **2**  
o Other medical services **4**  
o No, but I have an appointment scheduled **5**

Some countries might have added some items to this question. In France for example, the following items were added:

* Other practitioner (pediatrician, ENT, cardiologist…)
* Gynecologist / obstetrician
* Mid-wife
* Pharmacist
* School nurse (only asked for people under 18).

For Influenzanet analyses, all these items are grouped in the item “Other medical services”.

Each country can complete this document, adding the description of added items, and how they are grouped in the data sent to Influenzanet.

The item “Other medical services” is probably very country-dependent. Some countries include pharmacists (which are not healthcare, if people only buy paracetamol without talking to anybody) for example. We therefore decided to not show the results of this item.

In France, this item was literally translated, adding some examples: nurse, occupational medical service, child protection and family planning centers. For future works, each country can complete this document, adding the translation of what is exactly ask for the item “Others”.

Three different kinds of contact with health care will be considered for I3 indicator:

* Consultation with a GP or GP's practice nurse;
* Visit to an emergency department or out of hours service;
* Admission in an hospital service.

To be noted that participants can chose several items together.

## Calculation of percentages of ILI cases in contact with health care

Raw weekly percentages of ILI cases in contact with each category of health care are computed as the ratio between “the number of Influenzanet participants with an ILI episode starting during a given week and who seek the considered healthcare” AND “the total number of Influenzanet participants with an ILI episode starting during this given week”.

As for I2 calculation, these raw incidences rates are adjusted on age. In annex IV, raw and adjusted percentages are presented. The feedback of the consortium will be welcome, to decide whether or not we decide to adjust these rates.

At the time of calculation, some ILI participants of a given week did not seek healthcare yet, but could do it later, while their ILI episode is still ongoing. Furthermore, some participants with an ILI starting the given week can possibly declare their symptoms later. I3 indicator will therefore be consolidated during following weeks.

NOTE: The date of seeking healthcare is not clearly specified in the questionnaires, and is therefore not taken into account in the calculation method. If a participant has an ILI episode starting in week 3, and seek healthcare in week 4, he will (after consolidation) be counted in the numerator and denominator for the weekly percentages of ILI cases in contact with health care of the week 3, but will not be counted in week 4, neither in numerator nor denominator.

## Calculation of I3: cumulative percentages of ILI cases in contact with health care

The indicator I3 consists in the weekly cumulative percentages of ILI cases in contact with the three different medical services:

* Cumulative percentage of participants with an ILI who consulted a GP or GP's practice nurse;
* Cumulative percentage of participants with an ILI who consulted an emergency department or out of hours service;
* Cumulative percentage of participants with an ILI who was admitted in an hospital service.

If a participant had several ILI episodes since the beginning of the season, he is counted several time (same thing for I2).

As we can see in Annex IV, this estimated trends are quite constant during the season. These percentages could be visualized on a single graph, showing the temporal series; or on a simple plot for a single week, showing the three percentages for the considered week. Feedbacks from the consortium on this question would be very welcome.

As explained above, indicator I1 and I2 will not be produced for the two first weeks of every season. In order to be consistent, I3 will as well not be produced for the two first weeks of every season.

Delay before sending I3 = 2 weeks

## Parameters chosen for I3 computation

Following this procedure, several parameters have to be set up. We describe below all parameters that, in our mind, are relevant to discuss to compute I3 at a European level.

**ILI case definition**

ILI definition (ECDC) = the same as the one used for I2 calculation

**Determination of the end date of episodes**

duration\_limit: 11 days (3e quartile of the distribution of ILI duration we found in literature (12))

duration\_median: 7 days (median of the distribution of ILI duration we found in literature (12))

**Correction of raw rates**

Set of strata considered for adjustment = age ([0, 20], [21, 64], ≥ 65)

# Part 6. Indicator I4: cumulative percentages vaccinated by key target groups (in particular >65 and <65 at risk)

GrippeNet.fr team and the French National Institute for Public Health Surveillance (Santé publique France) are not in favor of the communication of this indicator.

It has been shown that vaccination coverage against influenza in the 65+ age class during the 2011/2012 season was larger in the Influenzanet participants of France, Portugal (and Sweden), whereas it was statistically representative in Italy (57.2% vs. 62.7%, *p* = 0.8) and UK (74.21% vs. 74%, *p* = 0.98)(9, 10). In the 2010/2011 season, vaccination coverage was higher among Influenzanet participants in all countries (p < 10–4), except in Italy where vaccinated 65+ individuals were strongly underrepresented (35% vs. 62%, p < 10–4), and in UK where vaccination coverage was in agreement with national data (10).

Showing a vaccination rate that does not reflect what happens in general population could interfere with prevention messages. In France for instance, public health authorities try to improve vaccination rate in target groups, because current vaccination rates are too low. It would be counterproductive to give non representatives figures showing that vaccination rates are high, because of non-representativeness of this category.

As a result, we propose not to transmit this indicator to ECDC for the winter season 2019-2020.

# Part 7. Indicator I5: weekly COVID-19 possible case incidences

## General considerations

The methodology of this indicator is the same of the indicator I2 (Cf. Part 1).

As we have few hindsight on SARS-CoV-2 epidemiological characteristics, it was decided to use to most raw version of the method, switching off most of the parameters.

## Incidence computation method

The method used to compute incidences is the one published by Guerrisi et al in 2018 (1).

## Parameters chosen for I5 computation

Following this procedure, several parameters have to be set up. We describe below all parameters that, in our mind, are relevant to discuss to compute incidences at a European level.

**COVID-19 possible case definition**

As this is a parameter computed for ECDC, we decided to use the [ECDC possible case definition](https://www.ecdc.europa.eu/en/covid-19/surveillance/case-definition):

Any person with at least one of the following symptoms:

* Cough;
* Fever;
* Shortness of breath;
* Sudden onset of anosmia, ageusia or dysgeusia.

“Sudden onset of anosmia, ageusia or dysgeusia” is part of the definition only for age over 5, to exclude inconsistencies.

**Window size of n week(s)**

active.week.before = 0

active.week.after = 0

The setup of this parameter at 0 implies that there will be few consolidation after the considered week (week w).

**Minimum of survey s**

No minimum of survey is implemented.

active.min.surveys = 1

**Adjustment**

Adjustment is the same as the one used for I2 indicator.

Data were not adjusted on gender.

The age of every participant is calculated at the day of the opening of the current surveillance season, based on the birthdate given in the last intake.

Set of strata considered for adjustment = age ([0, 20], [21, 64], ≥ 65)

**Summary**

This combination of settings can be visualized on <http://shiny.sentiweb.fr/ifn/> selecting the combination of parameters “w=0”.

# Part 8. Conclusion

As we plan to transmit in 2020-21 a new indicator to ECDC, it could be interesting to think about the standardization of the parameters used, in particular the valor of *w*. Using *w0* for indicator I2 should be an option to consider.

# Annex I: Influenzanet data analysis guidelines

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This Annex will be updated independently of this document, and will be available at <https://github.com/cturbelin/ifnBase>/docs.

## Data Naming

Data elements (variables) should be named with meaningful names instead of using data names in the database (not safe to use)

Data names used are defined in <https://github.com/cturbelin/ifnBase/blob/master/R/templates.R> (survey\_templates aliases entry)

Principles are : - All variables output from the same question are named with the same prefix - All variables from the same group of question are named with the same prefix (pregnant.\*) - Keep the names as simple as possible, one word for each part

## Data values recoding

Nominal Qualitative variables are encoded using integer values, sometimes in a counter intuitive way, this encoding is not safe to be used in data analysis.

Recoding each levels to human readable meaningful levels instead of meaningless integer can reduce error, and make analysis more understandable (i.e gender == “female” always more readable than gender == 1).

These levels should be the same regardless the platform, a unique set of recoding should be defined. Levels can be translated in a well-spelled language to produce output (tables, graphs).

Some variables should be carefully recoded because encoding are misleading:

In case of Yes/No question, variable can be recoded either in meaningful label or in a boolean values but with the Yes=True, No=False mapping.

old (value in the DB) -> new

Weekly survey:

* sympt.sudden (weekly:Q5) : 0 -> “Yes”, 1 -> “No”
* same.episode (weekly:Q2): 0 -> “Yes”, 1= “No”, 2=“DontKnow”, 3=[Missing]
* fever.sudden : 0 -> Yes(True), 1-> No (False)
* off.work (Q10b): 0 -> Yes, 1 -> No, 3 -> “other”
* take.temp (Q6c): 0 -> “Yes”, 1 -> “DontKnow”
* fever.when (Q6): 0 -> “Yes”, 1 -> “DontKnow”
* sympt.when.end (Q4): 0 -> Yes, 1 -> “DontKnow”
* sympt.when (Q3): 0 -> Yes, 1 -> “DontKnow”

Intake survey:

* gender (Q1): 0 -> “male”, 1 -> “female”
* vacc.curseason (Q10): 0 -> “Yes”, 1 -> “No”
* vacc.lastseason (Q9): 0 -> “Yes”, 1 -> “No”
* pregnant (Q12): 0 -> Yes, 1 -> No

## External Data

### Population Data

Population data source is **Eurostat**

Population of each country are regularly updated and published as yearly datasets, each analysis using population data should indicate the update year used to conduct the analysis for each country.

We recommend to store population along with an identifier of the update (for example the year the update has been done) and the year of the available population update for the country. Each data entry should have the attributes (or be linked to): country, update year, source year

To be reproducible, it’s better to always use a consistent update: avoid updating a country population’s data independently.

Update population for year N For each country consider the last update available (not always the year N, some country can have only) Store

# Annex II: detail of Influenzanet incidence computation

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This Annex will be updated independently of this document, and will be available at <https://github.com/cturbelin/ifnBase>/docs.

## Data & Variables used to compute Incidence

### External Data

@see DataAnalysisGuidelines.md

### Data Loading

Incidence are computed by season, considering the season`s data (from the last September of the season) Variables will be named in human readable & meaningful variable names, corresponding variable db column name in indicated aside each variable

Intake survey variables:

* timestamp
* date.birth = Q2
* code\_com = Q3

For each participant, the last available intake survey response for the season is considered (only one age and location is considered for a participant during a season)

Across platforms differences:

For some countries data are stored in the same table and the is no intake for the current season for some participants, Intake can be loaded from previous seasons but a limit should be used (to be sure very old data are not used) or participants without an intake during the season should be excluded (TBD)

This is especially the case for IT, ES and UK (2015) counting season from October to April.

Weekly survey variables:

* timestamp
* no.sympt=Q1\_0,
* fever=Q1\_1,
* chills=Q1\_2,
* rhino=Q1\_3,
* sneeze=Q1\_4,
* sorethroat=Q1\_5,
* cough=Q1\_6,
* dyspnea=Q1\_7,
* headache=Q1\_8,
* pain=Q1\_9,
* chestpain=Q1\_10,
* asthenia=Q1\_11,
* anorexia=Q1\_12,
* sputum=Q1\_13,
* wateryeye=Q1\_14,
* nausea=Q1\_15,
* vomiting=Q1\_16,
* diarrhea=Q1\_17,
* abdopain=Q1\_18,
* sympt.other=Q1\_19,
* fever.sudden=Q6b
* highest.temp=Q6d
* same.episode= Q2
* sympt.start= Q3\_0\_open
* fever.start= Q6\_1\_open
* sympt.sudden= Q5

### Variable Recoding

Recode some variables to make error-proof coding and recode to Missing value inconsistent values (date in the future)

weekly:

* sympt.sudden : 0 -> Yes(True), 1 -> No(False)
* same.episode : 0 -> “Yes”, 1-> “No”, 2->“DontKnow”, 3->Missing
* fever.sudden : 0 -> Yes(True), 1-> No (False)
* highest.temp : 6 -> Missing
* sympt.start : sympt.start > date(timestamp) -> Missing
* fever.start : fever.start > date(timestamp) -> Missing

intake:

* age : compute age as difference between yearly date birth and yearly intake timestamp, yearly(date)= year(date) + month(date)/12, age is rounded to 2 decimals

Remarks:

inconsistency of date.birth is not checked here, should be (negative and too old people can occur) Inconsistency of age was checked for syndromic classification but not for age-group stratification (should so) inconsistency of sympt.start and fever.start before the survey is not checked here (but they are excluded during computation if these date are outside from the computing period)

### Syndromic classification

Each survey is evaluated to fit a syndrome definition Consider one boolean column (0/1) for each syndrome type (corresponding to one definition), assigned to each survey response

For each participants, consider age of the last available intake survey [TBD]

Any symptom declared as sudden

*is\_sudden* = (sympt.sudden not missing and sympt.sudden is “Yes”) OR (fever.sudden not missing and fever.sudden is “Yes”)

Pain is only accounted if age over 5 (< 120 to exclude inconsistency)

*has\_pain* = if age > 5 and age < 120 use pain value else consider it`s True

Q6d coding (highest.temp)

* “Below 37°C” =0
* “37° - 37.4°C” =1
* “37.5° - 37.9°C”=2
* “38° - 38.9°C”= 3
* “39° - 39.9°C”=4
* 40°C or more"=5
* “I don’t know/can’t remember”=6

Fever over 39

*fever\_level\_39* = highest.temp not missing and is 4 or 5 (6 is recoded to missing)

Fever over 38

*fever\_level\_38* = highest.temp not missing and is 3, 4 or 5 (6 is recoded to missing)

General set of symptoms for ARI

*general\_ari* = any\_of[fever, chills, asthenia, headache ] OR *has\_pain*

Syndromes definitions:

* ili = *is\_sudden* and *fever\_level\_39* and *has\_pain* and any\_of[sorethroat,cough,dyspnea, sneeze ,rhino]
* ili.f = *is\_sudden* and (fever OR *fever\_level\_39*) and *has\_pain* and any\_of[sorethroat,cough,dyspnea, sneeze ,rhino]
* ili.minus = *is\_sudden* and fever OR *fever\_level\_38* and (*has\_pain* OR headache) & any\_of[sorethroat, cough, dyspnea]
* ili.minus.fever = *is\_sudden* and fever and (*has\_pain* or headache) & any\_of[sorethroat, cough, dyspnea]
* ili.who = *is\_sudden* & *fever\_level\_38* & (*has\_pain* or headache) & any\_of[cough, sorethroat]
* ari.ecdc = *is\_sudden* & *general\_ari* & any\_of[sorethroat, cough, dyspnea]
* ari.plus = *is\_sudden* & *general\_ari* & any\_of[sorethroat,cough,dyspnea, sneeze ,rhino, sputum]
* ari = *is\_sudden* & *general\_ari* & any\_of[cough, rhino, sneeze]

Remarks: Differences with written definition and last implementation:

* *is\_sudden* was only using sympt.sudden (not fever.sudden)
* *has\_pain* was only accounting on age for ili
* ili.who was including dyspnea

## Data preparation

Available Parameters:

* active.week.before : number of week before a given week to consider a participant as active
* active.week.after : number of week after a given week to consider a participant as active
* active.max.freq = Maximum delay between 2 surveys (in weeks)(this parameter is currently not used)
* active.min.surveys = Minimal number of weekly survey during the season
* ignore.first.delay = In days, Ignore the first survey of a if its dated less this delay from the Monday of the current progressed week
* ignore.first.only.new = Only ignore first survey for the new participants (if the season is the first of a participant)
* exclude.same.delay = Maximum number of day to consider a same episode

### 1. Exclude same rule [ param=exclude.same.delay ]

delay = number of days (computed on truncated date)

if same.episode is Yes and previous survey has delay < exclude.same.delay cancel syndrome report (consider syndrome is not incident)

### 2. Compute onset column

onset = first available date from *fever.start*, *sympt.start*, *survey date*

incidence week = ISO 8601 year week of the onset (caution use the year of the week, not the year of the date strftime %G%V), we use a numeric encoding year \* 100 + week number, but date of the Monday of the week

### 3. Aggregate syndromes count by week,participant, counting only 1 syndrome kind by person-week

(so for each syndrome = if syndrome > 0 then 1 else 0)

### 4. Compute season-wide data by participants (needed to apply selection rules for each week)

* count of weekly survey during the season
* week of the first weekly survey during the season
* week of the last weekly survey during the season
* maximum delay between two weekly surveys during the season (computed in number of weeks, with one survey by week)

## Incidence computation for a given week yw (year-week) in a given season.

### Active participants selection

For a given week, computation has two steps:

* Select active participants from all the weekly of the season by applying a set of selection rules
* Count syndromes for the week yw
* remove participants for whom the first survey is after yw
* Rule *ignore first survey*
  + Ignore participants for whom the first survey is less than ignore.first.delay days from the Monday of the week yw AND is the first season for the participant
* Rule *Active week before* and after\*
  + Include participants with onset in yw - active.week.before
  + Include participants with onset in yw + active.week.after
* Rule *minimum surveys count*
  + Include participants with at least active.min.survey count during all the season
* Rule *maximum frequency* (Not used in w2\_ex2\_if2\_s2 profile)
  + Include participants with a delay in weeks between two surveys <= active.max.freq over the season (this parameter is currently not used)

### Incidence computation for the week yw and a given syndrome definition

Computation can be done using a set of *strata* (for example age-group, regions)

1. With select active participants: compute active count for the week by *strata*
2. With weekly surveys for which onset week is equal to the currently computed week yw and participants is active for the week

* Count the number of participants with the syndrome by *strata*
* At this step, you should have in each strata, syndrome count and active participants for the week yw

#### Crude incidence rate

Crude incidence = total count of participants with the syndrome for the week yw/ total active participants (sum in all *strata*) at the week yw Confidence interval bounds is the Poisson exact IC95% computed on total active participants of the week yw

#### Adjusted incidence rate by strata

In each *strata*:

* prop\_pop : Proportion observed in the general population for the *strata*
* rate = prop\_pop \* count / active
* w2 = (prop\_pop / active) ^ 2 \* count

Adjusted incidence = sum(rate) over all *strata*

Confidence interval is computed using DKES estimated for adjuster ratio (Fay & Feuer, 1997, Stat In Med (16) p791-801)

* total\_count = sum(count) of all *strata*
* total\_w2 = sum(w2) of all *strata*
* Up(x, alpha) = quantile of Chisq distribution (1 - alpha / 2, DF=2(x+1))
* Lp(x, alpha) = quantile of Chisq distribution (alpha/2, DF=2x)
* Upper = rate + (sqrt(total\_w2) / sqrt(total\_count)) \* (Up(total\_count, alpha) - total\_count)
* Lower = rate + (sqrt(total\_w2) / sqrt(total\_count)) \* (Lp(total\_count, alpha) - total\_count)

# Annex III: determination of ILI episodes

The following appellations will be used:

Intake: intake questionnaire

Weekly: weekly questionnaire

Weekly registration date: the date on which the participant registered his weekly questionnaire

date\_onset\_weekly: the date on which we consider the symptoms declared in this weekly started

date\_onset\_episode: the starting date of the episode

The determination of an ILI episode follows 4 steps. One step is optional.

This method was developed to define ILI or ARI episodes. If we want to use this method for other syndroms, like acute gastroentiritis, this method should be adapted. For acute gastroenteritis for instance, the method should allow discrimination between acute diarrhea (lasting less than 14 days) and chronic diarrhea.

When the 4 steps are completed, the output we obtain is an R environment, containing 3 data.frame:

* + intake (unchanged);
  + weekly\_episode. It is the data.frame of the weekly questionnaires, with 3 new variables: date\_onset\_weekly (a date or NA), date\_onset\_episode (a date or NA), date\_end\_episode (a date or NA). A "presence\_syndrome" column will be given as a parameter ;
  + episode. This data.frame has one line for each episode. The variables are the same of the data.frame weekly\_episode.

For each definition used, we obtain one environment.

**Step 1: identification of the syndrome in weekly questionnaires**

For each weekly from each participant, a parameter named “presence\_syndrome” shows if the participant suffer from the considered syndrome. This parameter is TRUE if symptoms declared by the participant are in line with the syndrome, FALSE if not.

Possible definitions used for ILI and ARI are described in Annex II.

**Step 2 (OPTIONAL, not implemented for I3 indicator): participant identification**

This step selects some participants, based on intake and weekly questionnaires.

Several criterion can be used. Possible conditions are:

* At least 1 intake registered during the season (*has.intake*);
* At least 1 weekly registered during the season (*has.weekly*);
* A minimum number of weekly registered during the season (*min.survey*);
* A weekly registered before a specific date (*has\_before*), after a specific date (*has\_after*) or during a certain period (*has\_between*);
* Living in mainland (for countries with oversea territories) (*remove\_domtom*).

**Step 3: Identification of episodes**

1. Data cleansing for weekly
   * Elimination of duplicates : only one weekly is kept per date and per participant (the last registered weekly, for every date);
   * The starting fever dates and beginning of symptoms dates later than registration dates are deleted (considered as missing).
2. Determination of date\_onset\_weekly for each weekly with TRUE for the parameter presence\_syndrome.

The date\_onset\_weekly is defined following these ordered instructions:

* + Date of the beginning of fever, if provided, and if this date is less than 15 days before the registration date of the weekly;
  + If not, date of the beginning of symptoms, if provided and if this date is less than 15 days before the registration date of the weekly;
  + If not, registration date of the weekly.

1. Determination of date\_onset\_episode based on date\_onset\_weekly.

Objective: to identify all the weekly belonging to a same episode of the considered syndrome, for a participant.

* + Choice of the maximum time limit to consider that two consecutive weekly belongs to the same episode: *params$delay\_episode\_max*
  + Choice of the method used to create episode: the default method used is Ariza algorithm, described below. Other alternative methods has been developed and could be used.

**Ariza algorithme (11)**

We repeat this algorithm on each weekly belonging to a same participant, organized in chronological order.

For each weekly i (i ≥ 2),

* + - IF
      * Weekly i and i-1 are TRUE for the parameter presence\_syndrome
      * AND the gap between the two date\_onset\_weekly is less than **15 days**: (date\_onset\_weekly(i) - date\_onset\_weekly(i-1) < **15)**
      * AND the participant did not specify that weekly i and i-1 belong to different episodes (same.episode != « NO »)
      * AND IF i > 2,

one of these conditions is fulfilled:

* + - * + weekly i-2 is not TRUE for the parameter presence\_syndrome
        + OR (weekly i-2 is TRUE for the parameter presence\_syndrome AND the gap between the date\_onset\_weekly of weekly i and i-2 is less than **15 days** : (date\_onset\_weekly(i) - date\_onset\_weekly(i-2) < **15**)
        + OR date\_onset\_weekly i-1 and i-2 are different
    - OR IF
      * weekly i and i-1 are TRUE for the parameter presence\_syndrome
      * AND date\_onset\_weekly i and i-1 are the same

THEN weekly i and i-1 belongs to the same episode. The date\_onset\_weekly(i) takes the same value of the date\_onset\_weekly(i-1). The date\_onset\_episode also takes the same value as the date\_onset\_weekly(i-1).

For all the weekly with the parameter presence\_syndrome TRUE and with the date\_onset\_episode not defined by the algorithm described above (because there is no fusion), the date\_onset\_episode takes the value of the date\_onset\_weekly.

*Note 1:* according to this method, in the following case, the third weekly does not belong to the episode.

Weekly registration date same.episode onset syndrome  
2017-02-22 <NA> 2017-01-19 ILI  
2017-02-28 Yes 2017-01-19 ILI  
2017-03-03 Yes 2017-01-19  ARI

*Note 2:* weekly with presence\_syndrome FALSE will be coded NA for the variable date\_onset\_weekly and date\_onset\_syndrome.

1. Determination of the ending date of the episode

If the participant gave a coherent ending date for the episode (Cf. below), we use this ending date. If not, we use a “mean” duration for episodes, defined through literature (duration\_median). That is to say:

- IF the last weekly belonging to the episode (weekly i) has an ending symptoms date (date\_end) AND:

* date\_end > date\_onset\_episode
* AND date\_end ≤ weekly(i) registration date
* AND date\_end ≥ weekly(i-1) registration date
* AND date\_end - date\_onset\_episode ≤ duration\_limit

THEN date\_end\_episode = date\_end

ELSE date\_end\_episode = date\_onset\_episode + duration\_mediane

With:

delay\_episode\_max = duration\_limit

For influenza-like-illnesses:

duration\_limit: 11 days (3rd quartile of the distribution of ILI duration we found in literature, Cf. Looker C, Carville K, Grant K, Kelly H (2010) Influenza A (H1N1) in Victoria, Australia: A Community Case Series and Analysis of Household Transmission. PLoS ONE 5(10): e13702. https://doi.org/10.1371/journal.pone.0013702)

duration\_median: 7 days (median of the distribution of ILI duration we found in literature, Cf. Looker C, Carville K, Grant K, Kelly H (2010) Influenza A (H1N1) in Victoria, Australia: A Community Case Series and Analysis of Household Transmission. PLoS ONE 5(10): e13702. https://doi.org/10.1371/journal.pone.0013702)

For covid.hcsp syndrom:

duration\_limit : 17 days (3rd quartile of the distribution of the syndrom we found in literature, Cf. Lechien JR, Chiesa-Estomba CM, Place S, Van Laethem Y, Cabaraux P, Mat Q, Huet K, Plzak J, Horoi M, Hans S, Rosaria Barillari M, Cammaroto G, Fakhry N, Martiny D, Ayad T, Jouffe L, Hopkins C, Saussez S; COVID-19 Task Force of YO-IFOS. Clinical and epidemiological characteristics of 1420 European patients with mild-to-moderate coronavirus disease 2019. J Intern Med. 2020 Sep;288(3):335-344. doi: 10.1111/joim.13089. Epub 2020 Jun 17. PMID: 32352202; PMCID: PMC7267446)

duration\_median : 11 days (median of the distribution of the syndrom we found in literature, Cf. Lechien JR, Chiesa-Estomba CM, Place S, Van Laethem Y, Cabaraux P, Mat Q, Huet K, Plzak J, Horoi M, Hans S, Rosaria Barillari M, Cammaroto G, Fakhry N, Martiny D, Ayad T, Jouffe L, Hopkins C, Saussez S; COVID-19 Task Force of YO-IFOS. Clinical and epidemiological characteristics of 1420 European patients with mild-to-moderate coronavirus disease 2019. J Intern Med. 2020 Sep;288(3):335-344. doi: 10.1111/joim.13089. Epub 2020 Jun 17. PMID: 32352202; PMCID: PMC7267446)

*Note 3:* according to this method, it can occur that date\_end\_episode was earlier than the registration date of a weekly belong to this episode. This aspect was not considered as a problem. Therefore, there is no censorship on the weekly filled after date\_end\_episode, no information are lost about this episode.

*Note 4:* weekly with presence\_syndrome FALSE will be coded NA for the variable date\_end\_syndrome.

**Step 4: summary of weekly questionnaires for each episode**

During this step, information included in all the weekly questionnaires belonging to the same episode will be summarized in one line.

This step results in the creation of a new data.frame: episode.

We consider below only the questions from the core questionnaire, used by every Influenzanet countries. Specific questions added by only some countries are not considered.

This data.frame has one line per episode. Variables are the same of the one included in the data.frame weekly\_episode, that is to say all the variables of the weekly + 3 new variables (date\_onset\_episode (a date), date\_end\_episode (a date), date\_onset\_weekly), and presence\_syndrome as a parameter.

To build this data.frame episode, we start from the data.frame weekly\_episode of the last season. The weekly\_episodes lines with identical (and different from NA) variables: person\_id, date\_onset\_episode AND date\_end\_episode will be synthetized in one unique line in the data.frame episode.

For this line, the valor kept for each variable is defined by the following rules:

- Variables person\_id, date\_onset\_episode et date\_end\_episode: they keep the valor on which the combination is effected;

- Variables of the questions Q2, Q3, Q4, Q6 and date\_onset\_weekly: they have no interest for this data.frame, and will be coded NA;

**Q2:** On your last visit, you reported that you were still ill. Are the symptoms you report today part of the same bout of illness?

**Q3:** When did the first symptoms appear?

**Q4:** When did your symptoms end? **Q6**: When did your fever begin?

- presence\_syndrome parameter is TRUE;

- The rules to select the values of the other variables of the weekly questionnaires are described below. Five different summary methods will be used, depending on the question.

1. Summary of the weekly questionnaires, keeping all the answers - union method :

We keep all the items selected at least one time by the participant in the weekly questionnaires of this episode. This method can only be used with multiple answers questions (questions beginning with a o and not a •).

Relevant questions:

**Q1 weekly:** Have you had any of the following symptoms since your last visit (or in the past weeks, if this is your first visit)?

**Q9 weekly  
Did you take medication for these symptoms (tick all that apply)?**o No medication 0  
o Pain killers (e.g. paracetamol, lemsip, ibuprofen, aspirin, calpol, etc) 1  
o Cough medication (e.g. expectorants) 2  
o Antivirals (Tamiflu, Relenza) 3  
o Antibiotics 4

o Other 5  
o I don't know/can't remember 6

Note: some countries might have added some items to this question. For every country, please send us the description of added items, and how they are grouped in the data sent to Influenzanet.

**Q7 weekly**

**Because of your symptoms, did you VISIT (see face to face) any medical services?**

o No **0**  
o GP or GP's practice nurse **1**

o Hospital accident & emergency department / out of hours service **3**

o Hospital admission **2**  
o Other medical services **4**  
o No, but I have an appointment scheduled **5**

Note: some countries might have added some items to this question. For every country, please send us the description of added items, and how they are grouped in the data sent to Influenzanet.

**Q8 weekly**  
**Because of your symptoms, did you contact via TELEPHONE or INTERNET any of medical services?**o No 0  
o GP - spoke to receptionist only 1  
o GP - spoke to doctor or nurse 2

o NHS Direct / NHS 24 / NHS Choices 3

o NPFS 4

o Other 5

Note: some countries might have added some items to this question. For every country, please send us the description of added items, and how they are grouped in the data sent to Influenzanet.

1. Summary of the weekly questionnaires based on a hierarchy between items - « worst case » method:

* If for all the weekly questionnaires of this episodes the answers to this question are NA, the valor we keep will be NA;
* If at least one weekly questionnaire of this episode has and answer different from NA, we keep the « worst » answer which has been selected at least one time. Under each question, we show the hierarchy between items, the first one being the “worst”.

Relevant questions:

**Q6c weekly**

**Did you take your temperature?**

• Yes 0

• No 1

• I don't know/can't remember 2

« Yes » > « I don't know/can't remember» > « No »

**Q6d weekly**

**What was your highest temperature measured?**

• Below 37°C 0

• 37° - 37,4°C 1

• 37,5° - 37,9°C 2

• 38° - 38,9°C 3

• 39° - 39,9°C 4

• 40°C or more 5

• I don't know/can't remember 6

« 40°C or more » > « 39° - 39,9°C » > « 38° - 38,9°C » > « 37,5° - 37,9°C » > « 37° - 37,4°C » > « Below 37°C » > « I don't know/can't remember»

**Q10 weekly**

**Did you change your daily routine because of your illness?**

• No 0  
• Yes, but I did not take time off work/school 1  
• Yes, I took time off work/school 2  
« Yes, I took time off work/school » > « Yes, but I did not take time off work/school » > « No »

**Q10c weekly**

**How long have you been off work/school?**

• 1 day 0  
• 2 days 1  
• 3 days 2  
• 4 days 3  
• 5 days 4  
• 6 to 10 days 5  
• 11 to 15 days 6  
• More than 15 days 7

« More than 15 days » > « 11 to 15 days » > « 6 to 10 days » > « 5 days » > « 4 days » > « 3 days » > « 2 days » > « 1 day »

1. Summary of the weekly questionnaires keeping the answer given in the FIRST weekly questionnaire filled for this syndrome:

We keep the answer given in the first weekly questionnaire of this syndrome. If the first answer is NA, we keep the answer given in the second questionnaire of the syndrome, etc.

Relevant questions:

**Q5 weekly**  
**Did your symptoms develop suddenly over a few hours?**• Yes 0  
• No 1  
• I don't know/can't remember 2

**Q6b weekly**

**Did your fever develop suddenly over a few hours?**

• Yes 0  
• No 1  
• I don't know/can't remember 2

**Q7b weekly**

**How soon after your symptoms appeared did you first VISIT a medical service?**

**GP or GP'r practice nurse**

Hospital admission

Hospital accident & department/out of hours service

Other medical services

For every item, participant can chose:

• Same day 0

• 1 day 1

• 2 days 2

• 3 days 3

• 4 days 4

• 5 - 7 days 5

• More than 7 days 6

• I don’t know / can’t remember 7

**Q8b weekly**

**How soon after your symptoms appeared did you first contact a medical service via TELEPHONE or INTERNET?**

GP - spoke to receptionist only

GP – spoke to doctor or nurse

NHS Direct / NHS 24 / NHS Choices

Other

For every item, participant can chose:• Same day 0

• 1 day 1

• 2 days 2

• 3 days 3

• 4 days 4

• 5 - 7 days 5

• More than 7 days 6

• I don’t know / can’t remember 7

**Q9b weekly  
How long after the beginning of your symptoms did you start taking antiviral medication?**

• Same day 0

• 1 day 1

• 2 days 2

• 3 days 3

• 4 days 4

• 5 - 7 days 5

• More than 7 days 6

• I don’t know / can’t remember 7

1. Summary of the weekly questionnaires keeping the answer given in the LAST weekly questionnaire filled for this syndrome:

We keep the answer given in the last weekly questionnaire of this syndrome. If the last answer is NA, we keep the answer given in the second last questionnaire of the syndrome, etc.

Relevant questions:

**Q10b weekly**

**Are you still off work/school?**

• Yes 0  
• No 1  
• Other (e.g. I wouldn’t usually be at work/school today anyway) 3

**Q11 weekly**

**What do you think is causing your symptoms?**

• Flu or flu-like illness 0

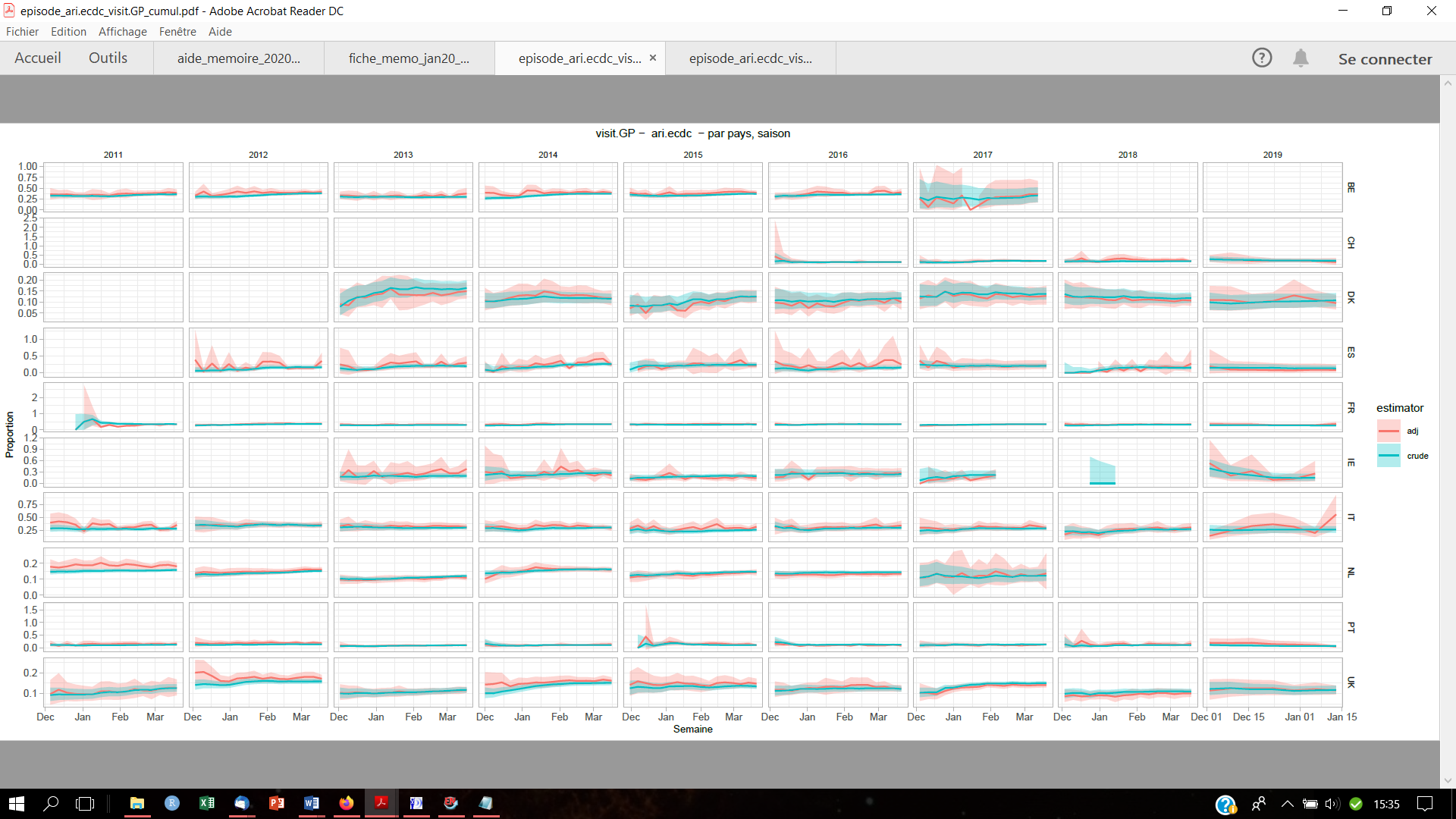
• Common cold 1  
• Allergy/hay fever 2  
• Ashtma 6

• Gastroenteritis/gastric flu 3

• Other 4  
• I don't know 5

Note: some countries might have added some items to this question. For every country, please send us the description of added items, and how they are grouped in the data sent to Influenzanet.

# Annex IV: cumulative percentages of ILI cases in contact with a general practitioner, per season, per country



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