

Twitter Thread by Dr. Simon ■



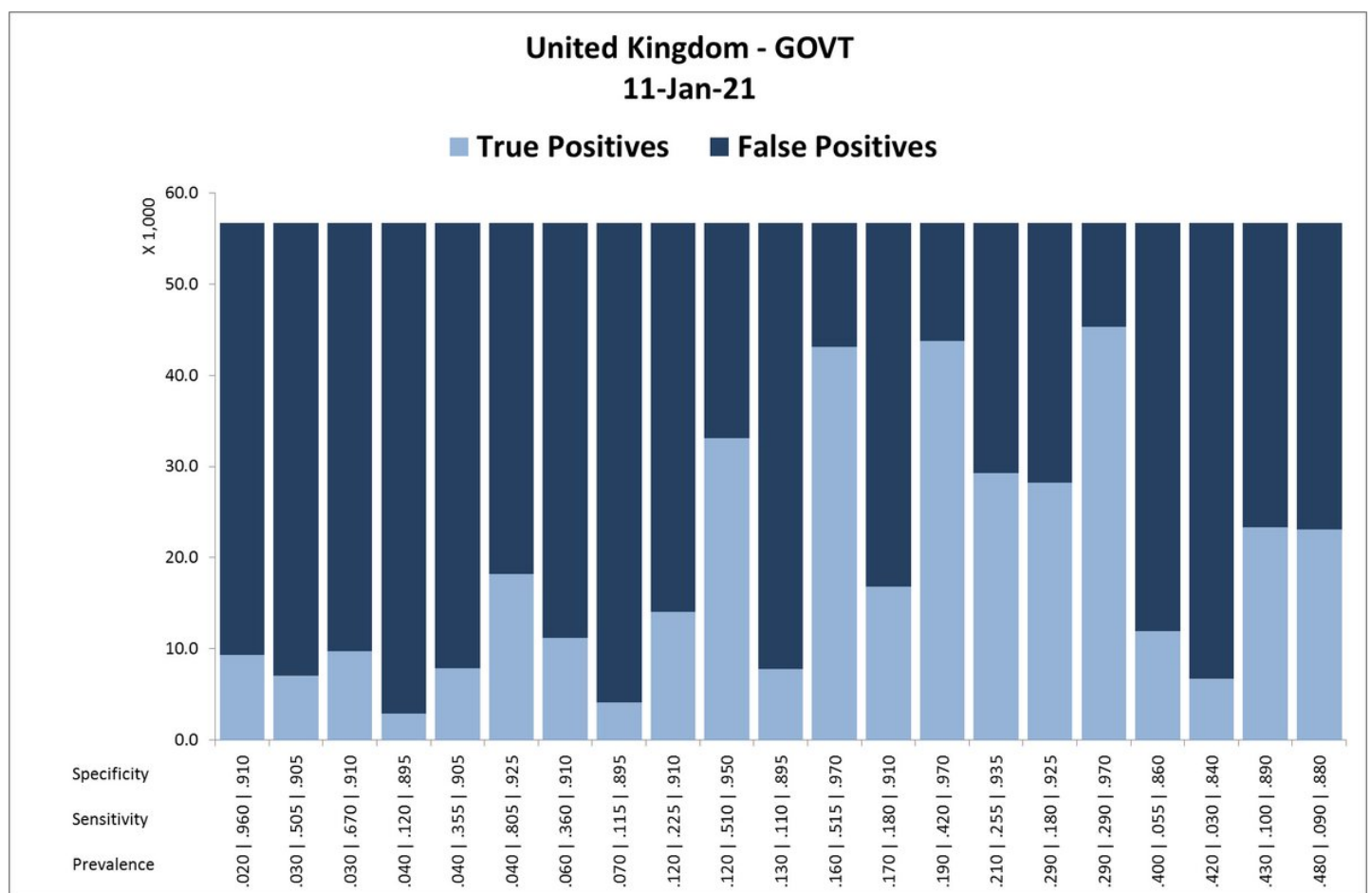
Dr. Simon ■

[@goddeketal](#)



1/ Happy to announce that we have submitted our #paper 'Bayes Lines Tool (BLT) - A SQL-script for analyzing diagnostic test results with an application to SARS-CoV-2-testing'.

In this ■■thread■■, I will explain why our tool is that powerful for decision makers.
#UnbiasedScience

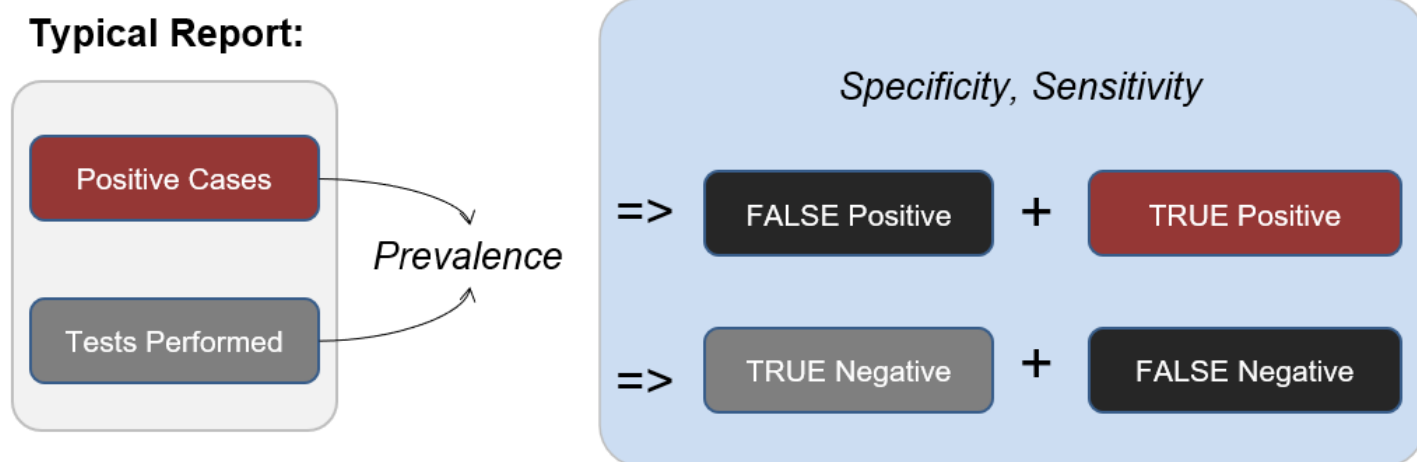


2/ In the meantime, the submitted paper is available on the preprint platform [@zenodo_org](#). Factual criticism is highly desired and encouraged. The publication itself presents a seminal Bayesian calculator, the Bayes Lines Tool (BLT). (Petje af, [@waukema!](#)) <https://t.co/FEYvH3D0Gf>

3/ The Bayes Line Tool (available on <https://t.co/jlomSlxOd9>) is able to back-solve disease #prevalence, test #sensitivity, test #specificity, and therefore, true positive, false positive, true negative and false negative numbers from official governmental test outcome reports.

4/ This is done by creating confusion matrices with four variables. Namely: TP, FP, TN, FN. In order to calculate the matrices, we need prevalence, specificity, and sensitivity as well as the number of people that got tested (within a given period) and the number of positives.

Back Solved using Bayes Law:



5/ The number of positives and the number of tests are given by the government. Prevalence, specificity, and sensitivity are unknown. So we assume any combination of them ranging from 0-99%. These three combinations can amount up to #millions of #combinations.

```

1  with tests as
2  (
3    select
4      :report_id::text as report_id, -- Feel free to call with any string, e.g. date-string
5      :tests as tests_performed, -- integer
6      :cases as positives_reported --integer
7    ),
8
9  permutations as
10 (
11  select
12    (prevalence::numeric / 1000)::numeric as prevalence,
13    (sensitivity::numeric / 1000)::numeric as sensitivity,
14    (specificity::numeric / 1000)::numeric as specificity
15  from
16    generate_series(1, 500, 1) as prevalence,
17    generate_series(30, 999, 5) as sensitivity,
18    generate_series(75, 999, 5) as specificity
19  ),
20
21  matrices as
22  (
23    select
24      t.report_id,
25      t.tests_performed,
26      t.positives_reported,
27      round(prevalence, 2) as prevalence, --just for cosmetic purposes
28      round(sensitivity, 3) as sensitivity,
29      round(specificity, 3) as specificity,
30      (t.tests_performed * prevalence)::int as has_disease, --calculation with full precision for data type numeric, but
31      (t.tests_performed * (1 - prevalence))::int as hasnot_disease, --casting to integer for cosmetic purposes
32      (t.tests_performed * prevalence * sensitivity)::int as true_positives,
33      (t.tests_performed * (1 - prevalence) * specificity)::int as true_negatives
34    from
35      tests t,
36      permutations p
37  )
38
39  select
40    *,
41    hasnot_disease - true_negatives as false_positives,
42    has_disease - true_positives as false_negatives
43  from
44    matrices
45  where
46    (true_positives + (hasnot_disease - true_negatives)) = positives_reported
47  order by
48    report_id,
49    prevalence,
50    sensitivity,
51    specificity

```

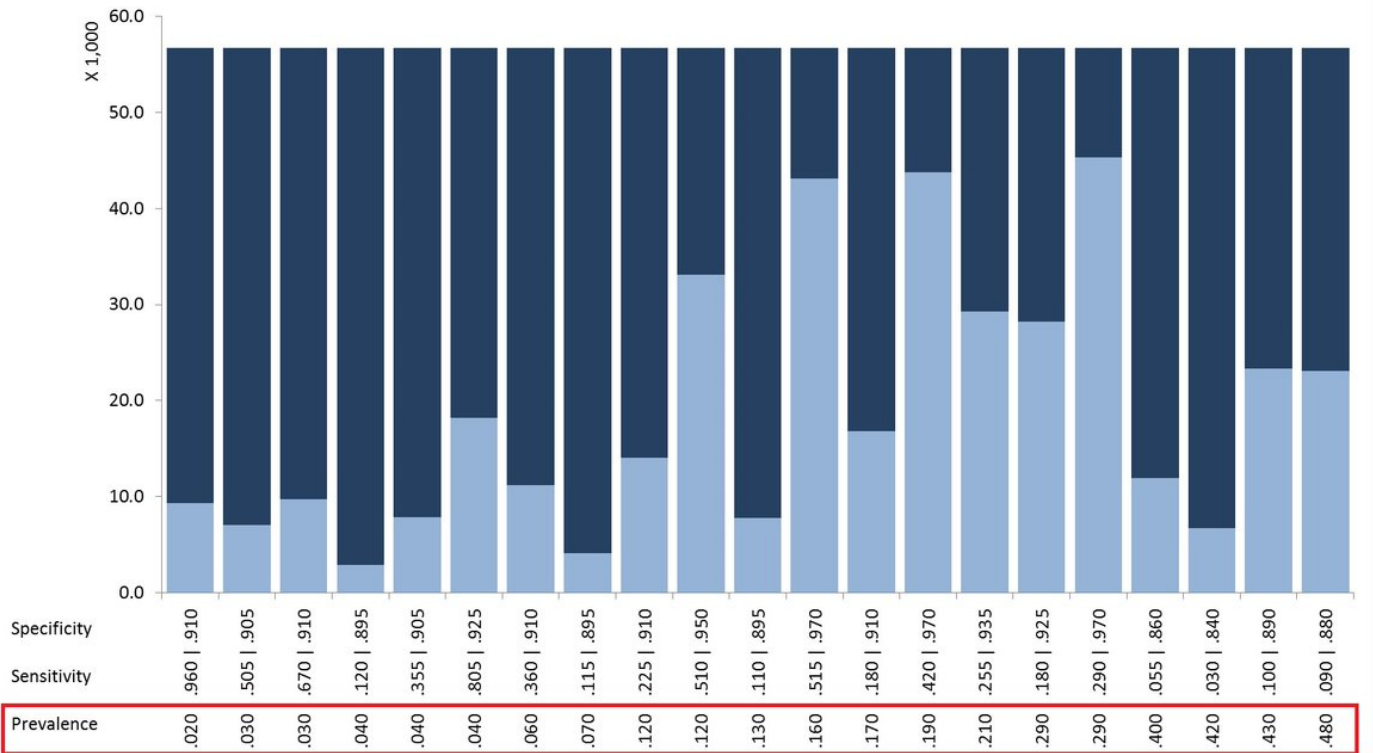
6/ Typically, we calculate with 7 million combinations. Of these 7 million combinations, only 1-100 usually match the numbers that the government gave us (e.g. TRUE Positives + FALSE Positives = amount of performed tests).

7/ For the 11 Jan 2021, 536,947 tests were performed, resulting in 56,733 reported positives. The confusion matrices contained 21 possible matches for that day, represented in the #columns. We have sorted the columns by 'prevalence', as marked in red.

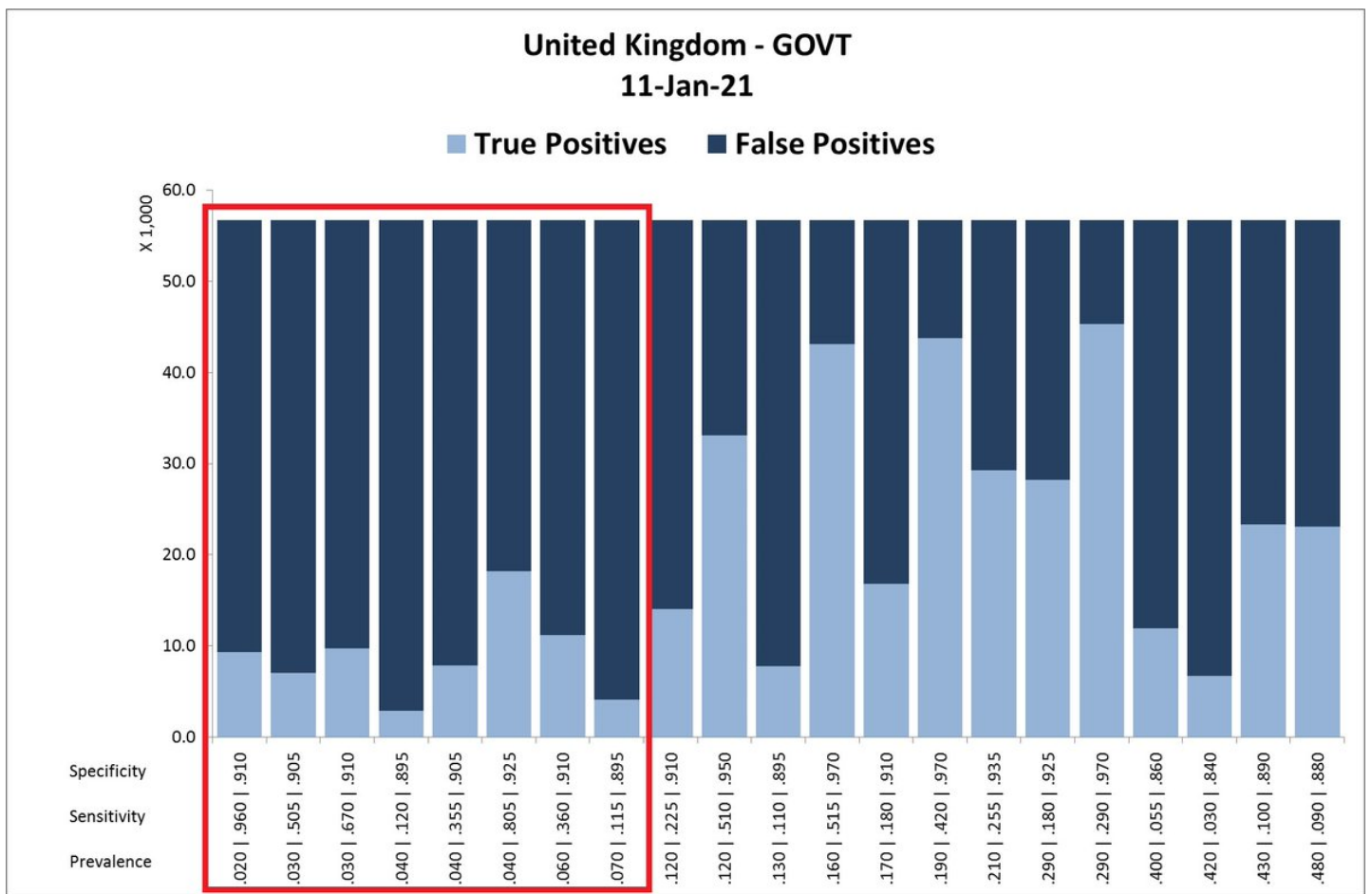
United Kingdom - GOVT

11-Jan-21

True Positives False Positives



8/ The prevalence in the UK is currently presumed to be 1,52% (<https://t.co/DuF3YXRA9s>). Given the fact that reported positives dropped by 43% since January 8, we are looking at a prevalence of around 3%, but definitely lower than 12%, leaving us with the following options:

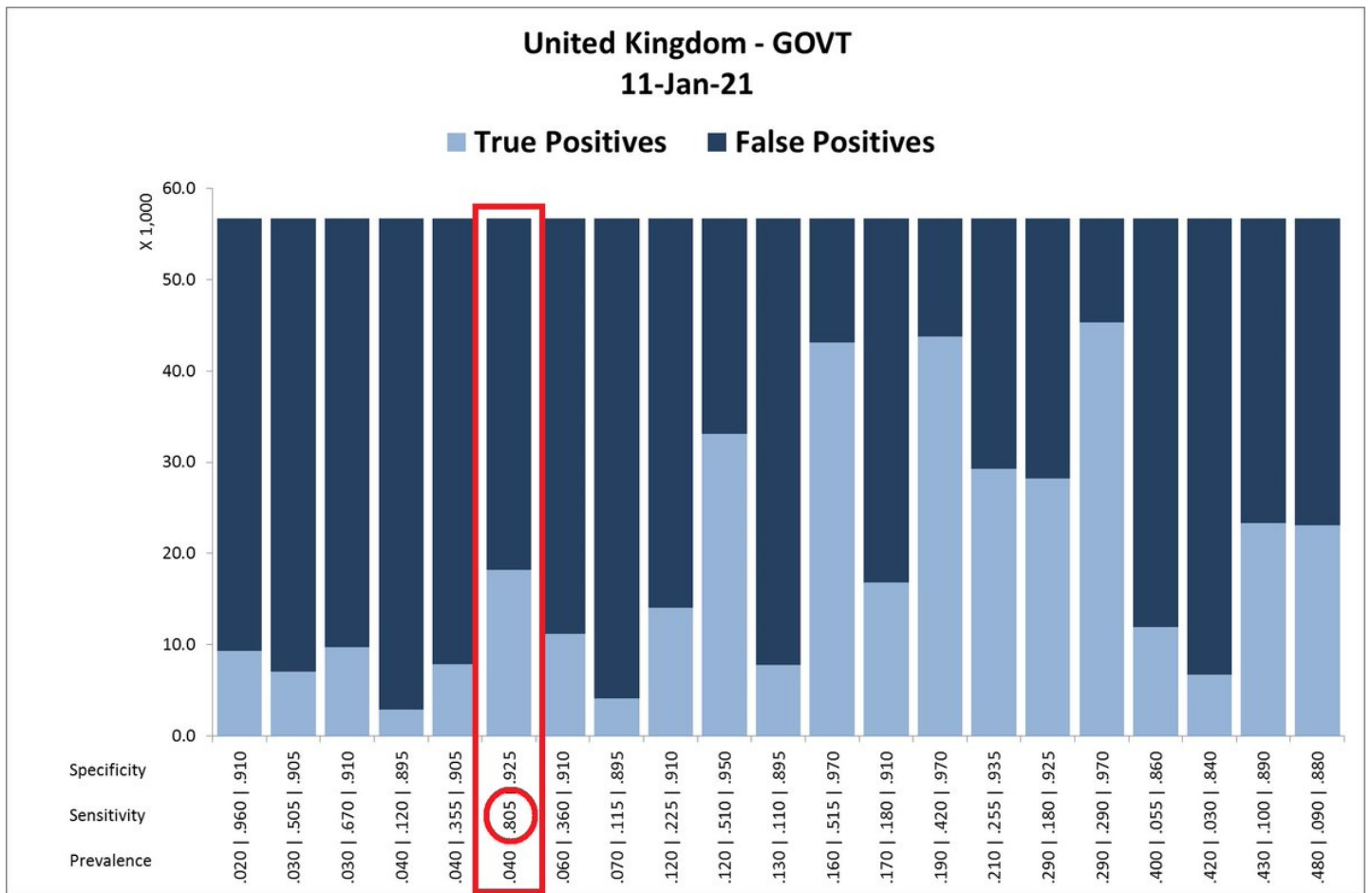


9/ Looking at the bars will already give you a good indication on the test result in the context of everyone else who got tested in the population. This means that the model tells us whether the test results are/were relevant.

10/ In the next steps, I will show you how to figure out which event might most likely have been the one that occurred that day, figuring out the real TP/FP rate, test specificity and sensitivity and prevalence. For this, let's take a look at the tests' sensitivity.

11/ In the UK antigen and PCR tests are used. Antigen tests have a sensitivity between .664 (66.4%) and .738 (73.8%) (<https://t.co/9ySnEL8c0l>). PCR tests about .842 (84.2%) (<https://t.co/guYiZUwW87>). PCR tests constitute the majority of tests that are used in the UK.

12/ We are consequently looking for a sensitivity value just below .842. #BINGO! By just getting the amount of performed tests and number of reported positives from the government, we can conclude the actual specificity, sensitivity, and prevalence.

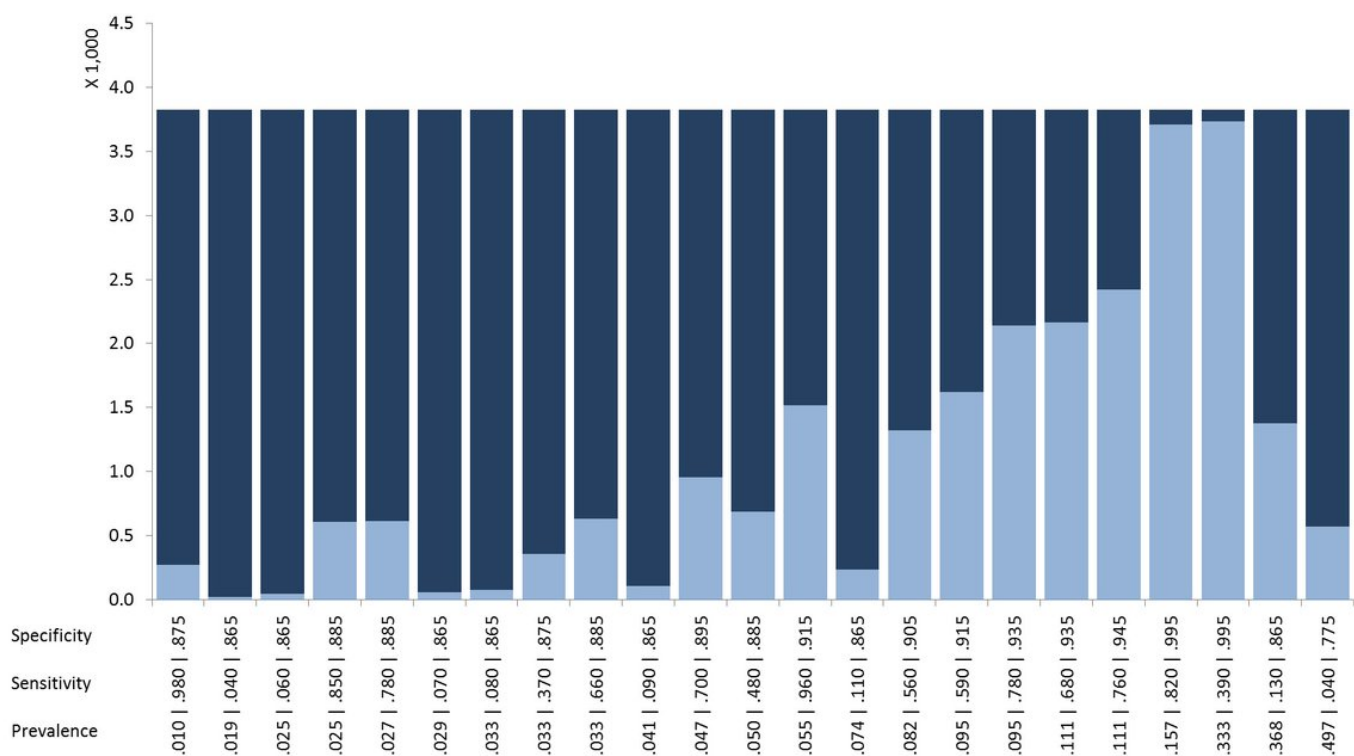


13/ So on January 11th, the prevalence was most likely about 4%, the tests' sensitivity about 80.5%, and the tests' specificity about 92.5% (which is much lower than the claimed 98.9%: <https://t.co/Pc4YxhiX07>). The false-positive rate that day would consequently have been 68%!

14/ Let's have a look at the calculated data that the Netherlands are providing.

Netherlands - GGD 10-Jan-21

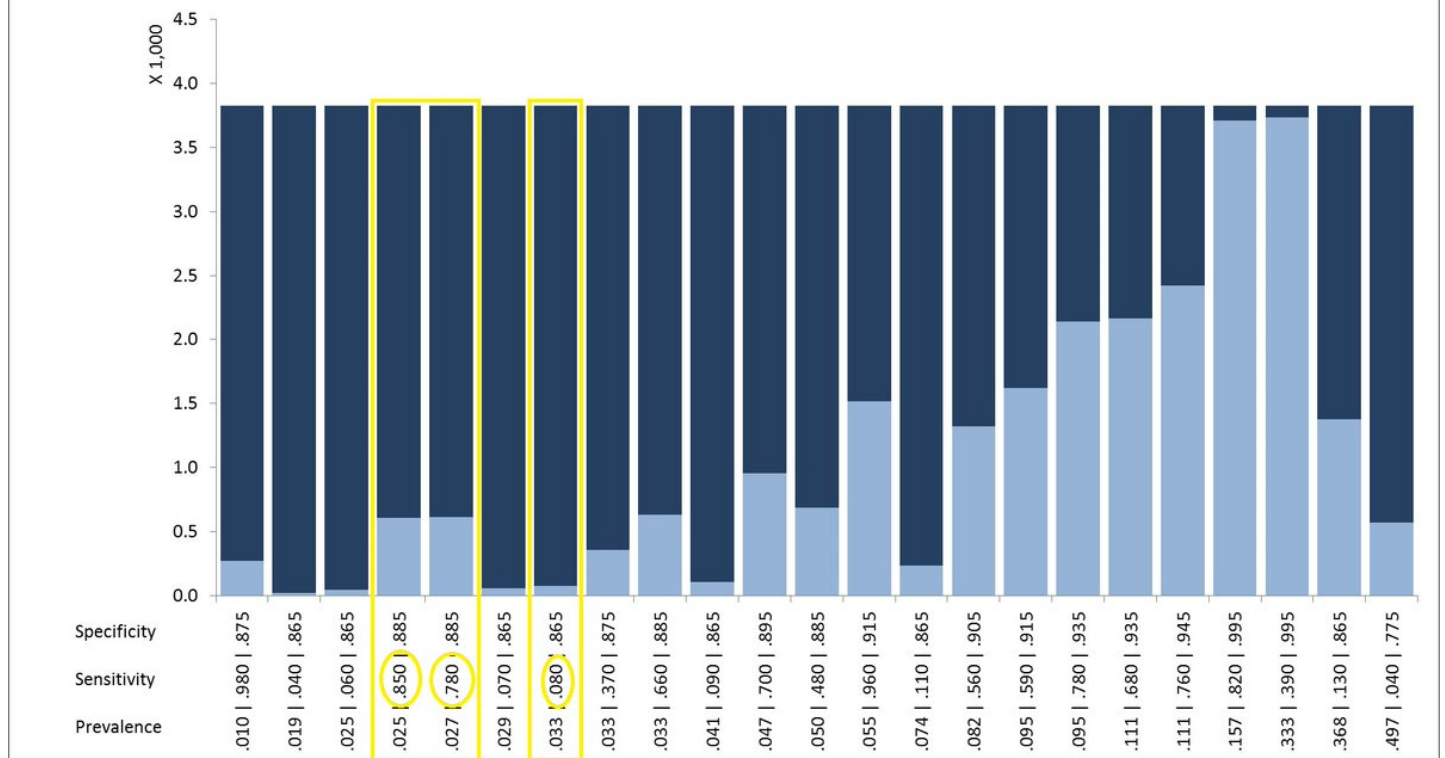
True Positives False Positives



15/ AFAIK, the #Dutch government did not make a recent comment about prevalence, but we can assume a similar one as in the UK. Also, the sensitivity should be in the range of 75-85%, leaving us with the following possible scenarios. Remark: note the low #specificities < 90%.

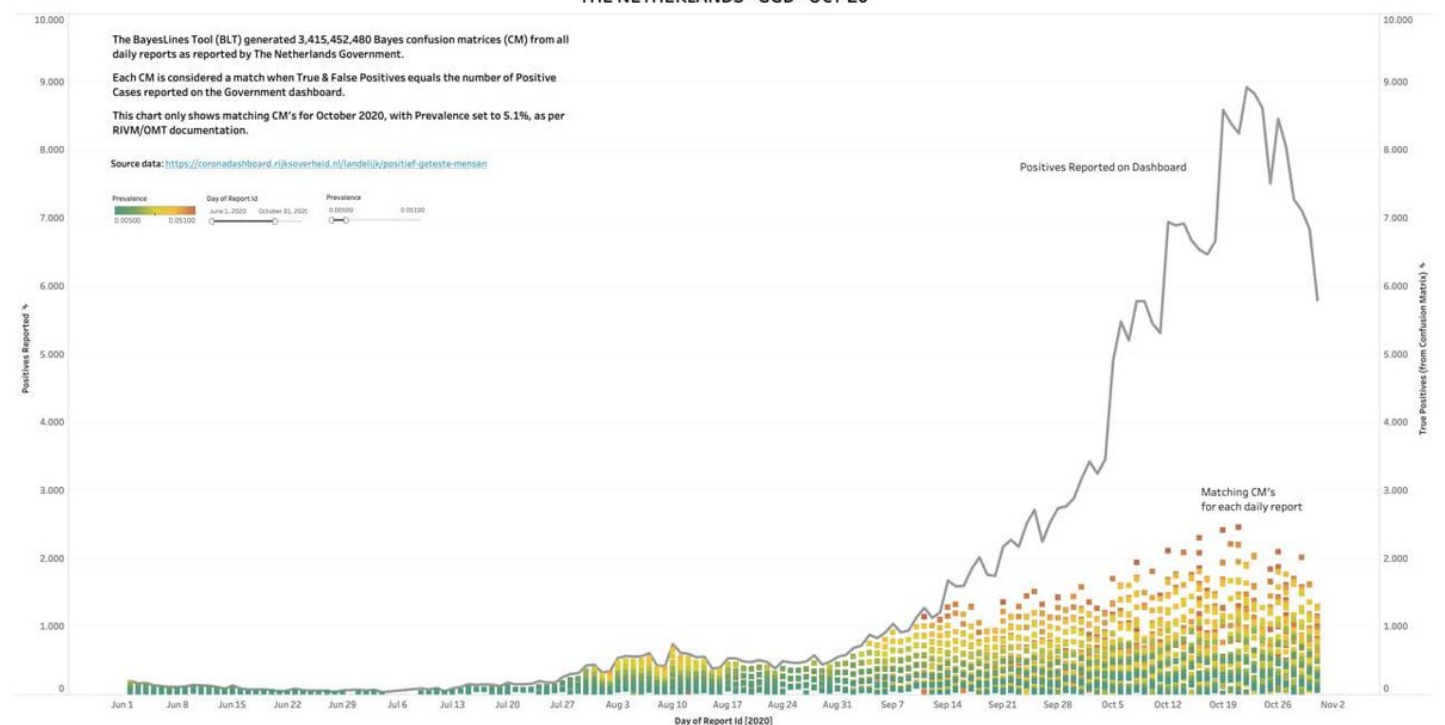
Netherlands - GGD 10-Jan-21

True Positives False Positives



16/ The model's outcomes are extremely valuable in that they can provide a decision-making tool for people in charge (i.e. #politicians, #physicians, #policymakers etc.) and support them in evaluating their strategy for fighting the disease. #COVID

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17/ This time-series can be further back-solved by solving single events following the #exclusionprinciple and consequently receiving insights with respect to the tests' specificity/sensitivity or the prevalence within the population.

18/ This method provides the light (i.e. better insights) for individuals, authorities and governmental agencies that are currently in the dark with measuring problems and often using imprecise prediction models.

19/ Furthermore, the outcomes can provide a better insight into the expectable operational effectiveness of the tests (specificity/sensitivity) compared to the theoretical commercial claims of the manufacturers (equipment, primers, probes, supplies etc.).