Norwegian Institute of Public Health

REPORT

2021

Optimizing configurations for Smittestopp version 3.0

Optimizing configurations for Smittestopp version 3.0

Camilla Mauroy, Elisabeth H Madslien, Hinta Meijerink, Christine S Lunde (NHN), Mia K Johansen,

Norwegian Institute of Public Health

Published by Norwegian Institute of Public Health
Division of Infection Control and Environmental Health
Department of infectious diseases and prevention
November 2021

Title: Optimizing configurations for Smittestopp version 3.0

Author(s):
Camilla Mauroy
Elisabeth H Madslien
Hinta Meijerink
Christine S Lunde (NHN)
Mia K Johansen

Project number: 10036

The report can be downloaded as pdf
at www.fhi.no/en/publ/

Graphic design template:
Per Kristian Svendsen

Graphic design cover
Fete Typer

ISBN digital: 978-82-8406-249-5

Citation: Mauroy C, Madslien EH, Meijerink H, Lunde CS, Johansen M. "[Optimizing configurations for Smittestopp 3.0]". [Optimalisering av konfigurasjonene for Smittestopp versjon 3.0] Report 2021. Oslo: Norwegian Institute of Public Health, 2021.

Table of Contents

Table of Contents 3

Executive summary 4

Introduction 4

Methods 4

Results 4

Conclusion 4

Preface 5

1 Introduction 6

2 Method 8

2.1 Devices used for testing 8

2.2 Set-up for scenario – queue 8

2.3 Data Analysis 9

3 Results 9

4 Discussion 12

5 Conclusion 14

References 15

Appendix 16

Overview of phones used in scenario testing of Smittestopp version 3.0 16

Results 18

Executive summary

Introduction

The Norwegian Bluetooth-based contact tracing app "Smittestopp" was launched in December 2020 as a supplement to manual contact tracing. The purpose was to rapidly notify people about possible exposure to SARS-CoV-2 in situations where manual contact tracing can be challenging. As the majority of the population is being vaccinated, social restrictions are gradually being lifted. However, the epidemic situation is still fragile with the emergence of new variants of SARS-CoV-2. Thus, until society is fully reopened, the Smittestopp app can be a useful tool to encourage targeted testing. If new variants spread more rapidly across larger distances, this raises the question of whether or not the criteria exposure notification should change. The Smittestopp app version 3.0 has a feature that makes the App more adjustable to criteria set by the health authorities. Running a test with the new version was essential for collecting a robust data set on which configuration setting is the best for different epidemic situations.

Methods

To test the new version of the Smittestopp app (v3.0), we simulated a real-life scenario, standing in a queue, with 5 people, and repeated this 6 times. The participants were standing in a queue, with a 1-meter distance between them, and had 5 phones each. To simulate different duration and distances of contact, the app was switched off at different times (4-20 min) for each of the phones. We registered one phone as infected and all other phones were contacts. By using a developer version of the app, data regarding exposure could be collected from each phone and analyzed. We analyzed the data using different settings within the app, including several attenuation thresholds (55-80dB), different time cut-offs, and weights for each attenuation threshold. Based on these settings we calculated the proportion of close contacts and others who would receive a notification. We identified the settings that yielded the most optimized notification rates among contacts while minimizing the rate of false exposure notifications.

Results

Data was received from 144 exposed phones during three days of testing. 4 phones were excluded due to errors. Of the 140 exposed phones 36 phones were contacts (< 2 meters, > 15 min) and 104 were non-contacts (> 2 meters, or < 15 min). Exposure notification rates from 72 different settings showed that performance could be considerably improved by adjusting configurations, weights, and time thresholds. The highest notification rate among contacts was 91.7% which was achieved with attenuation thresholds of 55, 70 and 80 dB with weights of 2.0, 1.5, and 0.5 and a time threshold of 13 minutes. This also notifies 32.7 % of the non-contacts, resulting in a precision of 46.0 %, recall of 91.7 % and accuracy of 73.6 %.

Conclusion

By adjusting the attenuation thresholds, time thresholds and weights, we were able to improve the notification of contacts without increasing the notification of non-contacts. The ability to adjust these settings is important, especially when the local situation changes.

Preface

Oslo, November 2021

1 Introduction

The Smittestopp app version 2.0 in Norway has been proven successful in identifying 80% of contacts in "real life" scenarios. That was the results from the project the National Institute of public health (NIPH) conducted prior to the launch of the app (Smittestopp version 2.0) in December 2020 (1).

Since then, the epidemic situation has changed in Norway. New variants of SARS-CoV-2 have emerged, which are possibly more contagious across longer distances, raising the need for flexibility in the definition of contacts that might be of risk of exposure (2). In Norway, people have been considered to be a "close contact" and quarantined if they have been less than two meters away from a person who is confirmed to have COVID-19" for 15 minutes or longer (3). Also, the proportion of fully vaccinated Norwegian citizens is increasing rapidly, and by October 3rd, 2021, 85 % of those 18 years or older had received 2 vaccine doses (4). Vaccination may replace other measures preventing the spread of the virus, and society will reopen. More people will meet in places where manual contact tracing will be difficult, and the Smittestopp app will be an aid in notifying those who have been in contact with an infected and that should get tested.

In June 2021 Netcompany launched an updated version of the app; Smittestopp 3.0. This version has added one more attenuation threshold value, yielding a total of four thresholds, instead of the three existing in the previous version. The Google/Apple exposure notification system (GA-ENS) used by the app will report four attenuation duration values (minutes)based on four attenuation thresholds: 1) time registered below threshold 1; 2) time registered between threshold 1 and 2; 3) time registered between threshold 2 and 3; 4) time registered above threshold 3. By adding different weights to each threshold and a time threshold value the app will calculate an exposure risk score and decide if this value is high enough to yield a notification. An extra threshold ensures the increasing sensitivity of the app, by allowing health authorities to adjust the configurable components even more, to ensure that the right type of exposure leads to a notification.

Over 30 countries have now implemented GAEN based contact tracing apps, including Germany, Ireland, Denmark, Switzerland, Netherlands, the United Kingdom, USA, Canada and Japan (5). It is essential to determine the optimal configuration of the app to identify relevant contacts as time registered and Bluetooth can be affected by many factors. Several of the countries with GAEN based app has simulated real-life scenarios, collected data, and reported their optimal configurations settings. Switzerland reported that at low attenuation (e.g. <50dB), two devices were within few meters, while higher attenuation values (50-70 dB) could result from devices 15 meters away, offering less certainty (6). A symposium set up in November 2020 (the Risk Score Symposium Invitational) considered data from real-life scenario testing performed in Switzerland, the United Kingdom and Germany. They agreed on two consensus configuration options; the narrow net ((<55 dB, <63 dB and < 70 dB) with weights 1,50; 1,00 and 0,40, and the wider net (<55 dB, <70 dB and < 80 dB) with weights 2,00; 1,00 and 0,25 (7).

In Norway, NIPH carried out a new real-life scenario test with the new version of Smittetopp (app version 3.0) to agree on optimal configuration settings. Our goal was to collect a robust set of data including phones exposed at different meters (1-4) for different minutes (4, 8, 12, 16 and 20 minutes). We wanted to test out a set of different configurations and compare the result with other similar tests. This would aid us in quickly determining if the configurations should be adjusted if manual contact tracing or epidemic situation changes. Optimizing the configurations is essential to identify relevant contacts that may have been exposed to the virus. By identifying these contacts quickly, they can be tested, quarantined, or isolated, thus breaking the chain of infection early. We aimed at achieving a better notification rate than the previous version; > 80 % for close contacts.

2 Method

2.1 Devices used for testing

For the app testing, we used a set of 50 phones consisting of a mix of iOS and android operating systems, as well as a mix of brands and models (iPhone, Samsung, Huawei, Oneplus; see supplementary material). These phones represent most phones used on the Norwegian market (8). During testing, a development version of the app was used for data collection from the phones, as well as allowing the use of fake identifications to notify infection.

2.2 Set-up for scenario – queue

In this test of the Smittestopp app, a queue scenario was simulated (Figure 1). The scenario was performed 6 times (rounds), and in each round there were five participants and 25 phones. The five participants were situated on chairs in a queue formation with 1 meter's distance between them.

The total duration for this scenario was 20 minutes. Each participant stayed in the same chair throughout the scenario with 5 phones each placed on trays on their laps. Every 4 minutes the participants would deactivate the Smittestopp on one phone. Participant 0 had the infected phone and a backup phone that they kept on throughout the whole scenario, and 3 other phones they switched off at 8, 12 and 16 minutes.

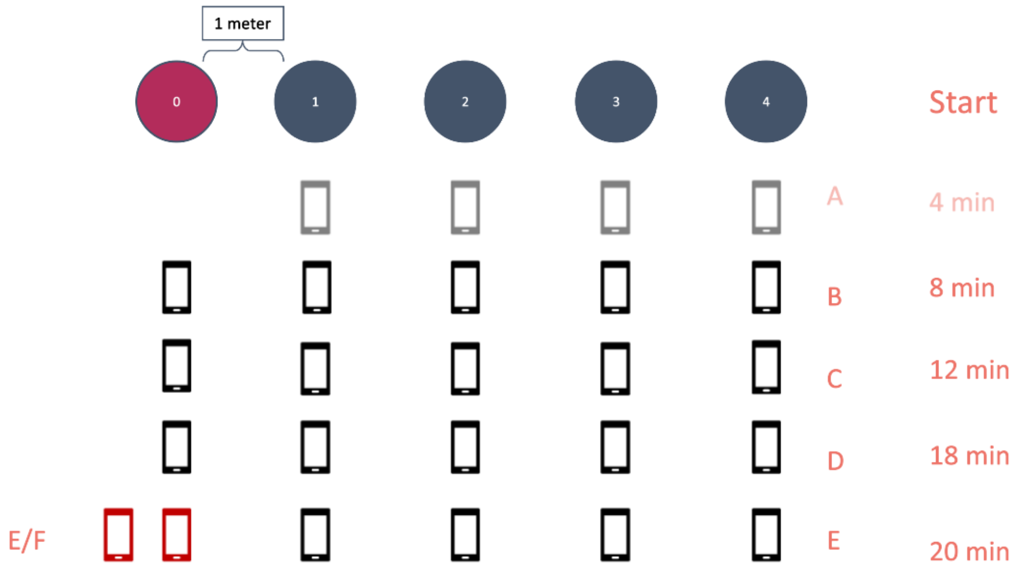

Figure 1. A representation of the scenario. Circles represent the testers (red; infected, orange; contacts, green; non-contacts). They have 5 phones each, all with the Smittestopp app activated at start. The minutes indicate after what time during the scenario the apps are deactivated. Red phones: the phone that will be infected + backup.

2.3 Data Analysis

After the scenario was finished, registration of infection was done on the “infected phone”. There were no issues with reporting infection, so the backup phones acted as “exposed phones”. The keys of the “infected” phone were used to check the data collected from the “exposed” phones. After data entry, the phones were cleaned, and the app was reinstalled for the next test run. Data was pulled for each of the exposed phones (24 per run) and collected.

The processing of collected data was performed in STATA (SE 16.0). From the data; “typical attenuation” and “since last scan” were used to assign duration in the four different buckets. We calculated the notification rates for all the exposed phones in the experiment using different attenuation thresholds, weights for each bucket and time thresholds to optimize the notification rates among “contacts” and minimize the risk of incorrect notification for “non-contacts”. We used a weight range between 0 and 2.5 and a time threshold between 10 and 15 minutes. Attenuation thresholds ranged from 55dB to 80dB. Contacts were defined based on those who were at 2 meters or less distance from the “infected” for 15 minutes or longer. The non-contacts were further split into those within 2 meters for a shorter period (less than 15 minutes) and those further away (over 2 meters). Precision, recall, and accuracy were calculated for the chosen setting and compared with the previous settings in the app.

3 Results

We collected data from a total of 144 exposed phones from the 6 rounds during the three days of testing. In the data analysis, 4 phones were excluded due to errors. In 11 phones no connection with the infected phone was detected, but they had received the correct infection key and were therefore included in the analysis.

Of the 140 exposed phones, 36 phones were of contacts (26 %) and 104 were non-contacts (74 %). The rate of notification rate was calculated for 72 different settings (see Appendix). For 17 of the 72 settings, the highest exposure notification rate was achieved (91.7 %), meaning that of all the contacts who should, in theory, receive a notification, 91.7 % did. Of these 17 settings, the proportion of non-contacts who received a notification varied between 32.7 and 64.4 %. The setting with the lowest percentage of non-contacts receiving a notification rate (14.4 %), resulted in 83.3 % of contacts receiving a notification.

The configuration with attenuation thresholds 55, 70 and 80dB, weights 2,00, 1,50 and 0,50 and a time threshold of 13 minutes results in the best notification rate among contacts (91.7 %) and a low notification rate among non-contacts (32.7 %). For this setting, of the non-contacts, 24.5 % of the uses were over 2 meters apart from the infected, while 42.2 % of the users were below or equal to 2 meters for less than 15 minutes.

The 72 different settings we tested included the configurations used in the previous version of Smittestopp (Smittestopp version 2.0), the configurations used in Denmark’s Smittestop app, and the narrow and wider net suggested by the Risk Score Symposium Invitational. These four settings, along with the setting decided for further use in version 3 is listed in Table 1.

Table 1. A selection of the settings tested with their corresponding attenuation thresholds, weights, and time threshold, as well as the percentage of contacts and other contacts that received exposure notifications.

Setting	Attenuation thresholds	Weights	Time threshold (min)	Contacts	Other contacts
Previous Norwegian Smittestopp	57;68;73	2.00; 1.50; 0.00	13	83.3 %	29.8 %
Danish Smittestop	63;68	2.5; 0.5; 0.00	10	75.0 %	39.4 %
Narrow net	55;65;70	1.50; 1.00; 0.50	15	50.0 %	6.7 %
Wider net	55:70;80	2.00; 1.00; 0.25	15	77.8 %	10.6 %
Optimal configuration	55;70;80	2.00; 1.50; 0.50	13	91.7 %	32.7 %

Table 2 shows the optimal attenuation thresholds and weights with different time thresholds. The configuration with a time threshold of 13 minutes has the highest notification rate among contacts (91.7 %), while the configuration with a time threshold of 15 minutes has the lowest notification rate among other contacts (22.1 %).

Table 2. The settings with the preferred configurations and weights, with three different time thresholds, and the resulting exposure notification rates.

Attenuation thresholds	Weights	Time threshold (min)	Contacts	Other Contacts
55;70;80	2.00; 1.50; 0.50	13	91.7 %	32.7 %
55;70;80	2.00; 1.50; 0.50	15	86.1 %	22.1 %
55;70;80	2.00; 1.50; 0.50	10	86.1 %	26.9 %

Figure 2 compares the previous settings with the optimal configuration setting. For the settings used in version 2, there were 30 true positives (83%) 73 true negatives (71 %), 6 false negatives (17 %) and 31 false positives (31 %). For the settings used in version 3, 33 were true positives (92%), 70 true negatives (74%), 3 false negatives (8 %) and 34 false positives (33 %).

The settings used in the previous version gave a precision equal to 49 %, a recall of 83 % and an accuracy of 74 %. For the new settings precision was calculated to be 49 %, recall being 92 % and accuracy to be 74 %.

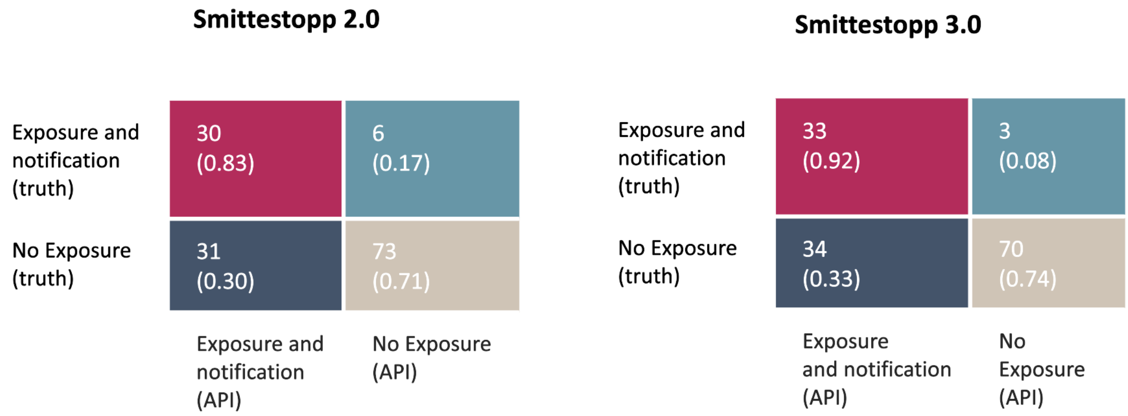

Figure 2. Overview of the contacts (exposure) and non-contacts (no exposure) who did (API) and did not (no API) receive notifications gives as number (percentage) using 57,68,73 settings for Smittestopp version 2 (A) and 55,70,80 settings for Smittestopp version 3 (B).

4 Discussion

In this study, we tested out the third version of the Norwegian Smittestopp app under a "real-life" scenario, a queue. The Smittestopp app version 3.0 has been developed to make the app more adjustable to criteria set by the health authorities. We aimed to collect experimental data from the new app version that could be used to determine settings that would result in the best balance between notifying high-risk close contacts and avoiding notifying low-risk sporadic contacts, a relevant "every-day-life" social situation. Our results show that performance could be improved by adjusting the configurations of the threshold values (Bluetooth attenuation levels, weights, and time thresholds), similarly to our previous testing of Smittestopp 2.0 (1). As expected, the additional attenuation threshold value that is featured in Smittestopp 3.0 allowed for more fine-tuning and improvement of the configurations to adjust to the current epidemic situation in Norway.

Our results show that we could either aim for a wider or more narrow approach for identifying contacts compared to our previous settings. With Smittestopp app version 2.0 we identified 80 % of close contacts (< 2 meters, >15 min) and 34 % of sporadic contacts (>2 meters or <15 min). For a narrow approach, we could decrease the notification rate among sporadic contacts to below 20 %. However, this would result in a lower notification rate among close contacts than previously. Another option would be the wider approach where we could increase the notification rate among close contacts up to 92 %, but then also increasing the notification rate of more sporadic contacts (2-4 m;< 20 min). We decided on notifying as many close contacts as possible and at the same time accepting a low (33 %) notification rate of sporadic contacts. This setting was chosen as people notified by the app are encouraged to get tested, not quarantined, and as Norway has a high testing capacity test results are available within 48 hours. We, therefore, considered the individual burden of notifying low-risk sporadic contacts to be low.

The suggested settings; narrow net (attenuation threshold 55, 60 and 70, weights 1.50, 1.00 and 0.5, time threshold 15) and narrow net (attenuation threshold 55, 70 and 80, weights 2.00, 1.00 and 0.25, time threshold 15) yielded a notification rate of 50.5 % and 77.8 % among contacts. They were not the most ideal configurations for our app, and the reason might be that the app also has the option to take into account symptom onset, meaning that their weights would differ based on the time between symptom onset and exposure (6). Thus, the closer exposure was to symptom onset, the higher the weights would be, increasing the risk score. Including the infectiousness of the infected at the time of contact has also been suggested as an important factor by other studies, along with proximity and duration of contact (9). While this was included in the narrow and wider net, we decided not to include this in our app. The reason for this being that there is so much uncertainty regarding how infectious a person is depending on where in the course of infection they are. We included the whole period, notifying those exposed 2 days prior until 8 days after symptom onset, with the same weights for the whole period.

Many countries have implemented Bluetooth or GAEN based contact tracing apps, including UK, Germany, Denmark, Italy Netherlands, Switzerland, and Japan, often in collaboration with public health institutes (10). Few have reported on testing configuration settings or the impact of the app on reducing the spread of COVID-19. In addition, the uptake of the app affects the impact. Only 0.6% of cases in Switzerland, reported receiving a notification in the app as the reason for the testing (11). Studies from the UK provide evidence for the benefits of digital tracing apps in terms of reducing the spread of COVID-19; they estimated the number of cases averted by the app was 284,000, and 594,000 using two different methods. Using the two different methods, they also estimated that for every percentage point increase in app uptake, the number of cases could be reduced by 0.8% or 2.3% (12). However, it's difficult to compare test results across countries as studies and terminology are not aligned.

Possible effects of the test environment itself were not considered in this experiment, i.e. wall, floors, ceiling, and furniture's ability to change the received signal strength. Studies describing experiments performed in bus and tram conclude that there is little correlation between received signal strength and distance between phones, likely due to reflections from the metal walls, floor, and ceiling (13;14).

This project adds to the current knowledge regarding GAEN based tools by showing the effect of configuration settings. In addition, the generated dataset will allow re-evaluation of the settings without the need of redoing the experiment. However, more work needs to be done to define configuration standards and harmonize testing and evaluation protocols across countries.

5 Conclusion

Results from this experiment showed that we were able to improve the notification rate of close contacts without increasing the notification of sporadic contacts by adjusting the attenuation thresholds, time threshold and weights. We found the most optimal settings to have configurations 55, 70 and 80 with the weights 2,00, 150 and 0,50, and a time threshold of 13 minutes. We identified 91,7 % of the contacts, and 32,7 % of the non-contacts received a notification. The setting had a precision of 46,0 %, recall of 91,7 % and accuracy of 73,6 %. Smittestopp 3.0 with the added threshold value and new configurations a had higher notification rate among contacts and a lower rate among non-contacts than Smittestopp 2.0.

References

1. Meijerink H, Madslien EH, Mauroy C, Johansen MK, Møgster Braaten S, Steen Lunde CU, et al. The first GAEN-based COVID-19 contact tracing app in Norway identifies 80% of close contacts in “real life” scenarios. medRxiv 2021:2021.05.06.21253948.
2. Risiko ved covid-19-epidemien i Norge i lys av framveksten av Delta-varianten av SARS-CoV-2. Oslo: Folkehelseinstituttet; 2021. Available from: https://www.fhi.no/contentassets/c9e459cd7cc24991810a0d28d7803bd0/vedlegg/2021-07-26-risiko-ved-covid-19-epidemien-i-norge-i-lys-av-framveksten-av-delta-varianten-av-sars-cov-2-.pdf
3. Coronavirus – facts, advice and measures: definitions [web document]. Oslo: Norwegian Institute of Public Health [updated 21.07.2021; cited 03.08.2021]. Available from: https://www.fhi.no/en/op/novel-coronavirus-facts-advice/testing-and-follow-up/definitions-of-probable-and-confirmed-cases-of-coronavirus-covid-19-and-con/?term=&h=1
4. COVID-19: ukerapport – uke 39. Oslo: Folkehelseinstiuttet; 2021. Available from: https://www.fhi.no/contentassets/8a971e7b0a3c4a06bdbf381ab52e6157/vedlegg/2021/ukerapport-uke-39-27.09---03.10.21.pdf
5. Rahman M. Here are the countries using Google and Apple’s COVID-19 Contact Tracing API [web document]. Havertown, PA: XDA Developers [updated 25.02.2021; cited 09.09.2021]. Available from: https://www.xda-developers.com/google-apple-covid-19-contact-tracing-exposure-notifications-api-app-list-countries/
6. Leith DJ, Farrell S. Coronavirus Contact Tracing: Evaluating The Potential Of Using Bluetooth Received Signal Strength For Proximity Detection. Acm Sigcomm Comp Com 2020;50(4):66-74.
7. Benzler J, Briers M, Flowers M, Halai S, Harris B, Judd M, et al. Configuring Exposure Notification Risk Scores for COVID-19: Guidance from the Risk Score Symposium Invitational [web document]. [s.l.]: GitHub [updated 12.03.2021; cited 04.11.2021]. Available from: https://github.com/lfph/gaen-risk-scoring/blob/main/risk-scoring.md
8. Statcounter Global Stats. Mobile Vendor Market Share Norway - October 2021 [web document]. [s.l.]: Statcounter [updated 01.11.2021; cited 04.11.2021]. Available from: https://gs.statcounter.com/vendor-market-share/mobile/norway
9. O'Connell J, Abbas M, Beecham S, Buckley J, Chochlov M, Fitzgerald B, et al. Best Practice Guidance for Digital Contact Tracing Apps: A Cross-disciplinary Review of the Literature. JMIR Mhealth Uhealth 2021;9(6):e27753.
10. Almalki M, Giannicchi A. Health Apps for Combating COVID-19: Descriptive Review and Taxonomy. JMIR Mhealth Uhealth 2021;9(3):e24322.
11. Salathe M, Althaus C, Anderegg N, Antonioli D, Ballouz T, Bugnon E, et al. Early evidence of effectiveness of digital contact tracing for SARS-CoV-2 in Switzerland. Swiss Med Wkly 2020;150:w20457.

12. Wymant C, Ferretti L, Tsallis D, Charalambides M, Abeler-Dorner L, Bonsall D, et al. The epidemiological impact of the NHS COVID-19 app. Nature 2021;594(7863):408-12.
13. Leith DJ, Farrell S. Measurement-based evaluation of Google/Apple Exposure Notification API for proximity detection in a light-rail tram. PLoS One 2020;15(9):e0239943.
14. Leith DJ, Farrell S. Measurement-based evaluation of Google/Apple Exposure Notification API for proximity detection in a commuter bus. PLoS One 2021;16(4):e0250826.

Appendix

Overview of phones used in scenario testing of Smittestopp version 3.0

Table 3. Overview of phone type with respective operation system and version, used in the scenario testing for Smittestopp version 3.0.

phone	operation	Version	phone	operation	Version
iPhone 6S +	iOS	14.4	iPhone 7	iOS	14.5
Samsung G A8	Android	9	Nokia 5.3	Android	10
Samsung s7	Android	8	iPhone 7 +	iOS	14.2
iPhone SE	iOS	14.2	iPhone 11Pro Max	iOS	14.4.1
iPhone XS	iOS	14.2	Samsung s10	Android	10
Samsung S8	Android	9	Samsung s20	Android	10
iPhone 7+	iOS	14.5	iPhone 7	iOS	14.5
Sony Xperia 1	Android	10	Samsung S9+	Android	10
iPhone 8	iOS	14.2	iPhone 6S +	iOS	14.5
Sony Xperia 1	Android	10	Samsung S10	Android	10
Samsung S9	Android	10	iPhone 7	iOS	14.2
iPhone 6s	iOS	14.5	iPhone 7	iOS	14.2
Samsung S21	Android	10	Samsung S9+	Android	10
iPhone XS	iOS	14.2	iPhone 7 +	iOS	14.5
Samsung S20 Ultra	Android	10	Samsung A 50	Android	10
iPhone 7	iOS	14.5	iPhone SE	iOS	14.2
Samsung A71	Android	10	Huawei P30Pro	Android	10
iPhone 8	iOS	14.2	Sony Xperia 1	Android	14.5
Samsung S9	Android	10	Samsung A 71	Android	10
iPhone 6S	iOS	14.5	iPhone 6	iOS	12.5.1

iPhone 11 Pro	iOS	14.2	Samsung S10	Android	10
One Plus 8	Android	10	Samsung S Note 10	Android	10
iPhone 12	iOS	14.3	iPhone XR	iOS	14.2
Samsung S10	Android	10	Samsung S20	Android	10

Results

Table 4. A table representing the settings tested and the corresponding results; number and percentage of users receiving and not receiver exposure notification. w_score: weighted score, attenuation thresholds (att_1/2/3), weights (w_1/2/2), time threshold (t_time), number of users and the percentage of received exposure notification (n_contacts and n_contacts_p) and the corresponding for users not receiving notification (n_noncon and n_noncon_p).

Setting	w_score	att_1	att_2	att_3	w_1	w_2	w_3	t_time	n_contacts	n_contacts_p	n_noncon	n_noncon_p
1	1	57	68	73	2,50	2,00	1,00	10	33	91,7	57	54,8
2	1	57	68	73	2,50	2,00	1,00	13	31	86,1	41	39,4
3	1	57	68	73	2,50	2,00	1,00	15	31	86,1	36	34,6
4	2	57	68	73	2,50	2,00	0,50	10	31	86,1	49	47,1
5	2	57	68	73	2,50	2,00	0,50	13	31	86,1	39	37,5
6	2	57	68	73	2,50	2,00	0,50	15	31	86,1	35	33,7
7	3	57	68	73	2,00	1,50	1,00	10	33	91,7	47	45,2
8	3	57	68	73	2,00	1,50	1,00	13	31	86,1	33	31,4
9	3	57	68	73	2,00	1,50	1,00	15	31	86,1	25	24,0
10	4	57	68	73	2,00	1,50	0,50	10	31	86,1	40	38,5
11	4	57	68	73	2,00	1,50	0,50	13	31	86,1	32	30,8
12	4	57	68	73	2,00	1,50	0,50	15	30	83,3	24	23,1
13	15	57	68	73	2,00	1,50	0,00	10	30	83,3	39	37,5
14	15	57	68	73	2,00	1,50	0,00	13	30	83,3	31	29,8
15	15	57	68	73	2,00	1,50	0,00	15	29	80,6	23	22,1
16	5	55	63	70	2,50	2,00	1,00	10	30	83,3	45	43,3
17	5	55	63	70	2,50	2,00	1,00	13	30	83,3	33	31,7
18	5	55	63	70	2,50	2,00	1,00	15	30	83,3	25	24,0
19	6	55	63	70	2,50	2,00	0,50	10	27	75,0	35	33,7
20	6	55	63	70	2,50	2,00	0,50	13	26	72,2	27	26,0
21	6	55	63	70	2,50	2,00	0,50	15	24	66,7	22	21,2
22	7	55	63	70	2,00	1,50	1,00	10	30	83,3	36	34,6
23	7	55	63	70	2,00	1,50	1,00	13	30	83,3	24	23,1
24	7	55	63	70	2,00	1,50	1,00	15	30	83,3	15	14,4
25	8	55	63	70	2,00	1,50	0,50	10	27	75,0	27	26,0
26	8	55	63	70	2,00	1,50	0,50	13	24	66,7	20	19,2
27	8	55	63	70	2,00	1,50	0,50	15	23	63,9	14	13,5

28	9	55	63	70	1,50	1,00	0,50	10	25	69,4	18	17,3
29	9	55	63	70	1,50	1,00	0,50	13	23	63,9	10	6,6
30	9	55	63	70	1,50	1,00	0,50	15	18	50,0	7	6,7
31	10	55	70	80	2,50	2,00	1,00	10	33	91,7	67	64,4
32	10	55	70	80	2,50	2,00	1,00	13	33	91,7	54	51,9
33	10	55	70	80	2,50	2,00	1,00	15	33	91,7	47	45,2
34	11	55	70	80	2,50	2,00	0,50	10	33	91,7	58	55,8
35	11	55	70	80	2,50	2,00	0,50	13	33	91,7	48	46,2
36	11	55	70	80	2,50	2,00	0,50	15	33	91,7	40	38,5
37	12	55	70	80	2,00	1,50	1,00	10	33	91,7	58	55,8
38	12	55	70	80	2,00	1,50	1,00	13	33	91,7	44	42,3
39	12	55	70	80	2,00	1,50	1,00	15	33	91,7	38	36,5
40	13	55	70	80	2,00	1,50	0,50	10	33	91,7	49	47,1
41	13	55	70	80	2,00	1,50	0,50	13	33	91,7	34	32,7
42	13	55	70	80	2,00	1,50	0,50	15	31	86,1	23	22,1
43	14	55	70	80	2,00	1,00	0,25	10	31	86,1	28	26,9
44	14	55	70	80	2,00	1,00	0,25	13	30	83,3	21	20,2
45	14	55	70	80	2,00	1,00	0,25	15	28	77,8	11	10,6
46	16	60	65	75	2,5	2	1		32	88,9	59	56,7
47	16	60	65	75	2,5	2	1		32	88,9	44	42,3
48	16	60	65	75	2,5	2	1		31	86,1	41	39,4
49	17	60	65	75	2	1,5	1		32	88,9	51	49,0
50	17	60	65	75	2	1,5	1		32	88,9	39	37,5
51	17	60	65	75	2	1,5	1		31	86,1	27	26,0
52	18	60	65	75	2	1,5	0,5	10	30	83,3	40	38,5
53	18	60	65	75	2	1,5	0,5	13	30	83,3	27	26,0
54	18	60	65	75	2	1,5	0,5	15	27	75,0	18	17,3
55	19	57	63	73	2	1,5	1	10	31	86,1	43	41,4
56	19	57	63	73	2	1,5	1	13	31	86,1	27	26,0
57	19	57	63	73	2	1,5	1	15	31	86,1	18	17,3
58	20	57	63	73	2,5	2	1	10	31	86,1	52	50,0

59	20	57	63	73	2,5	2	1	13	31	86,1	35	33,7
60	20	57	63	73	2,5	2	1	15	31	86,1	28	26,9
61	21	63	68		2,5	0,5	0	10	27	75,0	41	39,4
62	21	63	68		2,5	0,5	0	13	27	75,0	29	27,9
63	21	63	68		2,5	0,5	0	15	26	72,2	27	26,0
64	22	57	68	76	2	1,5	1	10	33	91,7	51	49,0
65	22	57	68	76	2	1,5	1	13	33	91,7	40	38,5
66	22	57	68	76	2	1,5	1	15	32	88,9	32	30,8
67	23	57	68	76	2	1,5	0,5	10	32	88,9	41	39,4
68	23	57	68	76	2	1,5	0,5	13	31	86,1	33	31,7
69	23	57	68	76	2	1,5	0,5	15	30	83,2	14	23,1
70	24	57	68	76	2,5	2	1	10	33	91,7	60	57,7
71	24	57	68	76	2,5	2	1	13	33	91,7	48	46,2
72	24	57	68	76	2,5	2	1	15	33	91,7	41	39,4

Published by the Norwegian Institute of Public Health
November 2021
P.O.B 4404 Nydalen
NO-0403 Oslo
Phone: + 47-21 07 70 00
The report can be downloaded as pdf
at www.fhi.no/en/publ/