# The Corona Warning App of the German Federal Government
## How perceived data protection issues hindered any effectiveness

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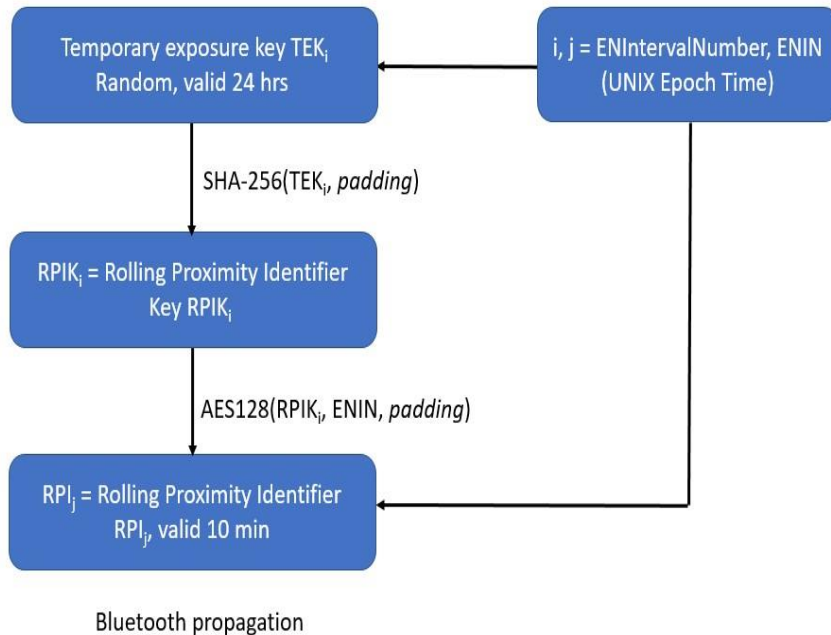
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# Germany 2020 – An App for Tracing and Warning



**The Robert Koch Institute (RKI) is the government's central institution in the field of biomedicine and leading the fight against COVID-19.**

# How it works in brief



Temporary exposure key TEK$_i$
Random, valid 24 hrs

i, j = ENIntervalNumber, ENIN
(UNIX Epoch Time)

SHA-256(TEK$_i$, *padding*)

RPIK$_i$ = Rolling Proximity Identifier
Key RPIK$_i$

AES128(RPIK$_i$, ENIN, *padding*)

RPI$_j$ = Rolling Proximity Identifier
RPI$_j$, valid 10 min

Bluetooth propagation

1. A TEK is created every day by each individual smartphone where the app is installed and running
2. A RPIK is created based on the TEK
3. Every ten minutes a new RPI is created by a function based on the RPIK and the ENIN
4. When two persons meet with the app up and running, they exchange their two RPIs which are stored in their smartphones only
5. When these two persons meet again ten minutes later, two totally different RPIs are exchanged.

## Technical requirements

The app was developed based on the Exposure Notification Framework developed by Google and Apple. Bluetooth must be activated, energy-saving mode deactivated … and it works only on

- iPhones using iOS 13.5 or higher, covering 81 percent of all iPhones (and subsequently not usable on 19 percent of all iPhones with lower versions of iOS)
- Android-based smartphones using Android 6 Marshmallow or higher, covering 92 percent of all Android-based smartphones in Germany
- Excluding popular smartphones like Huawei Mate 30, P40 Pro and Mate 40 Pro.

**Does this cover the whole population of Germany? And what about visitors, tourists, commuters, diplomats and other non-residents?**

# What is the actual usage of the app?

German population: 83.1 mio.

Downloads:
20.3 mio.

## The Federal Government unfortunately publishes the download figures only, no data on its actual usage.

All figures in this presentation as per the end of October 2020, the submission date of the full paper

# Two people meeting in Germany

**Given the 24.4 percent of the German population who downloaded the app …**

# Then the likelihood that *both* have the app …

1. is 24.4 squared or 5.9 percent.
2. one out of 16.8 meetings of two persons in Germany is covered by the app.

This comparatively small fraction is reduced further, if

- Others than residents of Germany downloaded the app, we (and the government) assume that all downloads are from residents only
- People de-installed the app
- Someone deactivated Bluetooth or is in energy-save mode
- Multiple downloads occurred, e.g. when someone bought a new smartphone in the last five months
- meetings with non-residents of Germany are considered.

## Are these assumptions realistic?

# A more realistic scenario

| Assumption | Alteration | Effect |
|---|---|---|
| Each of the 20.3 downloads was from an inhabitant of Germany | 5 % foreign downloads | minus 1m users |
| No multiple downloads occurred | 20 % multiple downloads | minus 4.1m users |
| No downloaded app deinstalled nor deactivated | 25 % stopped using the app | minus 5.1m users |
| Smartphones crashed, sold, or simply not used anymore | 5 % | minus 1m users |
| **Subtotal** | | **- 11.2m users** |

## So the coverage would be rather one out of 33 meetings than one out of 16.8 meetings!

# The Warning Function of the Corona-Warn-App



ANZAHL POTENZIELL TEILBARER POSITIVER TESTERGEBNISSE

56.681; 57%

100.312 potenziell teilbare Test-ergebnisse

43.631; 43%

■ Insgesamt geteilt   ■ Insgesamt nicht geteilt

**Erläuterung:** Im Zeitraum vom 1. September bis 11. November 2020 wurden insgesamt 100.312 positive Testergebnisse verifiziert - via QR-Code oder teleTAN - dies ist die Anzahl der potenziell teilbaren positiven Ergebnisse. Anschließend haben sich 56.681, d.h. 57 Prozent der Nutzerinnen und Nutzer dafür entschieden, ihr positives Testergebnis mit den anderen Nutzerinnen und Nutzern zu teilen. Nur so kann eine Risiko-Benachrichtigung der Nutzerinnen und Nutzer erfolgen, mit denen die Corona-positive Person epidemiologisch relevante Begegnungen hatte.
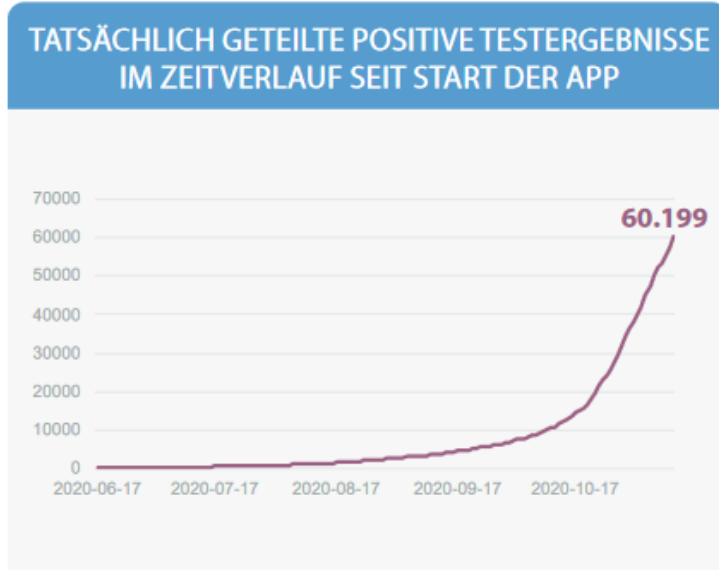
Source:
https://www.rki.de/DE/Content/InfAZ/N/Neuartiges_Coronavirus/WarnApp/Archiv_Kennzahlen/Kennzahlen_13112020.pdf?__blob=publicationFile

6. A person receives a positive COVID-19-test, hence is infected

7. **The decision to publish the infection is up to each individual user and not mandatory**

8. If the user shares, he or she publishes his or her TEKs of the 14 days considered

9. All millions of other users have to download these TEKs and calculate the respective RPIs and check with their locally stored own RPIs to find out whether they met the infected person

**According to the RKI only 57 % of the users shared a positive test between Sept 1 and Nov 11, 2020**

# What are the total figures?



TATSÄCHLICH GETEILTE POSITIVE TESTERGEBNISSE IM ZEITVERLAUF SEIT START DER APP

60.199

**Erläuterung:** Seit dem Start der Corona-Warn-App haben insgesamt 60.199 Nutzerinnen und Nutzer ihr positives Testergebnis geteilt - rund 79 Prozent von ihnen (oder 47.343 Nutzerinnen und Nutzer) allein in den vergangenen vier Wochen (14.10. bis 11.11.2020). Der 7 Tage-Mittelwert bezogen auf die Anzahl der Nutzerinnen und Nutzer, die täglich ihr positives Ergebnis teilen, liegt bei 2.205 Personen.
**Stand:** 12. November 2020

Source:
https://www.rki.de/DE/Content/InfAZ/N/Neuartiges_Coronavirus/WarnApp/Archiv_Kennzahlen/Kennzahlen_13112020.pdf?__blob=publicationFile



COVID-19-Fälle
1.006.394
aus total 1.006.394

Source:
https://experience.arcgis.com/experience/478220a4c454480e823b17327b2bf1d4

# Some 60,199 out of more than 1 million (6%) infected people of Germany shared their positive test result via the app

# Some more issues with the coverage

- 81.7 percent of the German population uses smartphones – 18.3 percent hence do not

- Those older than 70 years use smartphones with a 44 percent penetration/likelihood – and they are the most vulnerable residents of Germany with respect to the virus

- Commuters from abroad – 41,000 daily from France alone -, tourists, etc. are not covered, we consider it very unlikely that they use this app

# Requirements for a COVID-19 warning and tracing app

In order to provide real protection

- 100 percent of all meetings between two people on German soil must be covered

- Effectiveness is tied to quick information of all contacts, leaving the decision to the individual infected is a No-Go

- People entering and leaving must be covered by 100 percent

**COVID-19 is a serious pandemic – so these requirements must be fulfilled!**

# Vă mulțumim pentru atenție!
# Thank you for your attention!

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