

Documentation for COVID19 Employee Survey Systems

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This document described three possible practical implementation of a COVID19 exposure survey along the lines proposed by [Boudreau and Chassang \(2020\)](#). Both instructions, and implementation materials are provided under the [GNU Copy Left License v3](#).

The three survey solutions proposed are:

1. A **purely computer-based solution** that demands a basic understanding of spreadsheets and mailmerge, but is very scalable, and does not require compliance from employees to provide protection from stigma. This solution is best suited for organizations with IT support whose employees have reliable access to internet.
2. A **mixed computer-paper solution** that demands a basic understanding of only spreadsheets. It does not require compliance from employees to provide protection from stigma. This solution is best suited for organizations with some IT support, but whose employees need not have reliable access to internet.
3. A **purely paper-based solution** that requires no computers, is easy to implement, but requires some compliance from employees to provide protection from stigma. This solution is best adapted for organizations with limited IT support, whose employees need not have reliable access to internet.

1 Purely Computer-Based Solution

This implementation of random rotation uses the `response_encoding_and_decoding.xlsx` spreadsheet to generate and decode strongly anonymized answer codes that employees use to respond to yes/no questions about COVID19 exposure.

For each person taking the survey, the workbook generates one **YES** and one **NO** numeric code. **YES** codes are always decoded as yes, meaning that the respondent should be rotated out of the workplace the following week. **NO** codes are decoded as no, or yes depending on a “switch rate” set by the survey creator.

In a purely computer-based solution, answer codes are emailed to respondents using [mail merge](#), and responses are collected using a web-based survey system. Responses are decoded using the spreadsheet, producing an assignment of workers in and out of the workplace.

Overview of Encoder/Decoder Tool

The `response_encoding_and_decoding.xlsx` workbook contains three tabs:

1. **parameters:** The parameters tab is where the user sets the encryption key and the rotate-out rate. The encryption key can be any number between 111 and 999. The switch rate is the proportion of workers that will be randomly rotated-out of the workplace even if they report that they haven’t been exposed to COVID19. It can be any number between 0.01 (i.e. 1%) and 0.99 (i.e. 99%).

The survey creator **can** adjust parameter values.

2. **encoder:** This tab generates numeric codes corresponding to **YES** and **NO** answers. Employees use these codes when completing the survey. The spreadsheet uses the encryption key, the rotate-out rate, and a random number generator to produce the codes.

The user sets the encryption key and the rotate-out rate in the **parameters** tab. The user does **not** adjust the functions in the **YES/NO** columns. Doing so may cause errors in the coding/decoding process.

3. **decoder**: This tab decodes numeric answer codes submitted by employees to **TRUE** and **FALSE** values. If the decoded value is **TRUE**, then the employee is rotated out. If the decoded value is **FALSE**, then the employee is not rotated out. The user does **not** adjust the decoding function.

The **YES** encoding function generates answer codes that the decoder always evaluates as **TRUE**. The **NO** encoding function generates a proportion of answer codes that the decoder evaluates as **TRUE** equal to the switch rate. It generates a proportion of answer codes that the decoder evaluates as **FALSE** equal to $1 - \text{switch rate}$.

Note that we provide the encoder, decoder, and parameters tabs in the same spreadsheet for convenience alone. In practice, your organization may want to store, for example, the parameters and encoder tab separately from the decoder tab. In this case, the user will need to update the cell references in the decoder tab in order to reference the correct workbook.

Suggested Use

1. Set an encryption key and switch rate in the parameters tab. Generate one set of **YES/NO** answer codes per employee using the encoder tab.

We recommend against setting the switch rate too low (e.g., below 5%), especially when the number of employees who will complete the survey is small (e.g., below 25).

We suggest changing the encryption key each week, after survey results have been decoded.

2. Export answer codes to a spreadsheet with employees' information and email addresses (Figure 1).

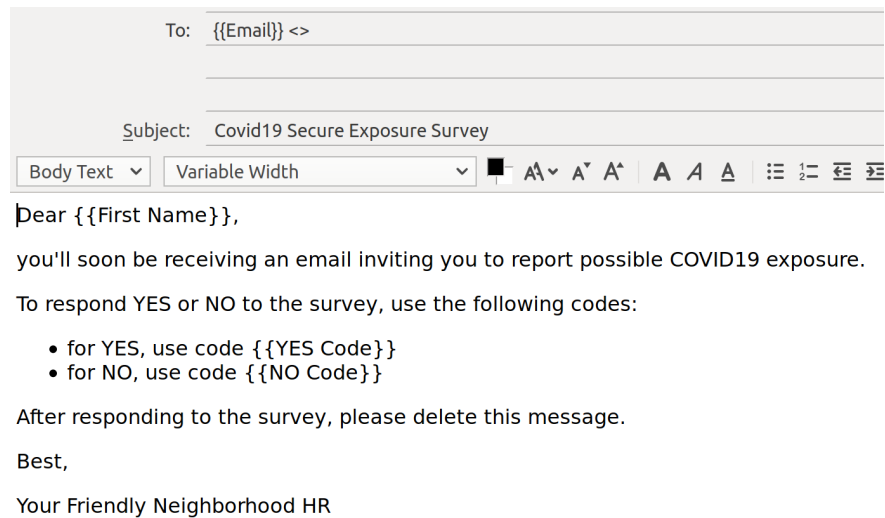
Figure 1: Example spreadsheet

	A	B	C	D	E
1	First Name	Last Name	Email	YES Code	NO Code
2	Joe	Smith	joe@smith.com	6546	7451
3	Jane	Lane	jane@lane.com	1473	5278

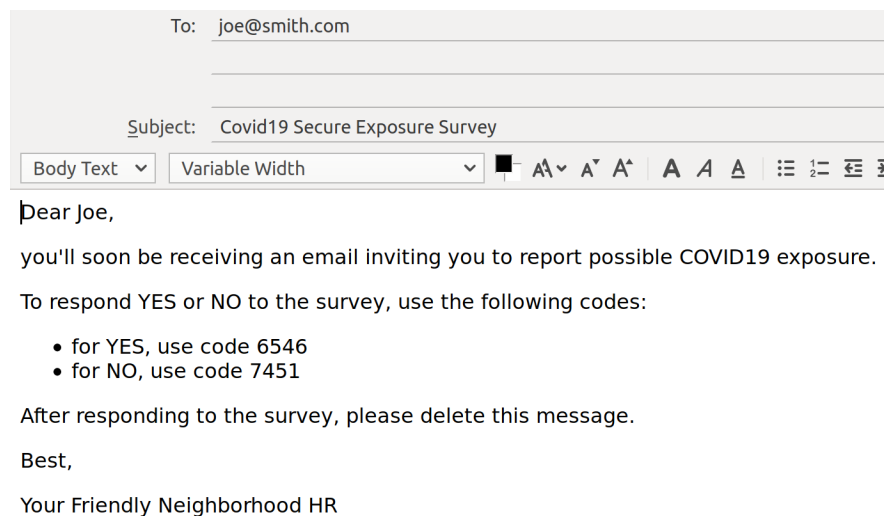
Use a mail merge to distribute codes to employees (Figures 2). We suggest sending codes from a dedicated specific address to minimize the risk of identifying information being leaked.

Figure 2: Template email, and received version after mail merge

(a) Template email



(b) Received email



Sent mail should automatically be purged. Once codes have been sent, the

original spreadsheet associating names and codes should be deleted.

3. Send a COVID19 exposure survey to employees.

Survey instructions should indicate that the employee use their numeric code to answer the survey questions. Employee should permanently delete the email informing them of their codes after submitting their survey responses.

Figure 3: Survey requiring encoded answer

COVID19 Survey

Do not respond to the question below directly by YES or NO, instead, use the secure response codes emailed to you as part of this survey.

*** Required**

Employee ID *

Your answer

In the last week, have you interacted with someone diagnosed with COVID19, or have you started experiencing any of the following symptoms? *

- Fever of 100 F (37.8 C) or above, or possible fever symptoms like alternating chills and sweating
- Cough
- Trouble breathing, shortness of breath, or severe wheezing
- Chills or repeated shaking with chills
- Muscle aches
- Sore throat
- Loss of smell or taste, or a change in taste
- Nausea, vomiting, or diarrhea
- Headache

Answer Code: 6465

! Please respond using one of the secure response codes emailed to you as part of this survey.

Submit

4. After employees complete the survey, use the decoder to evaluate which employees

should be rotated out. All employees with decoded values of **TRUE** are rotated out. Once all survey responses have been decoded, save the decoded values and destroy the numeric responses.

Figure 4: Decoded responses

	A	B	C
1	Code	Rotate Out	Employee ID
2	4564	0	1234
3	4444	0	2345
4	1121	0	3456
5	3247	0	4567
6	1111	0	5678
7	1471	0	6789
8	9875	0	7890
9	6471	1	8901
10	2247	0	9012

2 Mixed Paper-Computer Implementation

As an alternative to sending response codes and collecting survey responses via email, the survey can be conducted on paper using the `mixed_computer_paper.pdf` template.

The document contains 6 response cards to be cut out along the dotted lines. Respondents' names and answer codes generated using the `response_encoding_and_decoding.xlsx` workbook should be filled in, after which the codes can be deleted from the spreadsheet. Finally, the dark lines of each response card should be cut as indicated.

Response cards are distributed to participants. Participants tear out the response code corresponding to their response, and return it to the survey manager. Survey codes are then entered manually in the decoder tab of the spreadsheet to generate decoded **TRUE/FALSE** values. Workers with decoded values equal to **TRUE** are rotated out.

3 Purely Paper-Based Implementation

The `purely_paper_based_survey.pdf` template permits a purely paper based implementation. It consists of three pages to be printed single-sided.

The first page is the most important. It consists of 6 question cards to be cut out. Each card has a yes/no question about COVID19 exposure except for one, which gives the respondent instructions to answer **YES**.

The second and third page are simply **YES** and **NO** response cards, which could be replaced by spoken, written, or even text messaging. Response cards are cut out, and each respondent receives one **YES** and one **NO** card.

Survey System

We propose a simple approach to surveying employees using this tool. We describe an in-person survey, but the approach is analogous using the mail system to distribute the survey and to collect the responses. We expect that organizations will want to tailor these systems to their needs.

Suggested Use

1. Select the proportion of cards in the survey question deck that will instruct participants to respond **YES**. Create the deck of survey questions cards to maintain this ratio.
2. Create two additional decks of cards: One **YES** deck and one **NO** deck. Each survey participant receives one **YES** card and one **NO** card.
3. If possible, shuffle the survey question deck in front of survey participants. Provide each survey participant with a question card, a **YES** card, and a **NO** card in an envelope.
4. Instruct survey participants to **privately** read their question card, select their response card, and write their employee ID or other unique personal identifier on the response card. Survey participants should then return their chosen response card and shred both their survey question and unused response card.

Ideally, provide survey participants with a shredder or bin and instruct them to shred or tear their question card and unused response card.

5. All survey participants with YES responses are rotated out.

This approach is known as a randomized response design. For more information on using a randomized response design in surveys to guarantee plausible deniability for respondents, see [Warner \(1965\)](#), [Wikipedia](#), or [Blair et al. \(2015\)](#).

Notes about using the template

- The template contains 7 cards with COVID19 exposure questions and 1 card with instructions to answer YES. This results in 1-out-of-8 or 12.5% of participants' being randomly selected to respond YES. The survey creator can adjust the proportion of cards with instructions to answer YES based on their organization's needs. For example, in order to achieve 5% of participants' being randomly select to respond YES, the survey creator includes 1 card with instructions to answer YES per 20 cards in the deck.
- The first time that the survey is conducted, we recommend to demonstrate to survey participants how the survey provides plausible deniability. To do this, the survey creator can show survey participants the exposure question cards and instruction cards and shuffle them together in front of survey participants. The survey creator can explain to participants that they will each privately receive a card from the deck, and no one will know whether they receive a question card or an instruction card.
- The survey relies on survey participants' cards being private information to provide plausible deniability. It is critical that card assignment is private. We suggest to use envelopes to distribute cards and to collect responses. If the survey is conducted in-person, we suggest instructing survey participants to shred or to otherwise destroy cards immediately after they submit their responses.
- This survey system relies on employees complying with YES cards to ensure plausible deniability. If no YES response is submitted, it may be that employees are choosing

not to comply with YES cards. In this case, it may be necessary to use either the mixed computer-paper implementation, or the purely computer-based implementation of random rotation.

References

- BLAIR, G., K. IMAI, AND Y.-Y. ZHOU (2015): “Design and analysis of the randomized response technique,” *Journal of the American Statistical Association*, 110, 1304–1319.
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- WARNER, S. L. (1965): “Randomized response: A survey technique for eliminating evasive answer bias,” *Journal of the American Statistical Association*, 60, 63–69.