Occupation and SARS-CoV-2 infection risk among 108 960 workers during the first pandemic wave in Germany

by Marvin Reuter, DrPH,2 Mariann Rigó, PhD, Maren Formazin, PhD, Falk Liebers, MD, Ute Latza, PhD, Stefanie Castell, MD, Karl-Heinz Jöckel, PhD, Karin Halina Greiser, MD, Karin B. Michels, PhD, Gérard Krause, MD, Stefan Albrecht, MA, Ilter Öztürk, MA, Oliver Kuss, PhD, Klaas Berger, MD, Benedikt MJ Lampl, MD, Michael Leitzmann, MD, Hajo Zeeb, MD, Karla Romero Starke, PhD, Sabine Schipf, PhD, Claudia Meinke-Franze, PhD, Wolfgang Ahrens, PhD, Andreas Seidler, MD, Bianca Klee, MPH, Tobias Pischon, MD, Andreas Deckert, PhD, Börge Schmidt, PhD, Rafael Nikolajczyk, MD, André Karch, MD, Barbara Bohn, PhD, Hermann Brenner, MD, Bernd Holleczek, MD, Nico Dragano, PhD

1. Supplementary material
2. Correspondence to: Dr. Marvin Reuter, Institute of Medical Sociology, Centre for Health and Society, Medical Faculty and University Hospital, Heinrich Heine University Duesseldorf Moorenstrasse 5, 40225 Düsseldorf, Germany. [E-Mail: marvin.reuter@uni-duesseldorf.de]

### e-Table 1. Eligibility criteria for inclusion in the study sample

| Included | Excluded |
|----------|----------|
|          | N        | %        | N      |
| Baseline sample (2014-2019) | 204 895 | 100.0 | - |
| Invited for participation in the COVID follow-up (2020) | 197 834 | 96.6 | 7 061 |
| Completion of the questionnaire (2020) | 161 849 | 79.0 | 35 985 |
| Participants not unemployed or inactive at time of the COVID-19 questionnaire | 109 328 | 53.1 | 52 521 |
| If tested for SARS-CoV-2: Test date not before 01.02.2020 or after 31.08.2020 | 108 960 | 52.9 | 368 |

**Study sample** 108 960 100.0

### e-Table 2. Missing values in variables of interest

| Variable | Label | Missing | Complete | Total |
|----------|-------|---------|----------|-------|
|          |       | N %     | N %      | N %   |
| **Dependent variable** |       |         |          |       |
| a_postest | Infection with SARS-CoV-2 | 272 0.2 | 108 99.8 | 883 100.0 |
| **Independent variables** |       |         |          |       |
| timerisk | Person-time at risk | 0 0.0 | 108 100.0 | 960 100.0 |
| age      | Age in years | 0 0.0 | 108 100.0 | 960 100.0 |
| gender   | Sex | 0 0.0 | 108 100.0 | 960 100.0 |
| a_migr   | Migration background | 34 0.0 | 108 100.0 | 926 100.0 |
| studz    | Region of study centre | 0 0.0 | 108 100.0 | 960 100.0 |
| Variable   | Description                              | Original N | Original Mean | Original SD | Original Min | Original Max | Imputed N | Imputed Mean | Imputed SD | Imputed Min | Imputed Max |
|------------|------------------------------------------|------------|---------------|-------------|--------------|--------------|------------|--------------|-------------|--------------|-------------|
| a_migr     |                                          | 108 926    | 0.29          | 0.45        | 0            | 1           | 108 960    | 0.29         | 0.45        | 0            | 1           |
| a_househ   | Household composition                    |            |               |             |              |             |            |              |             |              |             |
| a_workh    | Weekly working hours                     | 7 322      | 6.7           |             | 101          | 93.3        | 638        | 960          | 108         | 100.00      | 0           |
| selfemp    | Employment relationship                  | 2 381      | 2.2           |             | 106          | 97.8        | 579        | 960          | 108         | 100.00      | 0           |
| a_kldb_major| Kldb 2010 major group                    | 5 380      | 4.9           |             | 103          | 95.1        | 580        | 960          | 108         | 100.00      | 0           |
| a_kldb_anf | Kldb 2010 skill level                    | 5 380      | 4.9           |             | 103          | 95.1        | 580        | 960          | 108         | 100.00      | 0           |
| a_kldb_fuehr| Kldb 2010 sup./manager responsibility   | 5 380      | 4.9           |             | 103          | 95.1        | 580        | 960          | 108         | 100.00      | 0           |
| a_kldb_sek | Kldb 2010 Occupational sector           | 5 380      | 4.9           |             | 103          | 95.1        | 580        | 960          | 108         | 100.00      | 0           |
| a_kldb_seg | Kldb 2010 Occupational segment          | 5 380      | 4.9           |             | 103          | 95.1        | 580        | 960          | 108         | 100.00      | 0           |
| essential  | Essential workers                        | 5 380      | 4.9           |             | 103          | 95.1        | 580        | 960          | 108         | 100.00      | 0           |
| a_isco_major| ISCO-08 major group                     | 6 223      | 5.7           |             | 102          | 94.3        | 737        | 960          | 108         | 100.00      | 0           |
| a_covtest  | Test for SARS-CoV-2                      | 272        | 0.2           |             |              |             |            |              |             |              |             |
| a_homeoffice| Working from home                        |            |               |             |              |             |            |              |             |              |             |
| a_riskcont~t| Risk contact to an infected Person      |            |               |             |              |             |            |              |             |              |             |
| a_red_whrs | Reduction in working hours              |            |               |             |              |             |            |              |             |              |             |
| a_inc_whrs | Increase in working hours               |            |               |             |              |             |            |              |             |              |             |
| a_newjob   | Job change                               |            |               |             |              |             |            |              |             |              |             |
| a_shorttim~l| Receiving of short-time allowance       |            |               |             |              |             |            |              |             |              |             |
| a_terminat~n| Dismissal                               |            |               |             |              |             |            |              |             |              |             |
| a_noworkch~s| No work changes                         |            |               |             |              |             |            |              |             |              |             |

**e-Table 3.** Comparison of original versus imputed data
| ISCO major groups (1st digit ISCO) | Number (N) | Person-days (x̄) | Unadjusted | Model 1 | Model 2 |
|-----------------------------------|------------|-----------------|------------|--------|--------|
| Technicians and associate         | 27         | 127             | 109.0      | 4.7    | 4.5    | 4.8    |
| professionals                     | 292        |                 |            | 3.9–5.5| 3.7–5.3| 3.9–5.7|
| Managers                          | 7 752      | 39              | 109.4      | 5.0    | 4.3    | 3.7    |
|                                   |            |                 |            | 3.5–6.6| 2.9–5.7| 2.2–5.3|
| Armed forces occupations          | 326        | 1               | 110.7      | 3.0    | 3.3    | 3.4    |
|                                   |            |                 |            | -2.9–9.0| -3.3–10.0| -3.3–10.1|
| Professionals                      | 35         | 947             | 141        | 3.5    | 3.6    | 3.3    |
| Skilled agricultural, forestry and |            |                 |            | 3.3–4.6| 3.0–4.2| 2.6–4.0|
| fishery workers                   | 886        | 3               | 112.4      | 3.3    | 3.1    | 3.2    |
|                                   |            |                 |            | -0.4–7.0| -0.4–6.5| -0.4–6.9|
| Clerical support workers          | 13         | 772             | 109.0      | 2.9    | 2.8    | 2.9    |
|                                   |            |                 |            | 2.0–3.8| 1.9–3.7| 2.0–3.8|
| Services and sales workers        | 10         | 594             | 111.1      | 2.8    | 2.7    | 2.8    |
|                                   |            |                 |            | 1.8–3.8| 1.7–3.7| 1.7–3.9|
| Elementary occupations            | 1 932      | 7               | 112.7      | 3.5    | 3.3    | 2.6    |
|                                   |            |                 |            | 0.9–6.1| 0.8–5.8| 0.0–5.2|
| Craft and related trades workers   | 7 252      | 12              | 112.5      | 1.6    | 1.5    | 1.6    |
|                                   |            |                 |            | 0.7–2.5| 0.6–2.4| 0.7–2.6|
| Plant and machine operators and assemblers | 3 207 | 4 | 112.8 | 1.2 | 1.1 | 1.1 |

Wald chi2 test for significance

| p | p | p |
|---|---|---|
| <0.001 | 0.001 | 0.001 |

IR=Incidence rate. x̄=Mean. CI=Confidence interval. IRs based on Poisson regression analysis. Person-days at risk were specified as an exposure variable to control for different lengths in observation times. Estimates of Model 1 were adjusted for age group (in five-year increments), sex, migration background, study centre, weekly working hours, and self-employment. Estimates of Model 2 were additionally adjusted for occupational skill level (5th digit of the KldB 2010), and supervisory/managerial responsibility (4th digit of the KldB 2010). N=108 960 employed individuals.
e-Figure 1. Cumulative number of SARS-CoV-2 tests and infections by occupational segment, essential occupation, skill level and supervisory/managerial responsibility. N=108,960 employed individuals. Cumulative numbers per 1000 workers in each category of occupational grouping.