

# The Situation of Individuals Aged 70+ Years During the Corona Lockdown in Germany on the Example of the Population-based AugUR Study

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## Research article

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# Abstract

**Background:** Individuals aged 70+ were most threatened by COVID-19 and most targeted by shielding recommendations. However, there is limited understanding of the situation of this high-risk population during lockdown.

**Methods:** We derived information via a written self-completion questionnaire sent out to our population-based AugUR study participants (aged 70+, living in/near Regensburg, Germany) shortly after the lift of the curfew in spring 2020 in Bavaria, Germany. This was combined with data from previous AugUR study center visits including medical history assessment, medical exams, and bio-probing, which enabled the comparison of pre- and during-pandemic assessments in the very same individuals.

**Results:** Among 1,850 survey participants (73–98 years; net-response 89%), 74% were at increased risk for severe COVID-19 according to medical conditions (75% extrapolated to the German population aged 70+). Despite 92% have potentially been exposed, only four reported SARS-CoV-2 infection (0.2%). COVID-19 related symptoms were reported by 23%. Regarding lifestyle changes since lockdown, we found no trend towards increased smoking or drinking alcohol, but 34% reported increased sedentary behavior and 29% refrained from medical appointments. Worse QOL was perceived by 38%. Particularly women and the more educated were susceptible to these changes. When comparing lifestyle differences between survey and previous visit, the pattern was similar.

**Conclusions:** Our presented data will help understand the situation of this vulnerable group in the pandemic. While a majority of individuals reported no changes towards a less healthy life style, about one third would benefit from help to sustain a healthy lifestyle when accommodating future strategies.

## Background

During spring 2020, the population aged 70 years and more (70+) was considered as the group most at risk of the coronavirus disease 2019 (COVID-19) and related death – and their protection was given as a reason for implementing lockdowns in many countries worldwide. To date, the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) has infected more than 35 million individuals and lead to over 1 million confirmed deaths worldwide.[1] The largest proportion of deaths is in this high age group: e.g. the 70 + constitute 16% of the population in Germany, but ~ 86% of deaths related to COVID-19.[2]

Besides high age, several medical conditions are listed as increasing risk of severe COVID-19 (i.e. requiring hospitalization) by the U.S. Center of Disease Control (CDC),[3] and most of these typically accumulate over the life course: Type 2 diabetes, heart conditions, or chronic kidney disease.[4, 5] There are only few attempts to quantify the risk-prone proportion of individuals, i.e. those having at least one of the listed medical conditions[4] and none – to our knowledge – in a population-based study in those aged 70+. Collateral damages that derive from pandemic-related containment strategies, such as (self-)isolation, may add to the direct health risk imposed by COVID-19, but little is known about the consequences of self-isolation and sheltering at home in older adults.[6, 7] There are hints that the

lockdown situation, i.e. requiring people to stay at home, closing certain businesses and venues, and implementing social distancing regulations, has led to changes in diets and physical activity, has affected healthcare-seeking behavior.[7–9] Therefore, it is also important to understand the situation of individuals of high age during lockdown, focusing on aspects related both to COVID-19 and to containment measures.

We thus set out to shed light on the situation of individuals aged 70 + during the corona lockdown in spring 2020, focusing on medical and behavioral aspects and quality of life (QOL). We conducted a survey of individuals aged 70 + living in the middle-sized city of Regensburg, Bavaria, and surrounding rural counties. These individuals were part of our AugUR study cohort and had previously visited our study center at least one time. Bavaria was the first hit state in Germany, but the study capture area has not been a ‘hotspot’. The Bavarian government implemented containment measures in spring 2020, which included the closure of shops, restaurants, and schools, physical distancing regulations, banning of gatherings of more than two persons, and a home confinement, with exemptions being made for shopping for food or taking exercise. These restrictions were in effect, to varying degrees, from March 16th to June 16th, 2020. For this study, we could resort to 2,314 individuals of a well-established cohort of older adults (the AugUR study), which were contacted in May 2020, about seven weeks into the lockdown measures. This allowed us to receive timely data on health, lifestyle and well-being during the COVID-19 pandemic with significant restrictions being in place. We here report on the results of the AugUR COVID-19 survey conducted in spring 2020 linking data assessed from prior study center visits.

## Methods

### Study design and sample size

AugUR is a research platform recruiting from the general mobile elderly population in and around Regensburg, a middle-sized city in Bavaria. The study region, city and counties of Regensburg, captures ~ 347,000 inhabitants of mostly Caucasian ethnicity, including 45,000 aged 70+.[10] A first baseline survey (AugUR-1, 2013–2015) included 1,133 participants.[10, 11] The AugUR-1 3-year follow-up (2016–2018) with the same protocols and procedures included 788 participants. The AugUR-1 6-year follow-up started in Nov 2019 and had to be paused on March 16th, 2020, due to the coronavirus pandemic. A second independent baseline survey (AugUR-2, 2017–2019) included 1,316 participants. For the AugUR COVID-19 survey reported in this manuscript, we resorted to the complete AugUR sample of 2,449 participants, excluding the following individuals: had been reported as dead or too ill or had not been contactable by mail or phone during the recruiting for the prior study center visit, had retracted consent for re-contact (Fig. 1). This yielded eligible 2,314 individuals.

The AugUR study was approved by the Ethics Committee of the University of Regensburg, Germany (vote 12-101-0258). The study complies with the 1964 Helsinki declaration and its later amendments. All participants provided informed written consent.

### AugUR COVID-19 survey questionnaire

For the AugUR COVID-19 survey, a written self-completion questionnaire was sent out per mail to the 2,314 eligible individuals on May 11th /12th, 2020. This was shortly after the lift of the curfew in Bavaria (May 6th ), but well within the period of contact restrictions (until June 16th ). We collected returned questionnaires until August 26th, 2020.

The questionnaire targeted the situation since the start of the pandemic (as per Feb 1st, 2020), details are given in **Supplementary Note**, the full English version of the questionnaire can be found as an **Appendix**. Questions were mainly excerpted from the published questionnaire used by the German National Cohort (NAKO) [12] and adapted to meet the needs of our elderly study participants (i.e. number of questions reduced, larger font size). In brief, we asked about SARS-CoV-2 testing and positive tests, COVID-19 related symptoms, living situation and potential exposure via outside contacts, as well as lifestyle changes such as refraining from medical consultation, changes in sedentary behavior, smoking, alcohol drinking, and QOL.

## Targeted testing for SARS-CoV-2 infection in Bavaria

Individuals in Bavaria were tested for SARS-CoV-2 infection, usually if they reported COVID-19 related symptoms, were hospitalized with symptoms, had contact with an infected person, and/or were returning from high risk areas. Positive tests were reported to health authorities and resulted in quarantine usually for 14 days for the affected and contact persons. From the Bavarian Food and Health Safety Authority, we gathered numbers reported as infected and died with COVID-19 among all inhabitants and those aged 70 + for the study capture area. From participants, we obtained self-reported test and infection status via the questionnaire.

## Assessment of medical conditions from prior study center visit

For all participants of the COVID-19 survey, we derived information on medical conditions from their prior study center visit (April 2016 - March 2020), which had included a face-to-face interview, medical exams and bio-probing.[10, 11] Body mass index (BMI) was computed based on measured weight in light clothing and measured height, obesity defined as  $BMI \geq 30 \text{ kg/m}^2$ , HbA1c and serum creatinine measured in fresh blood, and chronic kidney disease defined as estimated glomerular filtration rate (eGFR)  $< 60 \text{ mg/dl/1.73m}^2$ . [13, 14] Further medical history was assessed via self-report: cancer (excluding white skin cancer), type 2 diabetes mellitus, hypertension, chronic bronchitis, asthma, serious heart conditions (i.e. history of myocardial infarction OR percutaneous coronary intervention OR coronary bypass surgery OR heart weakness) and cerebrovascular disease (i.e. history of stroke).

The CDC classifies individuals of any age at increased risk for severe COVID-19 (i.e. hospitalization, intubation/ventilation, or death) based on medical conditions, from which we extracted conditions common in the elderly: cancer, chronic kidney disease, chronic bronchitis, obesity, serious heart conditions, or type 2 diabetes.[3] CDC lists further conditions as possible risk factors for severe COVID-19, from which we extracted asthma, hypertension, cerebrovascular disease, current/former smoking.[3]

# Assessment of lifestyle at prior study center visit and quantified changes

At each visit, QOL and lifestyle factors (number of smoked cigarettes and consumed alcoholic drinks, physical activity categories) had been assessed with the same questions as in the above-mentioned COVID-19 instrument, except for the data collection method (standardized face-to-face interview via trained staff instead of a self-administered questionnaire).[10, 11] We derived the difference in QOL scores and life style factors assessed at survey compared to prior visit.

## Assessment of demographic and genetic parameters from baseline visit

From the baseline visit, we obtained year of birth, sex, and years of education (from type/duration of schools visited/finished, formal training via vocational college/universities).

From whole blood ascertained at AugUR-1 baseline, we isolated and stored DNA (Genra Puregene Blood Kit, Qiagen, Hilden, Germany; stored at -20 °C). Genotyping was conducted by the Genome Analysis Center, Helmholtz Zentrum Munich, Germany (Global Screening Array-24, GSA; version 1.0, Illumina Inc., San Diego, USA; 700,078 variants before quality control). We estimated ABO blood groups by two genotyped variants in the *ABO* gene cluster (rs8176746 and rs8176719 [15]; variant call rate 100%; using PLINK, version 1.9[16]): blood group O as (any/any; del/del) for (rs8176746; rs8176719), blood group A as (C/C; del/G) or (C/C; G/G), blood group B as (A/A; G/G) or (C/A; del/G), and blood group AB as (C/A, G/G).

## Measures to minimize and understand non-response

Individuals returning the questionnaire until June 12th were considered immediate responders (with a more immediate impression of the lockdown), those returning it June 12th - Aug 26th as late responders. For all individuals without questionnaire return until July 12th, we implemented measures to minimize and/or understand non-response: (i) we obtained survival status by population registry; (ii) we attempted phone contact and, if successful, reminded individuals to return the questionnaire or conducted the survey as phone interview (late responder); (iii) if we had phone contact, but did not obtain the questionnaire information, we asked for the reason of non-response (no interest, no time, too ill, refused to give any information). We divided non-responders (i.e. presumably alive, but did not return questionnaire) into those who did not receive the questionnaire ("returned-to-sender", i.e. not contactable) and those for whom we had no adverse information that they received the questionnaire (contactable).

## Data management and statistical analyses

Data management and statistical analyses were conducted via SAS 9.4 software (SAS Institute Inc., Cary, NC, USA) and IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA). Using population weights by 10-years-age-groups and sex, we extrapolated observed proportions in our study data to the population aged 70 + in Germany, where applicable (<https://www.destatis.de/>). We used linear

and logistic regression models to evaluate the association of covariates (age, sex, education years, living alone, at increased risk) with perceived and quantified life style and QOL changes. For this, we evaluated age x sex and sex x education interaction, resorting to the model without interaction when the interaction term was not statistically significant. We conducted sensitivity analyses restricting analyses to immediate responders and restricted analyses to those with the prior study center visit < 12 months before lockdown, where applicable. Statistical significance was judged at 5%.

## Results

### Participant characteristics, analysis of immediate response and non-response

Among the 2,314 individuals to whom the questionnaire of the AugUR COVID-19 spring 2020 survey was sent out, 2,088 individuals were contactable (i.e. alive and received questionnaire) and the filled-out questionnaire was returned by 1,850 individuals (“AugUR COVID-19 survey participants”). This resulted in a net response of 89% (Fig. 1) that was higher among men than women (90% versus 87%) and among those aged 73–79 years than those 80+ (91% versus 87%). One main reason for non-response was illness (39% too ill among 110 in the non-responder phone follow-up). The 1,850 participants included 48% men and age at survey ranged from 73 to 98 years (birth years 1922–1947, Table 1). There were few current smokers (5%) and mean BMI was 27.6 kg/m<sup>2</sup>. Few women, but 57% of men had ≥ 13 years of education. When comparing the 350 non-responders or the 114 who had died since their prior visit with the participants, we found less men, more smoking, reduced QOL, and reduced physical activity (Table 1).

Table 1

**Characteristics of participants and those lost to follow-up.** Characteristics of AugUR baseline participants were derived at the prior study center visit before lockdown from face-to-face interview, medical exams, and serum measurements (n up to 2314). Shown are characteristics for (i) 1850 participants of this AugUR COVID-19 survey, (ii) 1734 participants with immediate response (i.e. questionnaire return May 12th – June 12th, 2020), (iii) 524 among the 1850 participants seen within 1 year before lockdown (i.e. March 2019 – March 2020), (iv) 350 non-responders (known to be alive, not participating in this survey, consent to be part of AugUR study platform; 112 not contactable, 238 contactable), (v) 114 who died between prior visit and this survey. Shown is median [inter-quartile range], if not noted otherwise.

| Participant characteristics                                       | Participants<br>n = 1850 | Participants -<br>immediate<br>response n =<br>1734 | Participants – seen<br>within 1 year before<br>lockdown n = 524 | Non-<br>responders<br>n = 350 | Died<br>n =<br>114        |
|---|--------------------------|---|---|-------------------------------|---------------------------|
| Year of birth   | 1922–1947                | 1922–1947   | 1924–1947   | 1921–<br>1947                 | 1919–<br>1946             |
| Age [yrs] at prior<br>visit, median<br>(min-max)                  | 78.8 (70–<br>96)         | 78.7 (70–96)  | 79.5 (72–95)  | 80.7 (71–<br>97)              | 83.8<br>(71–<br>98)       |
| Age [yrs] at<br>survey/death,<br>median (min-<br>max)             | 80.5 (73–<br>98)         | 80.4 (70–96)  | 80.1 (73–96)  | 82.9 (71–<br>97)              | 84.7<br>(71–<br>98)       |
| Men, % (n)  | 47.5 (878)               | 48.0 (833)  | 46.2 (242)  | 40.0 (140)                    | 61.4<br>(70)              |
| Years of<br>education <sup>a</sup>                                | 11 [10–14]               | 11 [10–15]  | 11 [10–15]  | 10 [10–13]                    | 11<br>[10–<br>13.3]       |
| Quality of life <sup>b</sup>                                      | 75 [60–85]               | 75 [60–85]  | 75 [60–85]  | 70 [50–80]                    | 62.5<br>[50–<br>80]       |
| Physically active <sup>c</sup> ,<br>% (n)                         | 80.6 (1478)              | 81.1 (1395)   | 78.4 (407)  | 68.3 (235)                    | 56.9<br>(62)              |
| Current<br>smoker/Ex-<br>smoker <sup>d</sup> , % (n)              | 4.8 (88) /<br>38.1 (703) | 4.7 (82) / 38.2<br>(660)                            | 3.6 (19) / 37.6 (196)   | 4.9 (17) /<br>37.8 (130)      | 6.1 (7)<br>/ 39.5<br>(45) |
| # cigarettes<br>smoked daily <sup>e</sup>                         | 6.0 [4.0–<br>15.0]       | 6.0 [4.0–15.0]                                      | 5.0 [4.3–10.0]  | 10.0 [4.3–<br>27.5]           | 12.5<br>[5–<br>18.5]      |
| # alcoholic drinks<br>daily <sup>f</sup> ,                        | 0.54 [0.15–<br>1.18]     | 0.54 [0.15–<br>1.18]                                | 0.54 [0.15–1.18]  | 0.54<br>[0.15–<br>1.18]       | 0.54<br>[0.15–<br>1.18]   |
| eGFR <sub>crea</sub><br>[mg/dl/1.73m <sup>2</sup> ],<br>mean ± SD | 68.4 ± 16.0              | 68.4 ± 15.9   | 67.3 ± 16.9   | 65.0 ± 17.3                   | 61.8 ±<br>22.9            |

| Participant characteristics  | Participants<br>n = 1850 | Participants -<br>immediate<br>response n =<br>1734 | Participants – seen<br>within 1 year before<br>lockdown n = 524 | Non-<br>responders<br>n = 350 | Died<br>n =<br>114 |
|--|--------------------------|---|---|-------------------------------|--------------------|
| HbA1c [%], mean<br>± SD  | 5.78 ± 0.65              | 5.78 ± 0.65   | 5.68 ± 0.59   | 5.84 ± 0.75                   | 5.97 ±<br>0.81     |
| Body-mass-Index <sup>f</sup><br>[kg/m <sup>2</sup> ] <sup>g</sup> , mean ±<br>SD   | 27.6 ± 4.4               | 27.6 ± 4.4  | 27.6 ± 4.2  | 28.4 ± 4.9                    | 26.7 ±<br>5.3      |
| Blood group O <sup>h</sup><br>(for n = 738), %<br>(n)  | 35.0 (258)               | 34.1 (228)  | 40.2 (45)   | 34.9 (61)                     | 31.0<br>(26)       |
| SD = standard deviation; IQR = interquartile range; eGFR <sub>crea</sub> = estimated glomerular filtration rate based on serum creatinine measurements;  |                          |   |   |                               |                    |
| <p><sup>a)</sup> School education ranging from 6 years (no final exam) to 13 years (high school graduation) and professional/university training from 0 years (none) to 11 years (professional training and university and doctoral thesis). <sup>b)</sup> Scale from 0 (very poor) to 100 (excellent). <sup>c)</sup> Light regular activity (includes bicycling, gardening, walking) in summer and/or winter, weekly for &gt; 2 hours (active), or less (not active). <sup>d)</sup> Current smoker (as per prior visit), n = 88; ex-smoker having stopped smoking for ≥ 1 month, n = 703. <sup>e)</sup> Currently smoking (as per prior visit), n = 73 with information on #cigarettes. <sup>f)</sup> For individuals with any alcohol consumption during the last 12 months (as per prior visit), computed as reported frequency of drinking times the number of drinks (1 drink = 33 cl beer, 12.5 cl wine, 4 cl hard liquors); n = 1716 with information on #drinks. <sup>g)</sup> Measured weight in kg divided by squared measured body height in m. <sup>h)</sup> Blood groups O, A, B, AB were derived from genotypes for rs8176746 and rs8176719 for n = 738.</p> |                          |   |   |                               |                    |

## Proportion at increased risk for severe COVID-19

For individuals at any age, the CDC classifies medical conditions with strong evidence for increased risk for severe COVID-19[3], most of which are common in the elderly (cancer, chronic kidney disease, chronic bronchitis, obesity, serious heart conditions, or type 2 diabetes). Based on the information assessed at the prior study center visit (mean time between survey and prior visit = 1.8 years; <1 year: n = 524, 28%; 1–3 years: n = 1029, 56%; >3 years: n = 297, 16%), we derived frequencies of these medical conditions (Fig. 2A, **Supplementary Table 1**). We found 74% of our 1,850 participants with at least one of these conditions and thus at increased risk for severe COVID-19 (Fig. 2B). This risk group was larger among men than women (76% and 72%, respectively) mostly due to more men with serious heart conditions, and the risk group increased by 10-year age-group (71%, 79%, 95% for those aged 70–79, 80–89, 90+, respectively; Fig. 2B). When extrapolating participants' proportion at risk to the German population 70+ by weights per 10-year age-group and sex (13 million inhabitants aged 70+), we found similar proportions: 75% overall, 76% in men, 74% in women and 71%, 79%, or 97% for the 70–79, 80–89, 90+ age-groups, respectively (Fig. 2B).

When extending to CDC conditions listed as possible risk factors for severe COVID-19[3] (asthma, hypertension, cerebrovascular disease, current/former smoking), the risk group increased to 94% among the 1,850 participants and 93% extrapolating to the German population 70+ (**Supplementary Table 1**).

## **Proportion infected**

Among the 1,850 participants, 52 reported to have undergone testing for SARS-CoV-2 infection (test dates March 21th - June 15th, 2020; reasons for testing: contact to infected, symptoms, returning from risk areas, other, n = 5, 15, 0, or 19, respectively). Four were tested positive (8% of 52, 0.2% of 1,850): their age ranged from 76 to 95 years, three men, all non-smoking, three at increased risk for severe COVID-19 due to medical conditions. Two reported to live alone, two with partners; the partners were also tested, but not infected. Their QOL ranged from 50 to 80.

When linking these observations to the infection occurrence among the 46,461 inhabitants aged 70 + in the study capture area (infections mostly March – June 2020, Fig. 3A), we found the proportion of positive tested (0.3%; n = 109) and the 4.3 expected individuals with infection among the 1,850 participants to fit well to our observation. Given the 16 individuals aged 70 + in the area who died with COVID-19 (0.03% of the 46,461), the expected number of 0.6 deaths among the 2,314 eligible individuals indicated little to no bias from COVID-19 related death. Of note, those aged 70 + comprised 13% of inhabitants, 8% of those tested positive, and 64% of those with COVID-19 related death (Fig. 3B).

## **Living situation and potential exposure due to outside contacts**

Given the strict recommended isolation for the high age group during the lockdown, the household was the primary living situation for many of the elderly. Of the 1,850 participants, 36% reported to live alone (more women than men), 62% lived with at least one more person in a private household (92% of these with their partner, 6% with a person < 50 years of age) and 1% in a nursing home (Table 2).

Table 2

**Living situation and outside contacts.** Shown is the proportion of the 1850 AugUR COVID-19 survey participants who sustained a lifestyle with outside contacts (direct contacts outside or younger generation person in the household as indirect outside contact) and were therefore potentially exposed, as well as information on the household situation (all via self-completion questionnaire).

| <b>Living situation, outside contacts</b>  | <b>Overall</b>     | <b>Women</b>      | <b>Men</b>        |
|--|--------------------|-------------------|-------------------|
|  | <b>n = 1850</b>    | <b>n = 972</b>    | <b>n = 878</b>    |
| <b>Household</b>   |                    |                   |                   |
| Living alone, % (n)  | 36.4 (664)         | 50.9 (489)        | 20.3 (175)        |
| Living with $\geq 1$ person, % (n)   | 62.3 (1137)        | 47.7 (458)        | 78.7 (679)        |
| Living in a nursing home, % (n)  | 1.3 (23)           | 1.5 (14)          | 1.0 (9)           |
| <b>Among those living with <math>\geq 1</math> person</b>  | <b>n = 1137</b>    | <b>n = 458</b>    | <b>n = 679</b>    |
| With partner as a couple, % (n)  | 91.5 (1040)        | 86.2 (395)        | 95.0 (645)        |
| With younger generation person <sup>a</sup> , % (n)  | 4.4 (50)           | 4.1 (19)          | 4.6 (31)          |
| <b>Outside contacts</b>  |                    |                   |                   |
| Contact with infected person <sup>b</sup> , % (n)  | 1.0 (18)           | 0.8 (7)           | 1.3 (11)          |
| Living with younger generation person <sup>a</sup> , % (n)   | 4.4 (50)           | 4.1 (19)          | 4.6 (31)          |
| Using public transport <sup>c</sup> , % (n)  | 25.6 (465)         | 30.5 (291)        | 20.2 (174)        |
| Doing errands <sup>c</sup> , % (n)   | 81.4 (1488)        | 80.8 (778)        | 82.1 (710)        |
| Having a help come to the household <sup>c</sup> , % (n)   | 18.0 (325)         | 19.7 (186)        | 16.1 (139)        |
| <b>Any of the above, % (n)</b>   | <b>92.3 (1633)</b> | <b>94.1 (858)</b> | <b>90.4 (775)</b> |
| <sup>a</sup> ) Defined as additional person in household with < 50 years of age. <sup>b</sup> ) Contact for more than 15 minutes at a distance less than 1.5 meter or person in the same household. <sup>c</sup> ) Defined as ever using public transport / ever doing errands / ever having a help come to the household during February 1st until July 12th, 2020. |                    |                   |                   |

We were also interested in the proportion of individuals who sustained a lifestyle with some outside contacts during lockdown and were therefore potentially exposed. Individuals at high age were advised to ask younger individuals to do errands and avoid public transportation; living with a younger person in the household was shown as risk of infection for the elderly.[17] Among the 1,850 participants, we found 92% to sustain outside contacts with little difference between women and men (Table 2), including the four infected.

## Proportion with symptoms

COVID-19 related symptoms include cough, shortness of breath, respiratory problems, fever/chills, or loss of taste/smell.[18] Among the 1,850 participants, 23% reported at least one of these symptoms since the start of the pandemic (as per Feb 1st ; Table 3), including the four infected. A loss of taste or smell, considered as quite specific to SARS-CoV-2 infection, was reported by 2% of individuals (none of the four infected). Other symptoms more generally related to infections were reported by 41% of participants (Table 3). Two of the four infected reported any symptoms (cough, difficulty breathing, pain in extremities, diarrhea, head ache, rhinitis), but none of the four infected reported any bronchitis and/or pneumonia. Any bronchitis and/or pneumonia were reported by 7% (n = 121), including 14 individuals requiring hospitalization; as none of the 14 reported to have been tested positive, these are not considered COVID-19 patients.

Table 3

**Proportions with symptoms among the 1850 participants.** Shown is the proportion of 1850 AugUR COVID-19 survey participants who reported symptoms related to COVID-19 or more generally to infections (via self-completion questionnaire).

| Symptom                                 | Overall<br>n = 1850   | Women<br>n = 972  | Men<br>n = 878    | Age<br>at survey<br>73–79<br>n = 829 | Age<br>at survey<br>80+<br>n = 1021 |
|---|-----------------------|-------------------|-------------------|--------------------------------------|-------------------------------------|
| <b>Related to COVID-19</b>              |                       |                   |                   |                                      |                                     |
| Cough, % (n)                            | 14.4<br>(266)         | 13.7 (133)        | 15.2 (133)        | 14.9 (123)                           | 14.0 (143)                          |
| Shortness of breath, % (n)              | 5.3 (97)              | 4.8 (47)          | 5.7 (50)          | 4.7 (39)                             | 5.7 (58)                            |
| Respiratory problems, % (n)             | 7.6 (141)             | 7.7 (75)          | 7.6 (66)          | 7.6 (63)                             | 7.7 (78)                            |
| Fever, % (n)                            | 1.8 (34)              | 2.0 (19)          | 1.7 (15)          | 1.6 (13)                             | 2.1 (21)                            |
| Chills, % (n)                           | 1.8 (34)              | 1.9 (18)          | 1.8 (16)          | 1.3 (11)                             | 2.3 (23)                            |
| Loss of smell, % (n)                    | 1.7 (32)              | 1.5 (15)          | 1.9 (17)          | 1.6 (13)                             | 1.9 (19)                            |
| Loss of taste, % (n)                    | 1.7 (32)              | 2.0 (19)          | 1.5 (13)          | 1.6 (13)                             | 1.9 (19)                            |
| <b>At least one of the above, % (n)</b> | <b>22.8<br/>(421)</b> | <b>22.3 (217)</b> | <b>23.3 (204)</b> | <b>22.8 (188)</b>                    | <b>22.9 (233)</b>                   |
| <b>Related to infections</b>            |                       |                   |                   |                                      |                                     |
| Red eye/eye infection, % (n)            | 7.0 (129)             | 8.0 (78)          | 5.8 (51)          | 6.2 (51)                             | 7.7 (78)                            |
| Limb pain, % (n)                        | 17.1<br>(315)         | 18.5 (180)        | 15.4 (135)        | 14.6 (121)                           | 19.0 (194)                          |
| Diarrhea, % (n)                         | 6.5 (120)             | 7.5 (73)          | 5.4 (47)          | 6.1 (50)                             | 6.9 (70)                            |
| Nausea, % (n)                           | 3.0 (55)              | 3.8 (37)          | 2.1 (18)          | 2.4 (20)                             | 3.4 (35)                            |
| Head ache, % (n)                        | 8.3 (153)             | 11.0 (107)        | 5.3 (46)          | 9.8 (81)                             | 7.1 (72)                            |
| Fatigue, % (n)                          | 19.6<br>(362)         | 20.8 (202)        | 18.3 (160)        | 17.1 (141)                           | 21.7 (221)                          |
| Rhinitis, % (n)                         | 13.3<br>(246)         | 11.9 (116)        | 14.9 (130)        | 13.1 (108)                           | 13.5 (138)                          |
| <b>At least one of the above, % (n)</b> | <b>41.2<br/>(761)</b> | <b>44.6 (433)</b> | <b>37.5 (328)</b> | <b>38.4 (317)</b>                    | <b>43.6 (444)</b>                   |

Multiple answers possible, except for severity of bronchitis/pneumonia.

| Symptom   | Overall<br>n = 1850 | Women<br>n = 972  | Men<br>n = 878    | Age<br>at survey<br>73–79<br>n = 829 | Age<br>at survey<br>80+<br>n = 1021 |
|---|---------------------|-------------------|-------------------|--------------------------------------|-------------------------------------|
| <b>Bronchitis/pneumonia, any, % (n)</b>                                 | <b>6.6 (121)</b>    | <b>6.7 (64)</b>   | <b>6.6 (57)</b>   | <b>5.7 (47)</b>                      | <b>7.4 (74)</b>                     |
| Mild symptoms, % (n)  | 4.2 (77)            | 4.5 (43)          | 3.9 (34)          | 3.7 (30)                             | 4.7 (47)                            |
| Bed ridden, % (n)   | 0.2 (4)             | 0.4 (4)           | 0.0 (0)           | 0.2 (2)                              | 0.2 (2)                             |
| Requiring physician, % (n)  | 1.4 (26)            | 1.1 (11)          | 1.7 (15)          | 1.3 (11)                             | 1.5 (15)                            |
| Hospitalized, % (n)   | 0.8 (14)            | 0.6 (6)           | 0.9 (8)           | 0.5 (4)                              | 1.0 (10)                            |
| <b>Any of the above, % (n)</b>  | <b>48.0 (881)</b>   | <b>50.9 (493)</b> | <b>44.8 (388)</b> | <b>45.1 (372)</b>                    | <b>50.3 (509)</b>                   |
| Multiple answers possible, except for severity of bronchitis/pneumonia. |                     |                   |                   |                                      |                                     |

## Lifestyle changes

At the COVID-19 survey, we asked for perceived lifestyle changes comparing the concurrent situation during the lockdown with before February 1st, 2020. (i) Seeing the physician on a regular basis is important for elderly individuals[19] and refraining from medical appointments despite need is a change towards a less healthy lifestyle. Of the 1,850 individuals, 29% reported to have refrained from medical consultation, more women than men (32% versus 25%, Table 4; model-I OR = 1.38, P = 0.003, **Supplementary Table 2A**), but no difference across age groups. Notably, we do not know how many medical appointments were canceled by physicians or hospitals. (ii) We evaluated whether participants perceived a change in their sedentary behavior since the start of the pandemic: 26% perceived themselves as less physically active versus 2% more active and 14% with more TV consumption versus 2% less, both of which was more pronounced in women (Table 4; model-I OR = 1.69 or 1.85, respectively, P < 0.001, **Supplementary Table 2A**). Decreased physical activity or increased TV consumption were reported by 34%. We also evaluated other subgroups for increased sedentary lifestyle: we found more TV consumption in the “younger” (model-II OR = 1.71 per 10 years younger), the more educated (model-II OR = 1.32 per 5 years more), and in those living alone (model-II OR = 1.02), but identified no subgroups particularly prone to decreased physical activity beyond female sex. Interesting was the little impact from higher age on any of the perceived life style changes beyond TV consumption. (iii) There was no systematic trend towards more smoking or alcohol consumption (7% reported more smoking vs. 11% less, 2% with more alcohol consumption vs. 2% with less; Table 4). This was in line with previous reports from one population-based study and an online survey.[20, 21]

Table 4

**Perceived lifestyle and QOL changes among 1850 participants.** Shown are perceived lifestyle changes assessed via self-reported questionnaire. Individuals were asked about the changes comparing the concurrent situation (at the end of the lockdown in Bavaria) to before Feb 1st, 2020.

| <b>Perceived changes<br/>(now vs. before pandemic)</b> | <b>Overall<sup>a</sup><br/>n = 1850</b> | <b>Women<br/>n = 972</b> | <b>Men<br/>n = 878</b> | <b>Age<br/>at survey<br/>73-79<br/>n = 829</b> | <b>Age<br/>at survey<br/>80+<br/>n = 1021</b> |
|--|---|--------------------------|------------------------|--|---|
| <b>Refraining from medical consultation</b>            |   |                          |                        |  |   |
| No % (n)   | 71.1<br>(1213)                          | 68.0<br>(598)            | 74.5<br>(615)          | 71.7<br>(562)                                  | 70.7 (651)                                    |
| Yes, any of below, % (n)                               | 28.9<br>(492)                           | 32.0<br>(282)            | 25.5<br>(210)          | 28.3<br>(222)                                  | 29.3 (270)                                    |
| Rescheduling, % (n)                                    | 21.5<br>(367)                           | 23.1<br>(203)            | 19.9<br>(164)          | 22.4<br>(176)                                  | 20.7 (191)                                    |
| Refraining despite acute need, % (n)                   | 0.9 (16)                                | 1.1 (10)                 | 0.7 (6)                | 0.9 (7)  | 1.0 (9)                                       |
| Refraining from regular check-up, % (n)                | 6.4 (109)                               | 7.8 (69)                 | 4.8 (40)               | 5.0 (39)                                       | 7.6 (70)                                      |
| <b>Physical activity<sup>b</sup></b>                   |   |                          |                        |  |   |
| Less, % (n)  | 25.8<br>(456)                           | 30.5<br>(281)            | 20.7<br>(175)          | 25.0<br>(200)                                  | 26.5 (256)                                    |
| Same, % (n)  | 72.1<br>(1273)                          | 67.4<br>(620)            | 77.2<br>(653)          | 72.3<br>(579)                                  | 71.9 (694)                                    |
| More, % (n)  | 2.1 (37)                                | 2.1 (19)                 | 2.1 (18)               | 2.7 (22)                                       | 1.6 (15)                                      |
| <b>TV consumption</b>                                  |   |                          |                        |  |   |
| More, % (n)  | 14.0<br>(259)                           | 18.0<br>(169)            | 10.6 (90)              | 16.0<br>(129)                                  | 13.3 (130)                                    |
| Same, % (n)  | 81.0<br>(1498)                          | 80.6<br>(755)            | 87.3<br>(743)          | 82.5<br>(666)                                  | 84.8 (832)                                    |
| Less, % (n)  | 1.7 (31)                                | 1.4 (13)                 | 2.1 (18)               | 1.5 (12)                                       | 1.9 (19)                                      |
| <b>Smoking<sup>c</sup></b>                             |   |                          |                        |  |   |

<sup>a</sup>) n is different for each variable (n = sum of the respective rows). <sup>b</sup>) Including bicycling, gardening, walking. <sup>c</sup>) Among current smoker as per survey (n = 54), defined as currently smoking  $\geq 1$  cigarette per day. <sup>d</sup>) For individuals with any alcohol consumption during the last 12 months (as per survey, n = 1424).

| Perceived changes<br>(now vs. before pandemic)  | Overall <sup>a</sup><br>n = 1850 | Women<br>n = 972 | Men<br>n = 878 | Age<br>at survey<br>73-79<br>n = 829 | Age<br>at survey<br>80+<br>n = 1021 |
|---|----------------------------------|------------------|----------------|--------------------------------------|-------------------------------------|
| More, % (n)   | 7.4 (4)                          | 10.7 (3)         | 3.8 (1)        | 11.8 (4)                             | 0.0 (0)                             |
| Same, % (n)   | 81.5 (44)                        | 78.6 (22)        | 84.6 (22)      | 73.5 (25)                            | 95.0 (19)                           |
| Less, % (n)   | 11.1 (6)                         | 10.7 (3)         | 11.5 (3)       | 14.7 (5)                             | 5.0 (1)                             |
| <b>Alcohol consumption<sup>d</sup></b>  |                                  |                  |                |                                      |                                     |
| More, % (n)   | 2.3 (39)                         | 2.3 (16)         | 3.1 (23)       | 2.9 (19)                             | 2.6 (20)                            |
| Same, % (n)   | 94.8<br>(1350)                   | 95.9<br>(661)    | 93.7<br>(689)  | 93.8<br>(618)                        | 95.7 (732)                          |
| Less, % (n)   | 2.0 (35)                         | 1.7 (12)         | 3.1 (23)       | 3.3 (22)                             | 1.7 (13)                            |
| <b>Perceived QOL</b>  |                                  |                  |                |                                      |                                     |
| Worse, % (n)  | 38.3<br>(668)                    | 40.7<br>(370)    | 35.6<br>(298)  | 39.7<br>(316)                        | 37.1 (352)                          |
| Same, % (n)   | 61.4<br>(1072)                   | 59.0<br>(536)    | 64.1<br>(536)  | 60.1<br>(478)                        | 62.6 (594)                          |
| Better, % (n)   | 0.3 (5)                          | 0.3 (3)          | 0.2 (2)        | 0.3 (2)                              | 0.3 (3)                             |
| <sup>a</sup> ) n is different for each variable (n = sum of the respective rows). <sup>b</sup> ) Including bicycling, gardening, walking. <sup>c</sup> ) Among current smoker as per survey (n = 54), defined as currently smoking $\geq 1$ cigarette per day. <sup>d</sup> ) For individuals with any alcohol consumption during the last 12 months (as per survey, n = 1424). |                                  |                  |                |                                      |                                     |

While the report that one's own lifestyle was perceived as having changed is a noticeable parameter, we were also interested in the quantified change by comparing lifestyle factors assessed at survey and at prior visit (change in physical activity category, difference in number of cigarettes or drinks consumed daily, difference in QOL score). We focused this analysis on the 524 individuals with the prior visit < 1 year before survey (balancing seasonal variation, but close enough to the lockdown). (i) For the change in physical activity category, we found 19% with decreased and 8% with increased activity, slightly more pronounced in women (**Supplementary Table 3**; model-I OR = 1.47,  $P \geq 0.05$ , **Supplementary Tables 2B**). (ii) We found a quantified change in smoking and drinking consistent with the perceived change supporting the lack of trend to one or the other direction (Fig. 4A&B; **Supplementary Table 3**). The number of current smokers at survey and/or prior visit was sparse (n = 14) and respective results thus not interpretable. For the difference in alcoholic drinks, we did not find an association with sex, education, or

living alone, but a decrease of drinks by age (-0.3 drinks per additional 10 years of age, model-I; **Supplementary Table 2B**).

Overall, the majority of participants (i.e. 2/3rd ) reported no change of behavior since the start of the pandemic and we found no trend towards more smoking or drinking, but about third of participants reported an increased sedentary behavior or having refrained from medical consultation. Increased TV consumption is here, in this extreme situation of the pandemic, probably also a marker of increased need for information.

## Changes in QOL

One may think that the situation during the lockdown was hard on the QOL, particularly for this high age group. We thus asked participants whether they perceived a change in QOL (better, same, worse) compared to Feb 1st, 2020. For the 1,850 participants, we found a clear trend towards a perceived worse QOL (38% worse, 0.3% better; Table 4), more pronounced among women compared to men independent of education and living alone (41% and 36%, respectively; model-II OR = 1.34, P = 0.0008; **Supplementary Table 2A**). A further subgroup with higher susceptibility to perceive a worse QOL were those with higher education (additional 5 years of education: model-II OR = 1.36, P < 0.001; **Supplementary Table 2A**), but not higher age or living alone. When adding “refraining from medical consultation”, “more TV consumption” and “perceived decrease in physical activity” as covariates to the model, these factors increased the odds of worse QOL independently (OR = 1.50, 2.38, 2.50, respectively; P < = 0.001); this indicates that the individuals who refrained from medical consultation, increased TV consumption or decreased physical activity overlapped with those having perceived a deteriorated QOL.

While the report of a perceived worsening of QOL is a noteworthy feeling of the participant, we were also interested in the difference of QOL scores reported at survey versus prior visit (restricting to 524 participants with prior visit < 1 year before lockdown): we found a pattern for the QOL score differences that was consistent with the perceived change, but a median difference of 0.0 QOL scores (Fig. 4C, **Supplementary Table 3**). We found no association with any of the investigated covariates.

## Sensitivity analyses

Immediate responders might have been more under the direct impression of the lockdown than late responders. When restricting to the 1,734 immediate responders, we found the same results with respect to living situation, symptoms, changes in lifestyle and QOL (**Supplementary Table 4A-C**).

## More about COVID-19 risk groups

We were interested in whether individuals at increased risk for severe COVID-19 according to CDC[3] (risk group I), only at possible risk (risk group II), or no risk differed with regard to outside contacts (i.e. potential exposure), refraining from medical consultation (despite having these medical conditions), or lifestyle change. We did not observe any notable differences (**Supplementary Table 5**; model-III P > = 0.05 for covariate “at risk yes/no”, **Supplementary Table 2A&B**). We did observe a decreased QOL score for those at risk (median score = 70, 75, 80 for risk group I, II, no risk, respectively, **Supplementary Table 5**;

model III: -5.2 score points,  $P < 0.001$ , **Supplementary Table 2C**), which is probably due to the severe medical conditions of these individuals. However, there was no difference between risk groups in the proportion of perceived or quantified QOL change (**Supplementary Table 5**; model-III  $P \geq 0.05$ , **Supplementary Table 2A&B**). Notably, the extent of awareness among participants to be at increased risk is unclear.

Finally, recent literature suggests a protective role of blood group zero for COVID-19.[22–24] We coded blood groups O, A, B, AB via genetic data in the *ABO* gene and found blood group zero in 35% of 738 AugUR-1 participants, but only 31% among the 114 individual who had died since the prior visit. As we expect no more than one COVID-19 related death among AugUR cohort participants, this would be in line with a protective role of blood group O for all-cause death, as reported previously in centenarians.[25] However, larger sample sizes and more detailed analyses are required for confirmation.

## Discussion

Here we provide key aspects of the spring 2020 lockdown situation for the age-group most threatened by COVID-19 and most targeted by shielding recommendations on the example of 1,850 individuals aged 73–98 living in and near Regensburg, Germany, from the COVID-19 survey of our population-based AugUR cohort.

We found 74% of individuals in our study at increased risk for severe COVID-19, i.e. having at least one of medical conditions listed by the CDC and WHO.[3] This refers to 75% when extrapolated to the German population aged 70+, which is comparable to the 73% for the European population aged 70+ as estimated for a similar list of conditions using large databases from the Global Burden of Diseases, Injuries, and Risk Factors Study. [4] One survey calling random phone numbers reported 80%[26], but with limited control of non-response. Our participants stem from a pre-defined study population with > 80% response to our mailed questionnaire, with medical history assessed through a face-to-face interview, medical exams, and bio-probing at the prior study center visit.[10] The high proportion at risk also underscores the public health relevance: with 13% of the German population aged 70+, this high-risk group accounts for 10% of the overall population.

Most individuals, > 90%, had sustained a lifestyle with outside contacts and potential exposure to SARS-Cov-2. The fact that only few were infected underscores the effectiveness of the shielding strategy. The fact that the four individuals with infection experienced little to no symptoms despite an age as high as 95 years is encouraging. Given the few infected, the 23% reporting any COVID-19 related symptom (“cough”, “respiratory problems”, “fever”, “loss of smell”, or “loss of taste”) might largely reflect the background frequency of these symptoms. Our 70+ surveyed here reported symptoms less frequently than the 4,684 individuals with a negative SARS-CoV-2 test from the German National Cohort, NAKO [27] (population-based study on adults aged 20–69 years from 18 study centers throughout Germany including Regensburg): 14%, 8%, 2%, 2%, 2% in AugUR versus 23%, 11%, 8%, 3%, 3% in the NAKO.[12] Anti-

body measurements would be required to evaluate what part of these symptoms were indicators of a yet un-detected SARS-Cov-2 infection.

Social life changed drastically in spring 2020 due to the lockdown in Bavaria – as in most countries worldwide. It still remains unclear how to protect the elderly and those with accumulated health conditions from severe COVID-19. The self-isolation of individuals at high risk is a conceivable option, but the benefits associated with this measure needs to be weighed against potential harms, such as inflicted lifestyle changes towards a less healthy behavior, or substantial declines in quality of life (QOL). Unfortunately, only few population-based studies focus on older adults and there is limited data on collateral damage induced by lockdown measures.[6] It would also be important to identify subgroups, e.g. defined by demographic factors like age, sex, and education, that are particularly susceptible to unfavorable lifestyle changes, so they could be offered tailored preventive measures.[7] We here provide data on changes in lifestyle and QOL in a survey conducted around the end of the contact restrictions in Bavaria in summer 2020. While we found no trend towards increased smoking or drinking alcohol, ~ 25% of participants perceived their physical activity as decreased, almost 30% had refrained from medical consultations, and ~ 40% perceived a worsening of their QOL. The perceived worsening of the QOL might reflect mental distress or depressive mood, but it can also be the consequence of uncertainties and personal restrictions associated with the COVID-19-pandemic and containment measures. Our findings of decreased physical activity and a lack of trend towards increased smoking and drinking behavior are in line with previous surveys conducted online and/or in different individuals pre/post lockdown.[8, 20, 21, 28] To our knowledge, this is the first report on individuals aged 70 + and their changes in lifestyle or QOL during the spring 2020 lockdown so far.

Decreased physical activity, refraining from medical consultation, and decreased QOL in this high age-group are markers of collateral damage to be taken-into-account when implementing pandemic-related containment measures. For example, it seems important to devise interventions that help maintain regular medical care for older adults - particularly those with medical conditions. To help individuals aged 70 + maintain a physically active lifestyle despite recommendations to stay at home, health promotion programs could develop interventions that encourage and support exercise to be performed at home. We found women and those with higher education to be more susceptible to these changes, but little impact from living alone or age (except for increased TV consumption when living alone and decreased number of alcoholic drinks by increased age), and surprisingly no impact from being in the risk group due to the CDC-listed medical conditions. This might give some indication about specific target groups for preventive measures.

There are several strengths to this study and analyses: (i) this is a population-based study with substantial efforts to minimize non-response, which is underscored by 89% net response. This is superior to using convenience samples with limited control of selection. (ii) Our ascertainment of medical conditions from medical history via face-to-face interview, medical exams and bio-probing from the prior study center visit enabled estimating the proportion at increased risk for severe COVID-19 without relying on self-completion questionnaires. (iii) These previous visits also included assessments of quantified

lifestyle factors and QOL. This enabled comparing pre- and during-pandemic assessments in the very same individuals, which is superior to two surveys before and after in different individuals, and complemented our reports of perceived changes. (iv) Our data provide a reference for individuals aged 70 + also for further COVID-19 related studies in other regions, e.g. hot spot areas or regions with excess COVID-19 related fatality.

The few individuals with infections underscore the relatively modest infection occurrence in the study capture area, but prohibits contrasting their situation or symptoms with those not infected. While studies in hotspot areas can provide better insights into the spread of the virus and risk factors for infection, studies covering regions of average epidemic history are required to learn about the situation of the general population. A limitation is the relying on routine targeted testing, but we had no systematic SARS-Cov-2 or anti-body test implemented and might thus have missed asymptomatic infected. We believe this bias is small, since our observed number of infected meets expectations from health authority data (Landesamt für Gesundheit und Lebensmittelsicherheit). It needs to be noted that our cohort is, by design, [10] on the mobile elderly and thus not a full account of the population aged 70+. Our results are generalizable to individuals that need to be considered “survivors”, not only having exceeded the age of 70, but also – with birth years 1922 to 1947 - having grown up in between-wars and post-war Germany.

In summary, three quarter of those aged 70 + in the German population are at increased risk for severe COVID-19 – and thus for COVID-19 related death as long as medication is evasive. Most individuals at that age sustained a lifestyle with some out-sides contacts, which documents a modest approach towards social isolation, but also potential exposure to SARS-Cov-2. The majority of individuals, i.e. 2/3rd, report no change in sedentary behavior, smoking or alcohol drinking nor a change in QOL. Less physical activity, refraining from medical appointments and a perceived deterioration of the QOL in approximately 1/3rd of individuals need to be weighed in when accommodating shielding strategies. Our presented data will help understand the situation of this vulnerable group in the pandemic.

## Abbreviations

AugUR Age-related diseases: understanding genetic and non-genetic influences - a study at the University of Regensburg

BMI Body mass index

CDC Center of Disease Control

COVID-19 Coronavirus disease 2019

DNA Deoxyribonucleic acid

eGFR Estimated glomerular filtration rate

HbA1c Glycated hemoglobin A1c

i.e. Id est

NAKO German National Cohort study

QOL Quality of life

SARS-CoV-2 Severe Acute Respiratory Syndrome Coronavirus 2

T2DM Type 2 diabetes mellitus

## **Declarations**

### **Ethics approval and consent to participate**

The AugUR study was approved by the Ethics Committee of the University of Regensburg, Germany (vote 12-101-0258). The study complies with the 1964 Helsinki declaration and its later amendments. All participants provided informed written consent.

### **Consent to publish**

Not applicable.

### **Availability of data and materials**

The datasets generated and analysed during the current study are not publicly available due to data privacy of study participants, but are available from the corresponding author on reasonable request.

### **Competing interests**

I. M. H. has received support from Roche Diagnostics for a project in the AugUR study, which is unrelated to this work presented here. All other authors declare that they have no competing interests.

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### **Authors' Contributions**

C.B.: Manuscript writing, statistical analyses

M.E.Z.: Data management, statistical analyses

F.G.: Statistical analyses, manuscript writing

H.K.: Interpreting results, manuscript writing

J.L.: Manuscript writing

K.J.S.: Data management, statistical analyses, manuscript writing

I.M.H.: Project initiation and supervision, manuscript writing, interpreting results

All authors have read and approved the manuscript.

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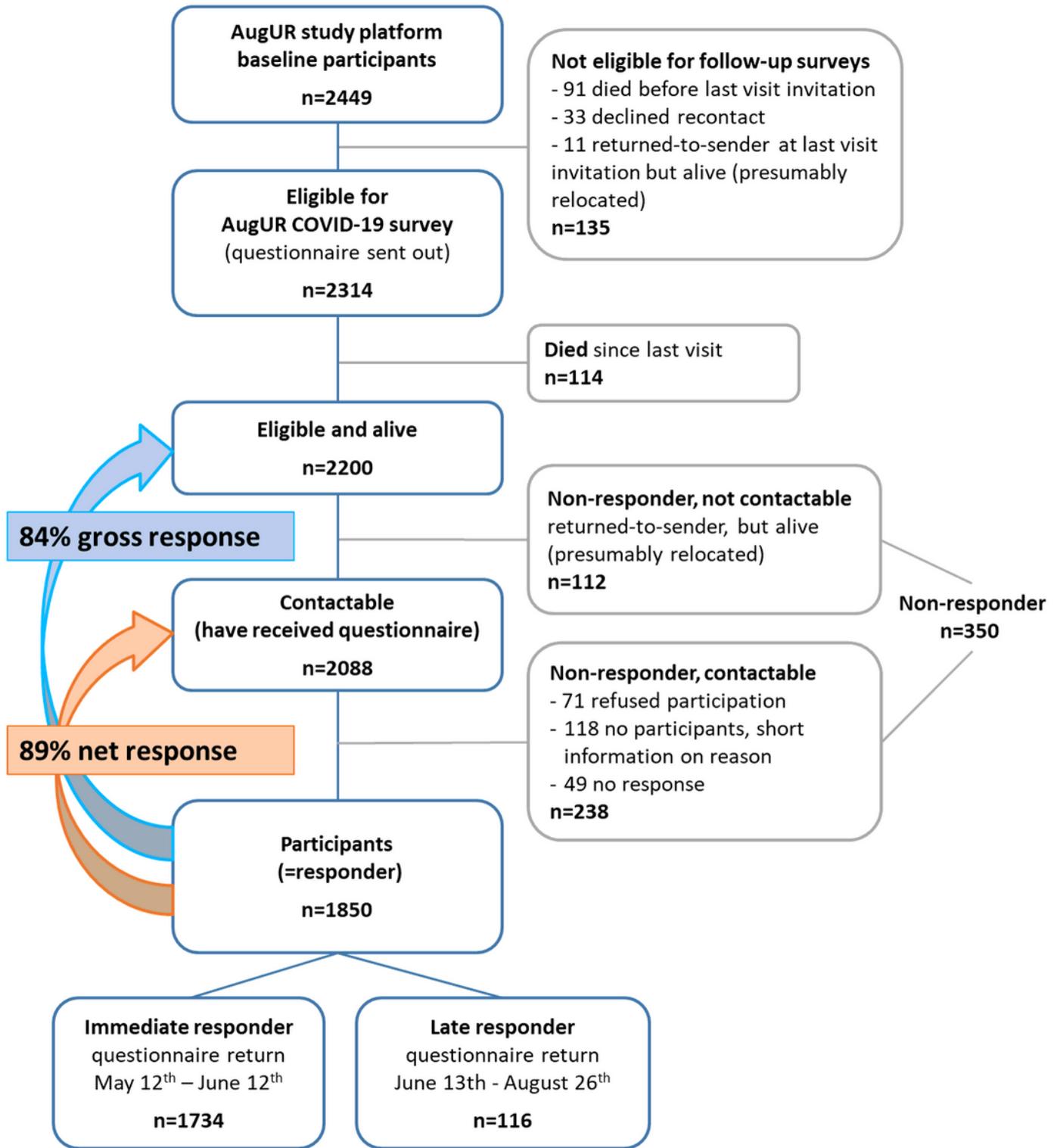
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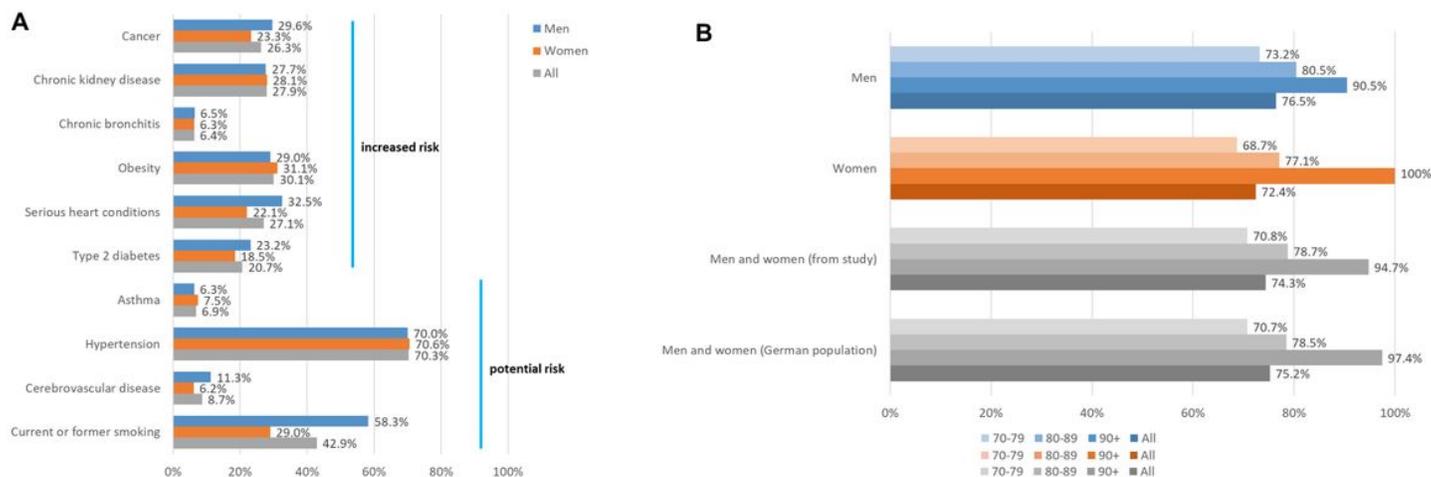
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## Figures



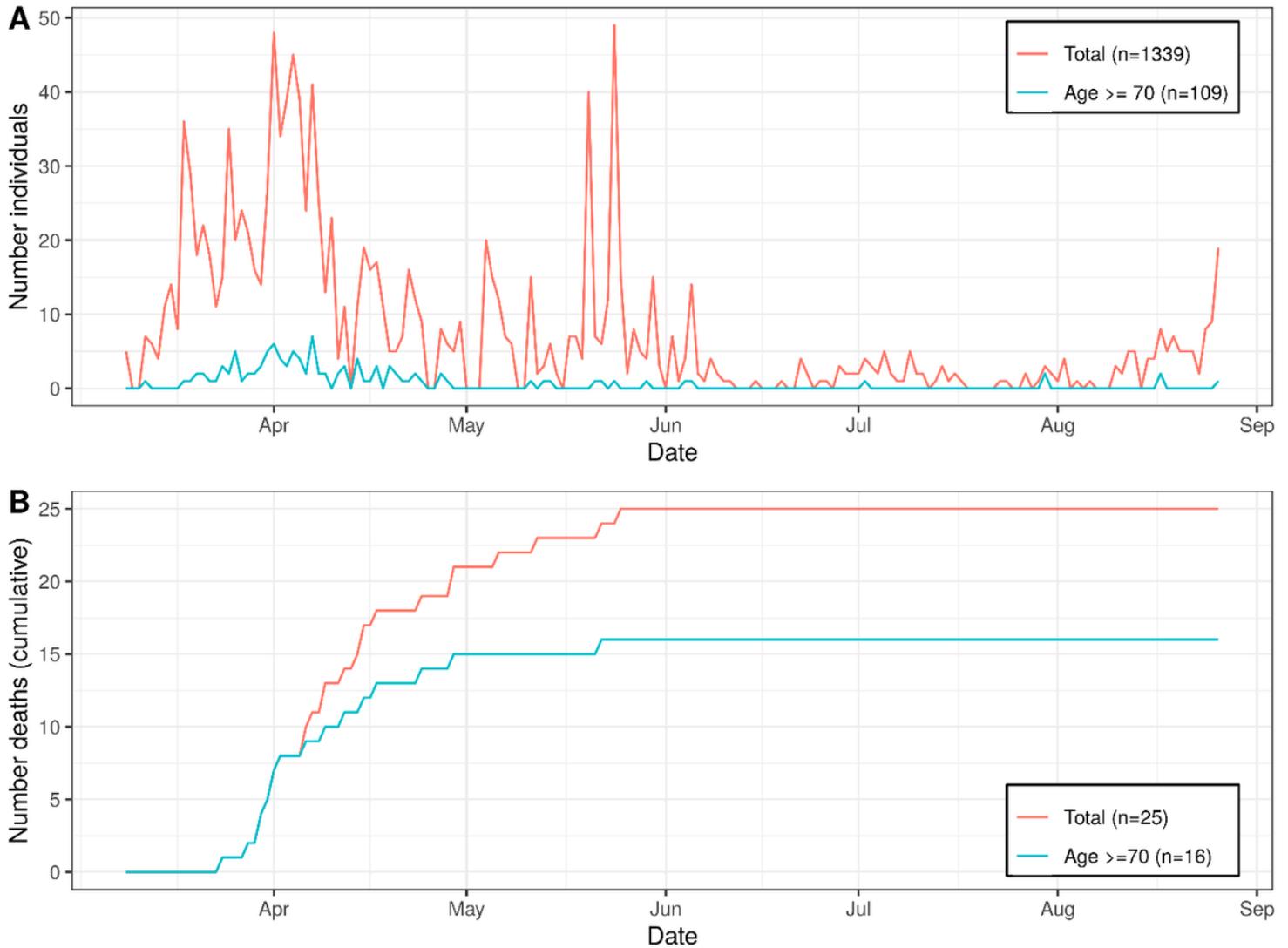
**Figure 1**

Flow chart of participant inclusion and response. The AugUR study platform included 2449 individuals aged 70+, all of who had given informed consent to participate in AugUR research investigations. The questionnaire was sent out to all, for whom we had no adverse information on survival, contactability, or willingness to participate.



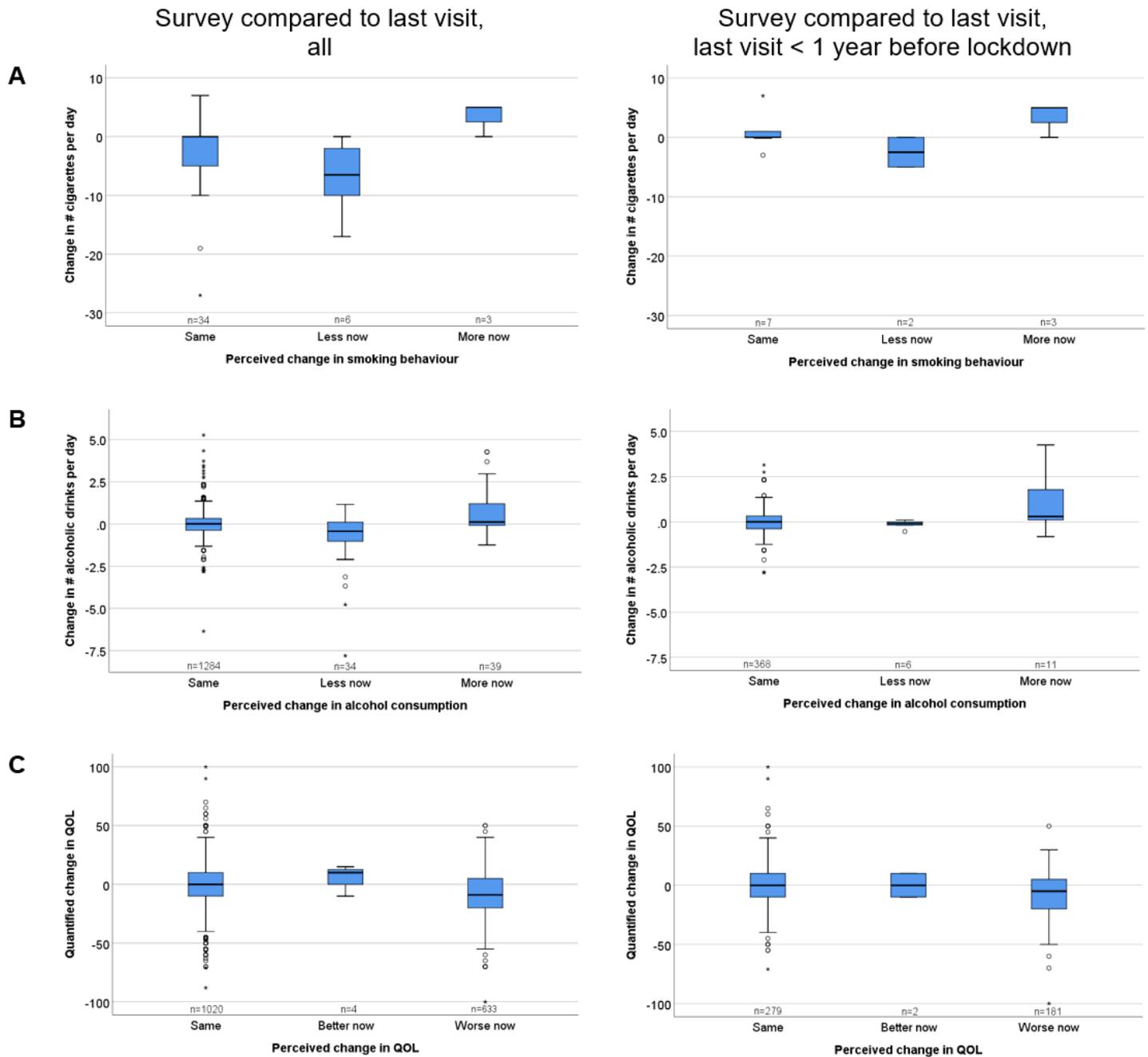
**Figure 2**

Frequency of individuals at increased risk for severe COVID-19. Shown are frequencies of individuals with medical conditions assessed during the prior study center visit: (A) medical conditions listed to increase or possibly increase risk for severe COVID-19[3] among the 1850 participants, (B) having at least one condition listed to increase risk (cancer, chronic kidney disease, chronic bronchitis, obesity, serious heart conditions, type 2 diabetes)[3] by 10-year age-groups and sex (study frequencies, used to compute the extrapolated frequencies for the German population 70+, blue and orange), men&women combined by age-group and all combined (study-frequencies and extrapolated to German population aged 70+, gray).



**Figure 3**

The epidemic situation in the study capture area over time for all inhabitants and those aged 70+. Shown are numbers of SARS-CoV-2 infections and COVID-19 related deaths in the study area (city and county of Regensburg) as reported by health authorities: (A) number of newly reported infected per day for the survey observation period (Feb 1st to Aug 26th, 2020), (B) cumulative number of deaths. Those aged 70+ comprise 8% of inhabitants and 64% of COVID-19 related deaths. Data is provided by the Bavarian Food and Health Safety Authority (Landesamt für Gesundheit und Lebensmittelsicherheit).



**Figure 4**

Distribution of quantified lifestyle factors and QOL. By category of perceived change reported at survey (same, less/better now, more/worse now), we quantified the difference of lifestyle parameters at survey compared to prior visit (April 2016 – March 2020,  $n=1850$ , mean time = 1.76 years,  $SD=0.93$ ; left column) and restricted to those with prior visit < 1 year before lockdown (March 2019 – March 2020,  $n=524$ ). Distributions are shown for individuals with data available on perceived change and quantified difference. Shown are (A) difference in number of cigarettes smoked daily (among current smokers at survey or prior visit,  $n=43$  or  $13$ , respectively), (B) difference in number of alcoholic drinks consumed daily (among alcohol consumers at survey or prior visit,  $n=1357$  or  $385$ , respectively), (C) difference in QOL score ( $n=1657$  or  $462$ , respectively).

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [AppendixAugURquestionnaireenglish.pdf](#)
- [AugURCOVID19SupplementaryMaterial20201110.pdf](#)