

memo

COVID-19-EPIDEMIC :

Social and economic
vulnerable groups during the
COVID-19 pandemic
– a rapid review

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Responsible	Camilla Stoltenberg, Director General
Authors	Vigdis Lauvrak, Senior advisor, Lene Juvet , Director. Norwegian Institute of Public Health
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Key messages

This rapid review is mainly based on searching the Norwegian Institute of Public Health's systematic living map on COVID-19 related evidence. One author assessed the relevance of each reference based on titles and abstracts. Both Authors' included studies based on full-text examinations and summarized the findings. We did not perform a formal quality assessment of included studies, nor did we grade the certainty of evidence. Results should be interpreted with caution. In the current situation, there is an urgent need for identifying the most important evidence quickly. Hence, we opted for this rapid approach despite an inherent risk of overlooking key evidence or making misguided judgements.

The aim of this rapid review is to identify any reported associations between increased severity of COVID-19 disease, and infection rates in populations postulated to be socially or economic vulnerable. We also looked for studies reporting on the effects of transmission control measures in vulnerable groups, and interventions specifically aimed at vulnerable groups. Vulnerable groups covered by this review are persons that may have socially and economic challenges including migrants/immigrants, homeless, persons with disabilities (physical or mental), persons with dementia, incarcerated persons, persons with psychological or psychiatric disorders, and persons with problematic substance or alcohol use.

We identified 434 titles from which 117 were included in full text. Based on full-text examinations, one systematic review and 32 primary studies were included. Except for one Swedish study of COVID-19 associated death rates and a global model on infection rates, we found no studies reporting data from a Scandinavian country.

We identified seven studies, including the Swedish study, suggestive of low income, poverty, living in deprived areas, and certain ethnic backgrounds to be associated with an increased risk of COVID-19 related death compared to the general population. Furthermore, poor people (one model study), incarcerated persons (two studies) and homeless persons in shelters (three studies) may have an increased risk of SARS-CoV-2 infection or COVID-19 disease compared to the general population.

We found evidence from two studies that persons with mental illness had fewer admissions to psychiatric hospital wards during the pandemic. In contrast to this, there is evidence of higher vulnerability with regard to anxiety, depression and stress in persons with psychiatric disorders. We found single studies of MS patients,

Parkinson patients, and parents of children with autism spectre disorder and parents of children with ADHD that reported anxiety, and mood to be negatively affected by the pandemic.

We found almost no research-based evidence (so far) of health related effects of interventions aimed to support socially or economic vulnerable groups exposed to the COVID-19 pandemic or transmission control measures.

In conclusion, there is very little research-based evidence related to socially and economic vulnerable groups during the COVID-19 pandemic and the transferability of finding to the Norwegian context is limited.

Hovedfunn (Norwegian)

Resultatene som presenteres i denne hurtigoversikten er basert på søk i Folkehelseinstituttets Levende kart over covid-19-forskning. Én forsker gikk gjennom søketreffet. To forskere valgte ut og oppsummerte resultatene. Vi vurderte ikke kvaliteten til de inkluderte studiene, og vi vurderte heller ikke kvaliteten til dokumentasjonen. Resultatene fra denne hurtigoversikten må derfor tolkes med varsomhet. I den nåværende situasjonen er det et presserende behov for å få fram forskningsresultatene raskt, så vi valgte denne raske tilnærmingen til tross for en iboende risiko for å for at vi kan ha oversett viktig dokumentasjon eller kan ha gjort feilvurderinger underveis.

Hensikten med denne hurtigoversikten er å identifisere og oppsummere om det er noen assosiasjon mellom økt infeksjon eller alvorlighet av covid-19 sykdom i sosialt eller økonomisk sårbare eller utsatte grupper i samfunnet. Vi så også etter studier som rapportere om effekt av pandemien og smittevernstiltak i disse gruppene, og vi så etter studier som rapporterte om effekt av tiltak for disse grupper. Sårbare eller utsatte grupper omfattet av denne rapporten er personer som kan ha sosiale eller økonomiske utfordringer inkludert migranter, hjemløse, personer med funksjonshemming (mentale eller fysiske), personer med demens, personer med psykiske sykdommer og personer med problematisk rusmiddelbruk.

Vi identifiserte 430 titler hvor vi leste 117 i fulltekst. Basert på fulltekst gjennomgang inkluderte vi en systematisk oversikt om psykosider under pandemien og 32 primærstudier. Med unntak av én svensk studie om covid-19 relatert død og sosio-økonomiske variabler, og én studie som modellerte globale infeksjonsrater, fant vi ingen studier fra skandinaviske land.

Vi inkluderte syv studier, inkludert den svenske, som gir indikasjon for at lav inntekt, fattigdom, å leve i dårlig stilte områder, og noen personer fra etniske bakgrunner er assosiert med økt risiko for covid-19 relatert død sammenliknet med den generelle befolkningen. Videre, fant vi studier på personer i fengsel (2 studier) og hjemløse i herberger (3 studier) som indikerer at disse kan ha økt risiko for SARS-CoV-2 infeksjon eller covid-19 sykdom.

To studier viste at det var færre innleggelses i psykiatriske sykehus avdelinger. I kontrast til dette, viste noen studier til høyere sårbarhet med hensyn på angst, depresjoner og stress under pandemien hos personer med psykisk sykdom sammenliknet

med friske personer. Vi fant også enkeltstudier som rapportere om personer med MS, Parkinson sykdom, barn som har autismspekter-diagnoser eller barn som har ADHD, som rapporterte at angst, humør og stress var negativt påvirket av pandemien.

Vi fant nesten ingen forskningsbasert dokumentasjon av helserelaterte effekter av intervensjoner som spesifikt er rettet mot sosiale eller økonomisk sårbare eller utsatte grupper under covid-19 pandemien.

For å konkludere: Det er svært lite forskningsbasert kunnskap om sosial og økonomisk sårbare grupper under covid-19 pandemien og funnene har begrenset overførbarhet til norske forhold.

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Problem statement

In connection to the ongoing COVID-19 pandemic, it is important to gather information about how potentially vulnerable groups are affected by the disease and by transmission control measures. In addition we were interested to see if any particular interventions have been reported to have a positive effect for vulnerable groups. The SARS-CoV-2 outbreak team at the Norwegian Institute of Public Health has asked us to conduct a rapid review of the existing research related to the pandemic and those (living) in socially or economic vulnerable situations.

Introduction

In relation to the Norwegian Institute of Public Health's role in handling the COVID-19 epidemic, we have been asked to produce a rapid summary of the available research on health effects amongst vulnerable population groups during the COVID-19 pandemic. It is widely recognised that the challenges that individuals in socially and economically vulnerable situations already face in their daily lives may be substantially exacerbated by potentially increased risk of infection and the various restrictions and transmission control measures imposed by national authorities. In a recent survey protocol, the European Centre of Disease Control (ECDC) (1) vulnerable population were described as:

- persons that are medically vulnerable (the elderly and those with underlying diseases)
- persons living in socially and economically vulnerable situations.

Several other sources also define vulnerable groups in similar ways (2-5). In this review we have adapted the ECDC survey division of vulnerable groups, and focused on people (living) in socially and economically vulnerable situations. This includes migrants, homeless, persons with disabilities, persons with psychiatric disorders, persons with dementia, persons with problematic substance use as well as persons with other socially or economic constraints.

A recent rapid review from NIPH has summarised risks related to COVID-19 (6) and a rapid review on risks for health care workers is ongoing work at NIPH. There has also been substantial number of editorials and comments in media and scientific fora, amongst others (7-11), addressing socially and economic vulnerable groups. However, we are not aware of any (rapid) systematic reviews specifically addressing health related outcomes in persons (living) in socially and economic vulnerable situations during the COVID-19 pandemic. This rapid review aims to identify research based evidence with regard to the health of these groups, produced and published during the COVID-19 pandemic. We have not searched for or assessed literature regarding the health, vulnerability or risks of these groups of persons in other situations.

Methods

The main objective of this rapid review is to assess the evidence related to the health of socially and economic vulnerable groups during the COVID-19 pandemic.

Literature search

We selected studies for this rapid systematic review by utilizing The Norwegian Institute of Public Health's (NIPH's) systematic and living map on COVID-19 publications (12). The search was conducted on the 25th of May 2020. The searched map is the visualization of a database of 17,000 screened articles of relevance for COVID 19. Displayed on the map are studies with primary, secondary, or modelled data that have been categorized by two researchers independently according to the population of interest (41 possible populations). Details of the search is provided in [Appendix 1 –literature search](#). In addition, reference lists of selected reviews and editorials were inspected and one recent published record (13) identified through other sources was included.

Selection criteria

We selected studies following the below described criteria:

Population: Persons (living) in social or economic vulnerable situations including: persons with economic or social constraints, migrants, homeless, persons with disabilities (physical or mental), persons with dementia, incarcerated persons, persons with psychological disorders, and persons with problematic substance use.

Exposure/Interventions:

- 1) The COVID- 19 pandemic
- 2) Interventions for transmission control during the COVID-19 pandemic
- 3) Interventions specifically aimed at securing the health/reducing health related risks of the selected population

Control: Non-pandemic situation, but no restriction was imposed on the included studies to have a control group

Outcomes: Health related outcomes

Study design: Systematic (rapid) reviews, any primary study fulfilling population, exposure/intervention and outcome criteria including case series and case-reports. Only studies with English language full-text available were included

We excluded: Records not considered to be primary studies, studies that did not report any health related outcomes, studies already included in the medical risk-assessment rapid review (6). We also checked if studies involving surveys and models reported associations with factors or variables of social or economic nature. Unless this was done, potentially vulnerable populations not predefined in this review (socially or economically vulnerable¹) were excluded. Also, studies not found in full-text or with a non-English language full-text only, were excluded.

Selection and assessment

First one author (VL) included studies based on titles and abstracts, then another author (LJ) checked the included titles and abstracts. The Authors' divided the list of included records in two, and one of the Authors' (VL or LJ) assessed the relevance of each full-text paper and then summarized studies fulfilling the inclusion criteria. One author (VL) checked all summaries and provided a draft of the review, the other author (LJ) read the draft and provided feedback on the review.

We have not performed a formal quality assessment of included papers, nor graded the certainty of evidence. The results should therefore be interpreted with caution.

Internal peer review

A group of researchers (see acknowledgement) affiliated within NIPH read and provided feedback on the draft report before publication.

¹ This implies that unless the study was analysing association with social or economic factors, the following were excluded: Studies of the population in general, pregnant women in general, persons with increased medical risks, persons with specified diseases not classifying as disabling diseases, elderly in general, students in general, children and adolescents in general, and health workers.

Results

The search resulted in 467 unique records. Of these, 117 records of potentially relevant primary studies were eligible for full-text retrieval based on title and abstract screening (step 1). Following full-text screening we ended up including 30 primary studies (step 2). Reference lists of the selected reviews and editorials were inspected leading to inclusion of two additional studies fulfilling our inclusion criteria and one record was provided by other sources. The total number of included primary studies was 32.

A total of 24 records of potentially relevant reviews or editorials eligible for full-text retrieval based on title and abstract screening (step 1). One systematic review was included as relevant, the review had included two relevant studies for this report.

Summary of included studies

Systematic reviews

We identified one rapid systematic review on pandemics and psychosis (14). The inclusion criteria of the review were studies that reported primary research; included participants that had a psychotic disorder (e.g., first-episode psychosis, schizophrenia, bipolar disorder) or were considered to be at high risk of psychosis. The Authors' had included 14 studies, two of which were performed during the COVID-19 pandemic. The rapid review authors included 14 primary studies, only two studies were from the COVID-19 pandemic. This was one observational study of patients attending a psychiatric hospital (30) and a single case report (31) of incident cases of psychosis in people living in a geographical area where COVID-19 was prevalent (potential effect of the pandemic). The observational study fulfilled our inclusion criteria (the main findings described below). The data were published on a Chinese open science platform not included in the NIPH research map and not available in full-text to us. The single case report was a report from Malaysia, of an acute episode of psychosis seemingly precipitated by fear and distress associated with COVID-19. The case report did not fulfil our inclusion criteria.

Based on all 14 studies, the Authors' main findings are: “..that there is moderate (if low quality) evidence to suggest a small but important number of patients will develop coronavirus related psychosis that is likely associated with steroid or viral exposure, pre-existing vulnerability and psychosocial stress. Psychosis in patients with coronavirus may present a major challenge and potential infection control risk to clinical teams...” (14).

Primary studies

We included 32 primary studies after full-text inspection. Several of the included studies were pre-prints. We divided the studies in three main groups according to what research question they were included for. The number of studies in the main groups and range of sample sizes within each population sub-group are described in the table below.

Table 1. Number of included studies within each population group

Research question (Number of studies)	Population studied (Number of studies)	N-range
Studies reporting on incidence rates or severity in vulnerable populations (14)	Homeless (3)	195 to 408
	Incarcerated patients (2)	4893 and 22 489
	Patients with TB and COVID-19 including migrants (1)	69 (43 migrants)
	General population in studies providing hazard ratios or correlations to socially or economic relevant factors/variables (10)	From 1276 in a single hospital to 17,4 millions in one country (5683 deaths attributed to COVID-19) and a global model of 29 economies
Studies reporting on effects of the COVID-19 pandemic or transmission control measures in (potentially) vulnerable groups (19)	Persons with psychiatric disorders (6)	1 to 23 124
	Patients with MS (1)	33
	Patients with Parkinsons disease (1)	137
	Children autism spectrum disorder (1)	85 parents
	Adults with one or more chronic condition (29.3% below poverty level) (1)	630
	Children with ADHD (1)	241 parents
	Persons of the more general population that could be vulnerable with regard to psychiatric adverse effects (3)	2 to 3000
Studies reporting on effect of interventions aimed at vulnerable groups	Dementia (1)	93
	Incarcerated (1) (also included for first question)	-

N= number of patients

The included studies were from: USA (11), China (6) The UK (5), Italy (3), Spain (1), Iran (2), Germany (1), Serbia (1), Sweden (1), and one was global (29 economies). Except the Swedish study and the global study, we found no data from Norway or any other Scandinavian country.

Severity of COVID-19 or infection rates

We included 16 studies as relevant for answering questions related to association between infection rates or severity of COVID-19 in groups potentially vulnerable due to socially or economic situations.

Ten studies were reporting incidence rates or severity of COVID-19 disease in the general population and associations between socially or economic vulnerable groups. These are shortly summarized in table 2. Based on various models analysing large datasets, there is evidence that persons with low income, in particular men (13), poor persons (15) or persons living in deprived areas (13, 16-19) have an increased risk of death caused by COVID-19. Most relevant for Norway, one study investigating all 3,135 COVID-19 related deaths in Sweden between March 5th and May 7th 2020 (13), using individual-level survival analysis the study reports that being male, having less disposable income, a lower education level, not being married, and being an immigrant from a low- or middle-income country all independently predict a higher risk of death from COVID-19. Similar data was seen in one study of 5683 hospital deaths attributed to COVID-19 in the UK (16). The same UK study and another UK study (20) also revealed that persons of none-white origin in the UK may have an increased risk of COVID-19 related deaths. This risk seemed to prevail even when adjusted for other factors including deprivation and another risk factor obesity. A similar increased risk was not observed in a smaller study of in-hospital deaths of persons with South Asian (mainly Pakistan) origins at a large University hospital in the UK (21). However, in New York there have also been reports of increased mortality amongst ethnic black and Hispanic, with an association between ethnicity and economic deprivation reported in one study (22) and obesity is reported in another study (23). Notably, the studies do not allow for conclusions with regard to causality.

Table 2 Studies reporting incidence rates or COVID-19 severity related outcomes in the general population, with associations between the health outcomes and vulnerable groups

Included study (reference) Country	Population (N) –Study design	Outcome	Short summary
Aldridge (20) UK	General population in hospital deaths 16,272 deaths	COVID-19 related deaths and ethnicity	The authors used NHS data on patients with a positive COVID-19 test who died in hospitals in England, in separate tables by age group, region, and ethnicity. Main findings: White Irish (SMR 0.52; 95%CI 0.45-0.60) and White British (SMR 0.88; 95%CI 0.86-0.89) ethnic groups continued to have a lower risk of death. Black African (3.24; 95%CI 2.90-3.62), Black Caribbean (2.21; 95%CI 2.02-2.41), Pakistani (3.29; 95%CI 2.96-

Included study (reference) Country	Population (N) –Study design	Outcome	Short summary
			<p>3.64), Bangladeshi (2.41; 95%CI 1.98-2.91) and Indian (1.70; 95%CI 1.56-1.85) minority ethnic groups continued to have a higher risk of death</p> <p>Authors' Conclusions: Several BAME groups have a higher risk of death from COVID-19 and that regional differences in ethnicity explains some but not all of the differences between ethnic groups. After accounting for geographical region SMRs reduced, but there remained large differences in SMRs between ethnic groups - White British and White Other have lower SMRs, but Bangladeshi, Pakistani, Indian, Black African and Black Caribbean ethnic groups all have substantially increased SMRs.</p>
Banik(15) 29 Economies globally spread	General population (NA) - Model and database	Fatality rates and associate factors	<p>The study has collected a broad range of datasets within and across countries and is modelling how different factors may explain intra and cross-country difference in fatality rates.</p> <p>Main findings: Public health system, population age structure and interactions between factors such as poverty level and BCG vaccination provide interesting insights into the complex interplay of factors.</p> <p>Authors' conclusion: The analysis suggests that poor citizens' access to the public healthcare system are worse in many countries irrespective of whether they are developed or developing countries.</p>
Drefahl (13) Sweden	Swedish general population aged 21 and above (All 3135 COVID-19 related deaths between Jan 5 th and March 7 th)	Mortality rate and socio economic factors	<p>Cox proportional hazard regression models were estimated to obtain hazard ratios for the risk of dying from COVID-19</p> <p>Main findings: Being male, having less disposable income, a lower education level, not being married, and being an immigrant from a low- or middle-income country all independently predict a higher risk of death from COVID-19. Among men, the gradient is most pronounced with individuals in the first and second tertiles of disposable income experiencing approximately 80% (HRQ1: 1.76; 95% CI: 1.49, 2.09) and 50% (HRQ2: 1.53; 95% CI: 1.30, 1.80) higher mortality, respectively, relative to those in the top tertile. Immigrants from low and middle income countries displayed approximately 2.5 times higher mortality among men (HRMen: 2.56; 95% CI: 2.18, 3.01) and more than 1.5 times higher among women (HRWomen: 1.66; 95% CI: 1.32, 2.09) as compared to those born in Sweden.</p> <p>Authors' conclusion: The main message is that while COVID-19 does not discriminate, the interaction of the virus and its social environment exerts unequal burden on the most disadvantaged members of society.</p>

Included study (reference) Country	Population (N) –Study design	Outcome	Short summary
El Chaar (23) USA	Inhabitants of selected New York City Boroughs (80 167 COVID-19 caes) – Registry analysis	Ethnicity, mortality rate and obesity	In this study age-adjusted COVID-19–related mortality rates of different ethnic groups were obtained and cross-compared with historic community health data on obesity rates. Main findings: The Hispanic and black populations had the highest age-adjusted (COVID-19 related) mortality rates per 100,000 compared with the other ethnic groups (22.8 and 19.8, respectively). Asians had the lowest mortality rate at 8.4%. The Hispanic and black populations also had higher obesity rates than the other ethnic groups (35.4% and 25.7%, respectively; P<.05) Authors' conclusion: Obesity may be playing a role in the high incidence of mortality in certain ethnic groups
Iacobucci (17) UK	General population (90232 deaths) -Registry data	Prevalence; Infection rates; Death rates	This study published figures showing deaths between 1 March and 17 April 2020 involving COVID-19 by local areas and deprivation from UK's Office for National Statistics. Main findings: Around a fifth (20 283 (22%)) of overall deaths were COVID-19 related. The age standardised mortality rate of deaths involving COVID-19 in the most deprived areas of England was 55.1 deaths per 100 000 compared with 25.3 deaths per 100 000 population in the least deprived areas. London has had the highest proportion of covid-19 related deaths Authors' conclusion: An increased understanding of the relationship between deaths from the virus and the circumstances in which people live is of crucial importance to ensure that unjust and avoidable differences in peoples' health do not become part of the crisis.
Mollalo (18) USA	The first 90 days confirmed cases of Covid-19 in the USA (675 000). - Modelling study	Socioeconomic, behavioural, topographic, and demographic factors correlating with incidence rate	The authors used Geographic Information System (GIS) mapping of incidence rates (dependent variable) and correlated these to 35 socioeconomic, behavioural, topographic, and demographic factors as explanatory variables, three global models: ordinary least squares (OLS), spatial lag model (SLM), spatial error model (SEM), and two local models: geographically weighted regression (GWR), and multiscale GWR (MGWR) to investigate correlations. Main findings/Authors' conclusions: Four variables, income inequality, median household income, the percentage of nurse practitioners, and the percentage of the black female population (to the total female population) could explain relatively high disease incidence in the continental USA. MGWR was shown to better explain the spatial context of COVID-19 incidence rates.
Santorelli (21) UK	Hospitalized patients in a single large hospital (1276 deaths) -Cohort	Death rates	This study has investigated deaths in patients who were tested for COVID-19 between 18th March to 27th April 2020 in a large teaching hospital in Bradford, a city with a diverse population of which 24.9% are of South Asian (20.4% Pakistani) origin. Mortality were analysed by ethnic group. Main findings: In total, 812 patients tested negative (63.6%) and 464 positives (36.4%). The overall mortality rate in those testing positive for COVID-19 was 23.5% versus 8.9 for those testing negative with similar symptoms. The age-adjusted risk of dying from COVID-19 was

Included study (reference) Country	Population (N) –Study design	Outcome	Short summary
			slightly lower in South Asian compared to White British patients (RR =0.87, 95% CI: 0.41 to 1.84). Authors' conclusion: Risk of death for infected individuals is higher compared to patients with similar symptoms with no COVID-19 infection. This increased risk is not greater in people of South Asian (mainly Pakistani) ethnicity. These data are only for hospitalised patients, and do not account for patients who subsequently died after the date of analysis.
Wadhera (22) USA	Inhabitants of five New York city Boroughs -Registry data analysis	Ethnicity, mortality rate and Socio demographic variables	Main Findings: The number of patients with COVID-19 who were hospitalized per 100 000 population was highest in the Bronx (634) and lowest in Manhattan (331). The number of deaths related to COVID-19 per 100 000 population was also highest in the Bronx (224) and lowest in Manhattan (122). The proportion of older adults (aged ≥65 years) was lowest in the Bronx (12.8%) and highest in Manhattan (16.5%), whereas the proportion of black or African American persons was highest in the Bronx (38.3%) and lowest in Staten Island (11.5%). Household median income was lowest in the Bronx (\$38 467) as was the proportion of persons with a bachelor's degree or higher (20.7%). Authors' conclusion: The Bronx, which has the highest proportion of racial/ethnic minorities, the most persons living in poverty, and the lowest levels of educational attainment had higher rates of hospitalization and death related to COVID-19 than the other 4 boroughs.
Williamson (16)UK	General population (17,4 millions, 11% Non-white ethnicity, 5683 hospital deaths attributed to COVID-19) - Cohort study	Factors associated with Covid-19 Hospital deaths	The authors used Cox regression to generate hazard ratios (HR) using the new OpenSAFELY analytics platform (NHS England): Covariates included age, sex, health risks, a large number of disease groups, as well as deprivation (measured by Index of Multiple Deprivation (IMD) based on post code) and self reported ethnicity grouped into White, Black, Asian or Asian British, Mixed, or Other. Main findings/Authors' conclusions: Early data from the COVID-19 pandemic suggest that that HR fully adjusted was increased for: <ul style="list-style-type: none"> • Increasing age compared to those at 50 to 59 (60 - <70 years = 2.09 (1.84-2.38); 70-< 80 years = 4.77 (4.23-5.38); 80 ->years = 12.64 (11.19- 14.28) • Male gender compared to general population (1.99, 1.88-2.10) • Obesity compared to normal weight (BMI=>40) (2.27 (1.99-2.58) • Black, Asian/Asian British and mixed ethnicities compared to white (1.62-1.71) • Deprivation (Most deprived quintile (1.75 (1.60-1.91) In addition co-morbidities were found to be risk factors (data not extracted for this review).
Wise (19)(UK	General population (NA) -Comments on	Age adjusted death rates relative to occupation and gender	This record represents a commentary on data from Office for National Statistics in England. Main findings/Authors' conclusions: Men working in the lowest skilled occupations such as construction workers and cleaners had the highest rates of death involving covid-19 with 21.4 deaths per 100 000. This is more than

Included study (reference) Country	Population (N) –Study design	Outcome	Short summary
	National statistics		double the average for working-age males of just under 10 deaths per 100 000. The rate of death among healthcare workers was 10.2 deaths per 100 000 males and 4.8 deaths per 100 000 females. The factors behind these observations cannot be explained by occupational exposure (to SARS-CoV-2) alone

Six studies reported infection rates or severity of COVID-19 in individual groups. These studies are summarized in table 3. Three studies from US revealed that homeless persons seeking accommodations in shelters (24-26) and two studies from the US on incarcerated persons (27, 28) revealed that these groups may have an increased risk of infection compared to the general population.

A small Italian study (29) reported on persons with tuberculosis co-infected with SARS-Cov-2. Of these 43/69 were migrants. The authors conclude that migrants in this group had lower mortality compared to non-migrants, probably because of their younger age and lower number of co-morbidities.

It should be noted that there might be low transferability of findings to the Norwegian context. In particular, Norwegian prisons are very differently organised from prisons in the USA in particular with regard to small spaces shared over long times.

Table 3 Studies reporting on infection rates, risk rates or severity in specific populations

Included study/ Country (alphabetically)	Population (N) –Study design	Outcome	Short summary
Baggett (24) USA	Homeless, above 18 year residing in a homeless shelter (408). –Case series	Infection rate; Symptoms	Boston Health Care for the Homeless Program (BHCHP) rolled out a coronavirus disease 2019 (COVID-19) response strategy that included respiratory symptom screening at shelter front doors and testing for SARS-Cov-2 by PCR. Main findings: Of the screened (408), 36% were positive and 88% were asymptomatic. The Authors' conclusion: The positivity rate amongst homeless is high, but those testing positive are mostly asymptomatic. It is important to test these vulnerable individuals.
Mosites(25) USA	Homeless residents in 19 shelters (1192) and staff members (313) –Case series	Incidence rate/prevalence	In late March and early April 2020, public health teams responded to clusters (two or more cases in the preceding 2 weeks) of coronavirus disease 2019 (COVID-19) in residents and staff members from homeless shelters in the US. Main findings: Testing SARS-CoV-2 (PCR) residents revealed 25% positive and staff members revealed 11% positive.

Included study/ Country (alphabetically)	Population (N) –Study de- sign	Outcome	Short summary
			Authors' conclusion: Homelessness poses multiple challenges that can exacerbate and amplify the spread of COVID-19. Testing all persons can facilitate isolation of those who are infected to minimize ongoing transmission in these settings.
Tobolowsky (26) USA	Homeless (195) staff members (38) – Case series	Incidence rate	The study addresses how COVID-19 can spread within and between congregate housing facilities, such as homeless shelters. Main findings: In total, COVID-19 was diagnosed in 35 of 195 (18%) residents and eight of 38 (21%) staff members who received testing at the shelter or were evaluated elsewhere. Authors' conclusion: Interrupting COVID-19 transmission in homeless shelters is challenging. In settings with known COVID-19 outbreaks, assistance with enforcement of shelter-in-place orders, testing of residents and staff members, and prompt isolation of symptomatic or residents with confirmed disease are needed to prevent further transmission in homeless shelters.
Wallace (27) USA	Persons in detention facilities with reported cases of COVID-19 (4893) and facility staff members (2778) – Case series	Death rates	The study reported on COVID-19 in Correctional and Detention Facilities in February–April 2020. Aggregated data on COVID-19 cases were reported to the CDC by 37 of 54 state and territorial health department jurisdictions. Main findings: Among these facilities, COVID-19 was diagnosed in 4,893 incarcerated or detained persons and 2,778 facility staff members, resulting in 88 deaths in incarcerated or detained persons and 15 deaths among staff members. Authors' conclusion: Many facilities face challenges in controlling the spread of SARS-CoV-2, such as crowded dormitories, shared lavatories, limited medical and isolation resources. Prompt identification of COVID-19 cases and consistent application of prevention measures, such as symptom screening and quarantine, are critical to protecting incarcerated and detained persons and staff members.
Wallace(28) USA	Persons in correctional and detention facilities with confirmed COVID-19 (22 489) staff (253) -Cohort/Intervention	Incidence and death rates. Effect of COVID-19 Management, Assessment and Response telephone call (CMAR)	The study reported on COVID-19 in Correctional and Detention Facilities in Louisiana US, February–April 2020. Main findings: During March 25–April 22, 489 laboratory-confirmed COVID-19 cases, including 37 (7.6%) hospitalizations and 10 (2.0%) deaths among incarcerated or detained persons, and 253 cases, including 19 (7.5%) hospitalizations and four (1.6%) deaths among staff members were reported. CMAR telephone assessment by the CDC was a useful tool that helped state and federal public health officials assist multiple correctional and detention facilities to better manage COVID-19 patients and guide control activities to prevent or mitigate transmission. Authors' conclusion: Correctional and detention facilities face unique challenges to the control of infectious diseases such as COVID-19. Preventing and mitigating transmission in these facilities protects the health of staff members and incarcerated and detained persons, and protects members of the nearby communities.

Included study/ Country (alphabetically)	Population (N) -Study de- sign	Outcome	Short summary
Motta (29) Italy	Patients with TB and COVID-19 (69, of which 43 were migrants) -Cohort		This study describes a group of patients who died with TB (active disease or sequelae) and COVID-19 in the two cohorts. Cohort A included 49 patients with TB and COVID-19 from 26 centres in Belgium, Brazil, France, Italy, Russia, Singapore, Spain, and Switzerland, whereas cohort B included 20 cases admitted to a single reference hospital located in Northern Italy. Main findings: Out of 69 patients 43 were migrants, who had a lower mortality compared to non-migrants. Authors' conclusion: TB might not be a major determinant of mortality and migrants had lower mortality, probably because of their younger age and lower number of co-morbidities

Health effects of the pandemic or transmission control measures

We included one rapid systematic review (14) and 17 primary studies relevant for answering questions related to effects of the COVID-19 pandemic or SARS-CoV-2 transmission control measures.

The observational study reported on in the rapid review (14) reported data from 13,783 outpatients attending a Chinese psychiatric hospital in January 2020. The Authors' reported a 25% increase - compared to previous years - in incident cases of schizophrenia in January 2020, which the Authors' attributed to the psychosocial stress and physical distancing measures associated with the COVID-19 outbreak.

We identified eleven studies reported on effects of the pandemic or transmission control in specific groups relevant for this review (see table 4). Of these, six reported outcomes in patients with psychiatric disorders. One of these, an Italian study comparing 23 124 admissions during the pandemic with the same period the year before (32), reported that persons with mental illness had 30% fewer voluntary admissions to psychiatric ward during the pandemic. Similar to this, a Chinese study (33) comparing outpatient visits and admissions of adolescent to 33 psychiatric hospitals (reported a reduction of outpatient visits with 53%, while reduction of inpatient visits was 50%. Another Chinese study (34) comparing 76 psychiatric patients with 109 matched healthy controls reported higher levels of stress and anxiety in the groups of psychiatric patients. One Chinese study (35) comparing 21 patients with suspected COVID-19 and Schizophrenia to 30 patients with suspected COVID-19 without Schizophrenia revealed higher depression and anxiety as well as sleep disturbance in the Schizophrenia group. A case report from Germany (36) reported increased

stress-related episodes of psychosis in a patient with schizophrenia. In an Italian report of two elderly with a history of depressive disorder (37) relapse with strong fear of COVID-19 contraction was reported.

Furthermore, an Iranian study of patients with MS (38), and an Iranian study of patients with Parkinsons disease (39), a Serbian study of parents to children with autism spectrum disorders (ASD) (40) and a Chinese study of parents to children with ADHD (41) all report on self-reported survey data indicative of increased anxiety, and that mood is negatively affected by the pandemic. Interestingly, the study of parents to children with ADHD revealed that symptoms were reduced with longer online study time. However, one American study (42), reported that those with three or more chronic conditions rated the threat of the pandemic as less serious than those with one condition, blacks as less serious than whites, and adults living under poverty level rated the threat as less serious than those with higher income. This reveals a different kind of vulnerability towards these groups possibly taking less precautions to avoid infections.

Table 4 Effects of the COVID-19 pandemic or SARS-CoV-2 transmission control measures in specific vulnerable groups

Included study	Population (N) –Study design	Outcome	Summary
Clerici (32) Italy	Patients admitted to hospital psychiatric wards (23 124) –Study of admission registries	Admission rate mentally health institutions	The study has assessed admission rates to seven General Hospital Psychiatric Wards (GHPWs) located in the Lombardy Region in the 40 days after the start of Coronavirus disease 2019 (COVID-19) epidemic, compared to similar periods of 2020 and 2019. The seven GHPWs care for approximately 1.4 million inhabitants and has a total of 119 beds. Main findings: A decrease of around 30% admissions was seen and was significant for voluntary admissions ($p < 0.001$) but not for involuntary admission ($p = 0.87$). Authors' conclusion: Large-scale pandemics can modify voluntary admission rates to psychiatric wards. It is uncertain whether the lockdown imposed by the government caused the main effect as much as the pandemic itself did.
Cui (33) China	Children and adolescent with mental health problems (33 hospitals)	Outpatient visits, admissions, established isolation wards	Chinese Society of Child & Adolescent Psychiatry conducted a survey about hospitals which provide mental health services for children in China; data were ascertained between March 20 and April 1. Main findings: Reduction of outpatient visits were 53%, while reduction of inpatient visits was 50%. A number of the mental health services had established isolation wards (70%). And 85% of the hospitals prepared isolation wards to receive newly hospitalized patients to avoid potential contagion of already admitted youths. Authors' conclusion: Online services might be the most suitable method to provide mental health care for children affected by COVID-19.

Included study	Population (N) –Study design	Outcome	Summary
Fischer (36) Germany	Patient with schizophrenia diagnosed with COVID-19 (1) –case report	Psychosis	The study reports the case of a patient with schizophrenia presenting with COVID-19 related delusions and hallucinations, illustrating the potential of COVID-19 to precipitate entry into a psychotic phase and impact symptom manifestation case.
Hao (33) China	Psychiatric patients (76) Healthy control (109) – Case-control study	Stress and psychological impact	<p>The study aimed to assess and compare the immediate stress and psychological impact experienced by people with and without psychiatric illnesses during the early lockdown period based on a survey on demographic data, physical symptoms during the past 14 days and a range of psychiatric symptoms using the Impact of Event (IES-R), Depression, Anxiety and Stress Scale (DASS-21) and Insomnia Severity Index (ISI).</p> <p>Main findings: The mean IES-R, DASS-21 anxiety, depression and stress subscale and ISI scores were higher in psychiatric patients than healthy controls ($p < 0.001$). Serious worries about their physical health, anger and impulsivity and intense suicidal ideation were significantly higher in psychiatric patients than healthy controls ($p < 0.05$).</p> <p>Authors' conclusion: Understanding the psychological impact on psychiatric patients during the COVID-19 pandemic has the potential to provide insight into how to develop a new immune-psychiatric service.</p>
Liu(35) China	Patients with schizophrenia and suspected COVID-19 (21) compared to a similar non-COVID-19 group (30)	Stress, anxiety, depression and sleep quality	<p>This retrospective, double-centre study investigate the clinical features of hospitalised patients with schizophrenia with or without suspected COVID-19. The Positive and Negative Syndrome Scale (PANSS) was used to assess the psychopathology associated with schizophrenia. The Perceived Stress Scale (PSS) was used to assess the perception of stress. The Hamilton Anxiety Rating Scale (HAMA) and the Hamilton Depression Rating Scale (HAMD) were used to assess the severity of emotional symptoms. The Pittsburgh Sleep Quality Index (PSQI) was used to assess the quality of sleep.</p> <p>Main findings: More patients in the COVID-19 suspected group received benzodiazepines (12, 57.1%) than in the non COVID-19 group (5, 16.7%), ($p=0.003$). Patients in the COVID-19 suspected group had significantly higher PSS, HAMD, HAMA and PSQI scores and showed higher stress, depression and anxiety levels and poorer sleep quality.</p> <p>Authors' conclusion: The observed increase psychological response should be accounted for in the management of these patients.</p>
Mehra (37) Italy	Elderly with relapse of depressive disorder (2) Case reports		<p>This report presents two elderly patients in a case series, who presented to the emergency services with relapse of depressive disorder, which was associated with fear of contracting COVID-19.</p> <p>A male and a female both developed syndromal depression, which led to emergency visit due to COVID-19. Pandemic and its social consequences are challenging for the elderly, especially, those who are already suffering from mental disorders. Supportive psychotherapy sessions and medication was helping</p>

Included study	Population (N) –Study design	Outcome	Summary
			these cases. Authors' conclusion: The holistic approach through social organizations, healthcare providers, media and charities can minimize the negative impact of the COVID-19 on the elderly and avoid recurrent depressive disorder.
Moghadasi (38) Iran	MS patients (33), -Observational/survey	Level of anxiety	This correspondence report on self-reported anxiety level using the Beck Anxiety Inventory. According to the Authors', anxiety is one of the leading causes of attacks among MS patients and can also exacerbate this disease. Main results: The mean level of anxiety in terms of the Beck Anxiety Inventory was 25.72±6.53 in these patients, which was within the range of moderate to severe based on the mentioned rating scale of this questionnaire. Authors' conclusion: Anxiety can exacerbate the severity of disease in MS patients.
Salari (39) Iran	Patients with Parkinson disease (137) - Observational/survey	Anxiety level	This cross-sectional, case-control survey from Iran evaluates the level of anxiety among Parkinson's disease (PD) patients compared with the general population. A web questionnaire, the Beck Anxiety Inventory II, was administered to a total of 137 subjects who were diagnosed cases of PD who responded to the questionnaire (95 were caregivers for PD), and 442 participants as matched controls. Main findings: The mean Beck Anxiety Inventory II total score among PD patients and the control group was 18.34±11.37 and 8.9±8.26, respectively. Severe anxiety was recorded in 25.5% of the cases and 4.8% of controls Authors' conclusion: These psychological disturbances may worsen of pre-existing anxiety, uncertainty regarding obtaining medications during lockdown, and the perceived higher risk of contracting COVID-19 because of an underlying chronic medical condition.
Stankovic (40) Serbia	Children with autism spectrum disorder (ASD) (85 parents)	Parents reported challenges	This study provides an exploration of challenges experienced by parents of children with autism spectrum disorder (ASD) during the COVID-19 pandemic and lockdown by self-reporting using the "Autism and COVID-19" survey. Main findings: The overall satisfaction with the support parents received during the pandemic and emergency was low. Many children lost their specialized school, medical and home help or additional education relevant to their child's needs, which led to a feeling of helplessness and discrimination. Authors' conclusion: The survey revealed a lack of support, feelings of helplessness, various challenges and needs amongst parents which, although present before, have become more prominent during this emergency state
Wolf (42) USA	Adults with one or more chronic condition (630, 29.3% below poverty level)	Self-reported knowledge, attitudes, and behavior	In this study adults were recruited from clinical trial registries and interviewed on the phone using the COVID-19 Awareness and Concern Survey items. Main findings: Those with three or more chronic conditions rated the threat as less serious than those with fewer conditions. Black participants were more likely

Included study	Population (N) –Study design	Outcome	Summary
	–Observational/survey	iors related to COVID-19	than white participants to report that they were “not worried at all”. Adults living below the poverty level rated it as less serious than those with higher incomes. Authors’ conclusion: Actions are needed now to ensure that as the pandemic unfolds, all citizens are adequately made aware of the gravity of the threat; with great clarity and attention to health literacy best practices, we need to explain specific steps that must be taken to avoid harm.
Zhang (41) China	Children with ADHD (241 parents)	Parents reported stress, behavioural symptoms and mood status	This study provides an exploration of ADHD behavioural symptoms measured by Swanson, Nolan, and Pelham scale (SNAP-IV) parent form, (Gau et al., 2008), the Child Stress Disorders Checklist (CSDC) and time allocation of children’s activities . Main findings/Authors’ conclusions: A one-sample t-test revealed that the average of children’s ADHD behaviours (M = 2.25, SD = 0.54) were significantly worsened in comparison to their normal state (95 % CI = 2.18–2.32). Children’s overall mood, and parents’ overall mood state significantly predicted children’s ADHD behaviours. The study time was negatively associated with the increase in ADHD symptoms. During the COVID-19 duration, the results indicated that ADHD symptoms reduced with longer (on-line) study time. Attention is required for the identification of appropriate approach for ADHD children in terms of disaster risk reduction activities.

We also included studies where the effect of the pandemic or transmission control measures were reported for people not classified as belonging to the vulnerable group, but where vulnerability was investigated or reported on (table 5).

One Chinese study (43) comparing self-reported data from before the outbreak (11 313 persons) with after outbreak (3000 persons) reported that the outbreak led to a 74% decline in wellbeing. The elderly experienced a larger decline, married people enjoyed a higher level of emotional wellbeing than unmarried ones and a higher income was associated with a higher level of emotional wellbeing. Two other studies from the pandemics in China (44, 45) reported that higher levels of stress and anxiety was associated with female gender, student status, specific physical symptoms, and poor self-rated health status.

We included a case series of reactive psychosis and suicidality (46) and an Indian report on suicides amongst poor persons with COVID-19 (47). In conclusions these studies may reveal that some patients or persons are more vulnerable to psychological effects of the pandemic than others, but there are no grounds to draw any conclusions of causality.

Table 5 Effects relevant for vulnerability reported in the more general populations

Included	Population (N) –Study design	Outcome	Summary
Mamun (47) India	Suicide victims identified through press reports (29)	Factors correlating with suicides during the COVID-19 pandemic	This is a report of suicide data extracted from press reports from Pakistani press media from January 2020. 29 suicide cases were reported, and 16 suicidality cases (i.e., 12 completions and four attempts) were related to COVID-19 issues and were included in this study. About 12 were males, most of the victims had suffered from economic recession. Author conclusion: Despite the limitations of the study, this provides novel data on lockdown-related economic crisis and recession that has not studied elsewhere. The present findings will be helpful in safeguarding the unprivileged people by turning national and international authority's attentions.
Valdes-Florio (46) Spain	Patients with no history of mental illness with reactive psychosis (4) – case series	Triggers of psychosis	This study reports reactive psychosis cases admitted during the first two weeks of the pandemic in one hospital. Main findings: Four patients met the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) criteria for a brief reactive psychotic disorder. All of the episodes were directly triggered by stress derived from the COVID-19 pandemic and half of the patients presented severe suicidal behaviour at admission. Authors' conclusions: We may be witnessing an increasing number of brief reactive psychotic disorders as a result of the COVID-19 pandemic. This type of psychosis has a high risk of suicidal behaviour and, although short-lived, has a high rate of psychotic recurrence and low diagnostic stability over time. Therefore, we advocate close monitoring in both the acute phase and long-term follow-up of these patients.
Wang (44) China	General population (1210)	Psychological impacts correlations with medical and socio demographic data	In this study, self-administrated psychological impact measured with the Impact of Event Scale-Revised (IES-R) and Mental health status was measured using the Depression, Anxiety and Stress Scale (DASS-21) was correlated with physical symptoms, gender, age, education, residential location in the past 14 days, marital status employment status, monthly income, parental status, and household size, contact variables and Knowledge variables. Main findings: 53.8% of respondents rated the psychological impact of outbreak as moderate or severe; 16.5% of respondents reported moderate to severe depressive symptoms; 28.8% of respondents reported moderate to severe anxiety symptoms; and 8.1% reported moderate to severe stress levels. Female gender, student status, specific physical symptoms, and poor self-rated health status were significantly associated with a greater psychological impact of the outbreak and higher levels of stress, anxiety, and depression ($p < 0.05$). Specific up-to-date and accurate health information and precautionary measures were associated with a lower psychological impact of the outbreak and lower levels of stress, anxiety, and depression ($p < 0.05$).

			Authors' conclusions: The findings can be used to formulate psychological interventions to improve mental health and psychological resilience during the COVID-19 epidemic.
Wang(45) China	General population at two time points 1) January 31 to February 2 (1302) and 2) February 28 to March 1 (861)	Psychological impacts correlations with medical and socio-demographic data	This study used the same methods as the study above but was conducted later. Main findings/Authors' conclusion: After February 8, 2020, there was a rapid decline in the number of new and suspected cases and the downward trend continued thereafter. Simultaneously, the number of recovered patients showed a substantial increase during this period. The second survey was conducted from February 28 to March 1, 2020. The important unexpected finding is the stable levels of stress, anxiety and depression despite sharp increases in the number of COVID-19 cases between the two surveys as well as statistically but not clinically significant reduction in the psychological impact on the general population. Young and students are prone for the psychological impact of the current COVID-19 outbreak as well as various factors that might help in safeguarding the mental health of general population.
Yang (43) China	General population before (11 313) and after (3000)after the COVID-19 outbreak	Emotional well-being and associate factors	The study is based on self-reported outcomes. Participants in both surveys indicated whether they smiled or laughed a lot yesterday, and whether they experienced a lot of enjoyment/happiness/anger/sadness/stress/worry yesterday (1 = yes, 0 = no). Participants in both surveys also responded to demographic measures: age, sex, marital status, monthly household income, and residence region. Participants in the second survey responded to additional measures pertaining to perceived knowledge about coronavirus infection. Main findings: The outbreak led to a 74% decline in wellbeing. The elderly experience a larger decline, married people enjoyed a higher level of emotional well-being than unmarried ones and a higher income was associated with a higher level of emotional well-being. Participants' perceived knowledge about coronavirus infection was associated with a higher sense of control, which protected their emotional well-being during the outbreak. Authors' conclusion: Public policies and mental health interventions aimed at boosting/protecting psychological well-being during epidemics should take account of these factors.

Health effects of interventions aimed at vulnerable groups

We included two studies as relevant for answering questions related to effects of interventions specifically aimed at groups potentially vulnerable due to their social or economic situation (table 6).

Table 6. Interventions specifically aimed at groups potentially vulnerable due to their social or economic situation

Included	Population (N) –Study design	Outcome	Summarized
Wallace (28) USA	Incarcerated	Not reported	COVID-19 Management, Assessment and Response (survey) telephone call (CMAR) for detention centres. –See summary in table 2
Goodman-Casano (48) Spain	Home living persons with mild dementia (93) Study nested in the clinical trial: TV-AssistDem (ClinicalTrials.gov NCT03653234)	Confinement on health and mental well being	This study explores the impact of television-based and telephone-based health and social support, and the effects of a television-based assistive integrated technology (TV-AssistDem). Main findings: TV-AssistDem demonstrated potential for cognitive stimulation.

In conclusion, there is almost no research-based evidence of health-related effects of interventions aimed to support socially or economic vulnerable groups exposed to the COVID-19 pandemic or transmission control measures.

Discussion and conclusion

We included one systematic review and 32 original studies in this rapid review of research related to vulnerable groups.

With regard to socially and economic factors influencing the severity of COVID-19 disease and infection rates, largescale data on risk factors and potential underlying causes of COVID-19 complications for social and economic vulnerable groups are not available as yet, so the few identified studies represent only a very small subsection of what has been experienced and will be experienced. Nevertheless, it seems reasonably clear that persons with low income levels, or living in deprived areas, minority groups, homeless and incarcerated represent vulnerable groups at least in some countries. Causalities are probably complex involving many determinants of health, but living in conditions or under situations which can make physical distancing and self-isolation difficult, is probably one factor influencing vulnerability.

With regard to the pandemic or transmission control measures effects on health related outcomes in socially or economic vulnerable groups, there is some evidence from the included studies that on one side, admissions to psychiatric ward is reduced, and on the other side persons with pre-existing vulnerability such as mental diseases may experience worsening of their conditions. Also, the included studies reveal that an increase in anxiety and depression in the general population, may be related to pre-existing vulnerability.

So far in the COVID-19 pandemic there is almost no research-based evidence of health-related effects of interventions aimed to support socially or economic vulnerable groups exposed to the COVID-19 pandemic or transmission control measures.

Strengths of this review

We systematically screened a large set of COVID-19 literature (more than 17 000 references) according to predefined research questions. This makes us, with regard to the pre-defined socially and economic vulnerable groups, relatively certain that major relevant primary studies produced so far during the COVID-19 pandemic are not overlooked.

Limitations of the review

The review is restricted to studies reporting on outcomes related to the COVID-19 pandemic identified only six months after the start of the pandemic. Studies of vulnerable groups during other infections and other pandemics may constitute indirect evidence of vulnerability not searched for. As a start to look for this evidence, searches for systematic reviews concerning specific groups, infections and pandemics might provide relevant findings. Furthermore additional sites of relevant reports published by international organisations, public health institutions and health technology assessment organisations in relevant countries should be looked for.

The definition of vulnerable groups used in this review will be dependent on the context and is difficult to precisely define. In line with the pre-defined inclusion criteria, and unless the study was analysing associations with social or economic factors, we excluded studies of the population in general, pregnant women in general, persons with increased medical risks, persons with diseases not normally classifying as disabling diseases, elderly in general, students in general, children and adolescents in general. As this was a rather complex inclusion process performed during limited time, we cannot be certain that the inclusion process would provide the same studies when repeated. In particular, there were several reports on students, pregnant women and older persons during the COVID-19 period that could have been included as evidence for these subgroups of the populations being vulnerable. During full-text examination, we also excluded studies that only reported associations of anxiety and depression with one single “soft factor of vulnerability” like social support and education level.

We have not specifically searched for relevant ongoing research. Studies are published fast, an overview of relevant ongoing studies in particular in Norway and Scandinavia could be made as an extension of this rapid review.

No quality assessment of included studies was performed, and the summary was focusing only on main findings and conclusions. Limitations of the included studies are several, including many being pre-prints without peer-review. However, these limitations were not assessed in depth. In addition, a main concern is transferability to a Norwegian context. The results should therefore be considered with caution.

Conclusion

In conclusion, there is very little evidence related to vulnerable groups exposed to the COVID-19 pandemic and transferability of our findings to the Norwegian context is limited. Nevertheless, factors like poverty or living in deprived areas, and certain

ethnic backgrounds are associated with an increased risk of both infection with SARS-CoV-2 and probably death of COVID-19 compared to the general population. Furthermore, incarcerated persons and homeless persons in shelters may have an increased risk of SARS-CoV-2 infection. There is evidence that the pandemic or transmission control measures may lead to fewer admissions to psychiatric ward during the pandemic. In contrast to this, there is evidence of higher vulnerability with regard to experiencing anxiety, depression and stress in patients with psychiatric disorders and other vulnerable groups. So far, there is almost no research-based evidence of health-related effects of interventions aimed to support socially or economic vulnerable groups during the COVID-19 pandemic.

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Appendix 1 Literature search

The search strategy for the NIPH research map on COVID-19 related publications are described in reference 1 of the review. We first identified all studies that have been categorized with the following populations: *Immunocompromised (which includes people with HIV)*, *Homeless*, *Refugee camps*, *Prisons*, *Housing status: other*, *Gender: other*, *Social and economic: socioeconomic*, and *Social and economic: ethnicity*. We also searched all studies (title and abstracts) in our database including records not yet finally indexed using the keywords listed in the table below:

Key words	Vulnerability group (potential vulnerability related to)
Seasonal lab*	Migrant/Immigrant
Seasonal work*	Migrant/Immigrant
Seasonal employ*	Migrant/Immigrant
Migrant*	Migrant/Immigrant
Immigrant*	Migrant/Immigrant
Refugee*	Migrant/Immigrant
Asylum	Migrant/Immigrant
Stateless	Migrant/Immigrant
Homeless*	Homeless
Disable*	Disabled
Handicap*	Disabled
Autism	Disabled
Autistic	Disabled
Intellectual disability	Disabled
Intellectual impairment	Disabled
Mental deficienc*	Disabled
Mentally disabled	Disabled
Down syndrome	Disabled
Development* disorder	Disabled
Development* disabilit*	Disabled
Incarcerat*	Incarcerated
Jail*	Incarcerated
Prison*	Incarcerated
Imprison*	Incarcerated
Inmate*	Incarcerated
Immigrant*	Migrant/Immigrant

Dement*	Mental disorder
Alzheimer*	Mental disorder
Mental disorder*	Mental disorder
Mental disease*	Mental disorder
Mood disorder*	Mental disorder
Depression	Mental disorder
Anxiety	Mental disorder
Psychiatric	Mental disorder
Psychosis	Mental disorder
Psychotic	Mental disorder
Schizophreni*	Mental disorder
Substance-related disorder*	Drug or alcohol
Addict*	Drug or alcohol
Substance use	Drug or alcohol
Dependence	Drug or alcohol
Alcoholism	Drug or alcohol
Alcohol-related disorder*	Drug or alcohol
Substance abuse*	Drug or alcohol
Socioeconomic	Other social-economic situations
Socio-economic	Other social-economic situations
Prostitut*	Other social-economic situations
Deprived	Other social-economic situations
Disparit*	Other social-economic situations
Inequal*	Other social-economic situations
Equity	Other social-economic situations
Ethnic*	Other social-economic situations
Indigenous	Other social-economic situations
Aborigin*	Other social-economic situations
Native*	Other social-economic situations
Romani	Other social-economic situations
Racial	Other social-economic situations
Sex worker*	Other social-economic situations
LGBT*	Other social-economic situations

** indicates key words used truncated*

The following search terms were tested and found to provide too much noise (not manageable to sort within the given time-frame of the review)

Search term not used	Reason for exclusion
Vulnerab*	"patients vulnerable to" xyz is really common
Impairment*	used in biological studies
First people*	returns "the first people to report.."
First nation*	returns "the first nations to experience..."

All referenced were imported to EndNote-database and duplicates removed.

