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Research Article

Evidence of quality of life for hospitalised patients with COVID-19: a scoping review

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Abstract

Background: Information on the quality of life of people hospitalised with COVID-19 is important, both in assessing the burden of disease and the cost-effectiveness of treatments. However, there were potential barriers to collecting such evidence.

Objective: To review the existing evidence on quality of life for people hospitalised with COVID-19, with a focus on the amount of evidence available and methods used.

Design: A scoping review with systematic searches.

Results: A total of 35 papers were selected for data extraction. The most common study type was economic evaluation (*N* = 13), followed by cross-sectional (*N* = 10). All economic evaluations used published utility values for other conditions to represent COVID-19 inpatients' quality of life. The most popular quality-of-life survey measure was the Pittsburgh Sleep Quality Index (*N* = 8). There were 12 studies that used a mental health-related survey and 12 that used a sleep-related survey. Five studies used EQ-5D, but only one collected responses from people in the acute phase of COVID-19. Studies reported a negative impact on quality of life for people hospitalised with COVID-19, although many studies did not include a formal comparison group.

Limitations: Although it used systematic searches, this was not a full systematic review.

Conclusion: Quality-of-life data were collected from people hospitalised with COVID-19 from relatively early in the pandemic. However, there was a lack of consensus as to what survey measures to use, and few studies used generic health measures. Economic evaluations for COVID-19 treatments did not use utilities collected from people with COVID-19. In future health crises, researchers should be vigilant for opportunities to collect quality-of-life data from hospitalised patients but should try to co-ordinate as well as ensuring generic health measures are used more.

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Background and introduction

Coronavirus disease 2019 (COVID-19) is a new disease caused by the SARS-CoV-2 virus, first discovered in Wuhan, China, in December 2019,[1] which has caused global disease, suffering and disruption. Most people infected with the virus will have mild or moderate respiratory or viral symptoms; however, some become seriously ill and require hospital-based treatment. Individuals who develop severe illness due to COVID-19 tend to be older people with comorbidities such as cardiovascular disease, chronic respiratory disease, diabetes and cancer.[2]

As well as studying COVID-19 symptoms, risk factors, management and mortality, it is important to know how COVID-19 affects quality of life (QOL). Knowing the impact on QOL gives a holistic picture of the burden of COVID-19 on the patient experience. It is also an important factor in knowing how to guide care to support patients' needs. Furthermore, vast resources have been spent on combating COVID-19, with estimates of over US$7 billion in research and development funding being made available in the first 9 months of the pandemic.[3] QOL data underpin examinations of how cost-effective interventions that aim to tackle COVID-19 are, by reducing the risks of hospitalisation, intensive care unit (ICU) admission, ventilation, etc., and/or by aiding recovery.

There has been research focusing on the QOL of people with COVID-19 following discharge from hospital, with a systematic review including 21 studies.[4] There have also been studies on how Long COVID-19 affects QOL, with reviews summarising the findings.[5,6] However, we are not aware of any summaries of findings for QOL for patients hospitalised with COVID-19, and this study seeks to fill this gap by providing an overview of research in this area. QOL for hospitalised patients with COVID-19 is important to study alongside post-hospitalised/long COVID-19 patients, as they are the people most impacted during the acute phase of the disease. Thanks to the delivery of large, rapid randomised controlled trials,[7,8] there is now much more knowledge about how best to prevent and treat COVID-19, including widespread vaccination,[9,10] and the distribution of disease severity in hospitals has consequently changed over time. As novel diagnostics and therapeutics continue to emerge, it is important to understand the evolving burden of disease and impact on QOL for individuals hospitalised with COVID-19.

Quality of life is typically measured using questionnaires, ideally completed by the individual with the disease in question, typically including generic questions which capture the individual's physical, psychological and social capabilities. Another reason it is important to examine the research on QOL for patients hospitalised with COVID-19 is that collecting data on patient-reported outcome measures (PROMs) in hospitals during the peak of the pandemic presented a logistical challenge, with the protection of patients and staff rightly taking priority.

Aims and objectives

The aim of this paper is to provide an overview of studies reporting QOL data for individuals who are hospitalised with COVID-19, and the methods they used. This will reveal the best currently available evidence on COVID-19 inpatients' QOL. It will also give an overview of how QOL research progressed throughout the course of the pandemic, given the challenges involved. Finally, the review will highlight where knowledge gaps exist in relation to QOL for people hospitalised with COVID-19, as well as providing recommendations for research practice during future health crises.

Methods

Search terms were developed with reference to Arber *et al*.[11] by two authors, one a health economist (EW) and one an information specialist (NK). The search terms centred around the concepts of hospital patients, COVID-19 and health utility measures, including quality-adjusted life-years (QALYs), disability-adjusted life-years (DALYs) and survey measures such as EQ-5D, the Short Form (36) Health Survey (SF-36) and the Health Utilities Index (HUI). A full list of search strategies is included in the *Appendix*. The following databases were searched in May 2022, with searches re-run in December, from database inception to 7 December 2022: EMBASE (Classic and Ovid), Ovid MEDLINE®, Scopus and Web of Science (Core Collection, SCI-EXPANDED 1900+, SSCI 1900+, A&HCI 1975+, CPCI-S 1900+, CPCI-SSH 1900+, ESCI 2015). We did not apply limits for language or publication date to the search. The search was peer-reviewed by a second information specialist using the PRESS checklist.[12]

Search results were stored and deduplicated in an EndNote library. Titles and abstracts were initially screened for inclusion in full-text review, after which the selected full texts were screened for inclusion in the data extraction process. Screening was done by one health economist author (EW).

The inclusion criteria were:

- reporting on original research
- English language full text available
- includes quantitative data specifically for inpatients with COVID-19.

Pre-prints and conference abstracts were included, but editorials, letters and commentaries were not. Likewise, review papers, protocols, secondary analyses and animal and laboratory studies were excluded. Studies only reporting results for pooled samples of COVID-19 inpatients and non-COVID-19 inpatients were not included. Studies were included if they used published utility values for conditions other than COVID-19, provided these utilities were used to represent QOL for COVID-19 inpatients within the context of that study. So, for example, cost–utility analyses of interventions for COVID-19 inpatients were eligible for inclusion, even if the utility values were taken from patients with other conditions.

Three authors (EW, DH, BS) used a data extraction form to extract information on the studies' methods and key results. The data extraction form is provided as *Report Supplementary Material 1*.

Extracted data were analysed using narrative synthesis.

Equality, diversity and inclusion

Inclusive language was used throughout the manuscript. Studies from many different countries, including low- or middle-income countries, met the inclusion criteria. Patient and public involvement co-researchers were involved throughout the project.

Results

Figure 1 gives a PRISMA diagram of the search results and paper identification. The final search identified 2222 records with 1040 unique records after deduplication. There were 107 records selected for full-text review, out of which 35 studies were selected for data extraction. *Table 1* summarises the individual studies, with all extracted data available as *Report Supplementary Material 1*.

Figure 2 illustrates which geographical contexts the studies were set in. Four out of six inhabited continents were represented, with no studies coming from Oceania or South America. The most common country was the USA, with just over a quarter of all studies (*N* = 9).

Figure 3 shows which study designs were chosen. The most common design was economic evaluation (*N* = 13) followed by cross-sectional (*N* = 10). *Figure 3* also illustrates what approaches were taken for economic evaluation. Most (*N* = 8) used a decision tree, with almost half (*N* = 6) using a Markov model.[48] These modelling approaches were often combined, with a decision tree representing the hospitalisation phase, followed by a Markov process representing the rest of a patient's life post discharge, with transitions between ill health, recovery and death. In two studies[21,46] a value of information analysis was performed.

Table 2 gives details about the various QOL measures employed by studies and *Figure 4* illustrates how frequently they were used. Most (*N* = 13) used published utility values, all of which were economic evaluations. Four studies[27,37,41,46] used values for influenza to represent mild/moderate COVID-19 and values for patients with *Clostridioides difficile* infection to represent more severe illness. Two other studies used values for influenza to represent less severe COVID-19 cases and values for either influenza H1N1 (swine flu)[19] or pneumonia[16] to represent more severe cases. Kelton *et al.*[30] used values for patients with *C. difficile* infection and Sheinson *et al.*[43] used utility values from people with severe acute respiratory syndrome (SARS). Dijk *et al.*[21] used published HUI values for SARS for patients hospitalised with COVID-19, and published EQ-5D-3L values to represent QOL in post-ICU and post-hospitalisation patients. Two studies reported DALYs for patients using published disability weights from the Global Burden of Disease (GBD) study.[49] One used weights for severe lower respiratory tract infection to represent severe COVID-19 inpatients, and pneumonia to represent critical inpatients;[18] the other used severe respiratory tract infection for severe patients, but weights for ICU admission for critical patients.[28] In four studies, it was unclear what conditions some or all published utility values came from.[30,32,38,43] A single study[25] used a nine-member expert panel to estimate COVID-19 disability weights for calculating DALYs.

Twelve studies[17,22,24,26,29,33,34,36,42,44,45,47] used 12 different mental health-related measures: the Patient Health Questionnaire-9 (PHQ-9; *N* = 3), the Hospital and Anxiety Depression Scale (HADS; *N* = 2), Generalised Anxiety Disorder-7 (GAD-7; *N* = 2), the Beck Anxiety Inventory

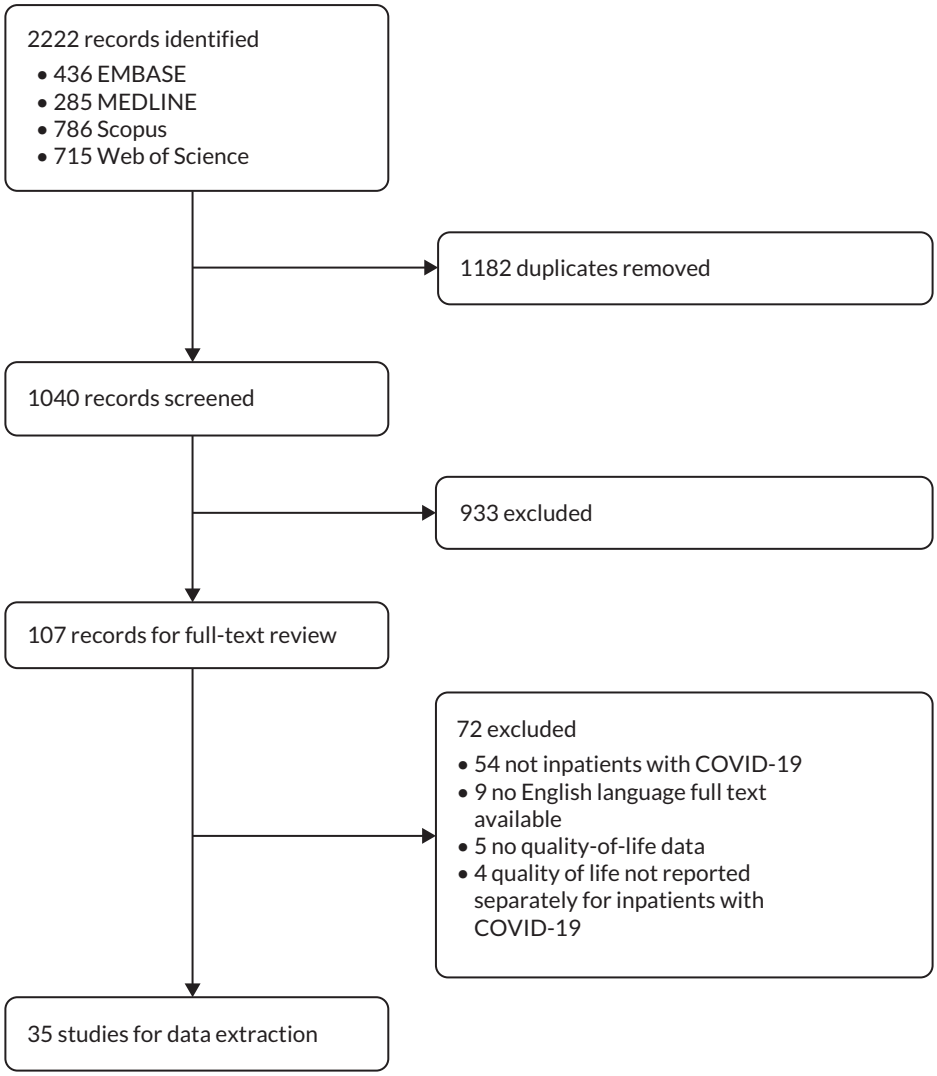

FIGURE 1 PRISMA diagram.

(BAI; *N* = 1), the Beck Depression Inventory (BDI; *N* = 1), the Child Depression Inventory (CDI, *N* = 1), the Child Post-Traumatic Stress Reaction Index (CPTS-RI; *N* = 1), the Harvard Trauma Questionnaire (HTQ; *N* = 1), the Perceived Stress Scale (PSS-10; *N* = 1), the Screen for Child Anxiety Related Disorders (SCARED; *N* = 1), the Self-Rating Anxiety Scale (SAS; *N* = 1) and the Self-Rating Depression Scale (SDS; *N* = 1). Twelve studies used one or more sleep-related QOL measures,[13,17,23,26,29,33-36,42,44,47] with the most popular being the Pittsburgh Sleep Quality Index (PSQI; *N* = 8).

Considering generic health measures, four studies[15,22,36,39] used the Short Form (36) Health Survey (SF-36) and five studies[20,24,31,40,47] used EQ-5D, of which two used EQ-5D-3L and three used EQ-5D-5L. Two studies using EQ-5D assessed inpatient rehabilitation programmes[24,31] and one looked at patients seen 7 days after undergoing surgery for a proximal femur fracture.[40] Thus, although they qualify for inclusion in this review due to reporting QOL data for inpatients with COVID-19, they did not collect data from patients in the acute phase of the disease. The remaining study[20] collected only data from those aged over 80.

Figure 5 shows how many COVID-19 inpatients were analysed by each study. The median number of participants was 97.5 and the mean was 1096.25. The mean was far higher due to two outliers, He *et al.*[25] and Kairu *et al.*,[28] who included 2702 and 20,836 patients, respectively. These numbers were achieved by reporting DALYs calculated using years of life lost from routine data and disability weights from either published values or a nine-member expert panel.

Figure 6 shows a timeline of when studies collected data and publication dates (where only the month of data collection start/stop is given, we assumed collection started

TABLE 1 Studies selected for inclusion

Study	Design	*N* analysed	Quality-of-life measures	Quality-of-life values	Quality-of-life conclusions
Akinci and Basar[13]	Cross-sectional	189	PSQI; HADS	87 had PSQI < 5, 102 had PSQI>=5; 17% of good sleepers above HADS anxiety threshold vs. 9% for poor sleepers (p = 0.131); 29% of good sleepers above HADS depression threshold vs. 52% for poor sleepers (p = 0.010)	COVID-19 patients with poor sleep were more likely to be above the HADS depression scale
Bayrak and Çadirci[14]	Prospective cohort study	122	World Health Organization Quality of Life-OLD (WHOQOL-OLD)	Overall WHOQOL-OLD total score = 41.5 (27.0–69.0). For those who survived (n = 111), total score = 42.0 (20.01–69.0). For non-survivals, total score = 21.0 (17.0–38.0)	QOL scores were significantly lower in the non-survivors on the first day of hospitalisation
Bounoua *et al.*[15]	Cross-sectional	85	SF-36	Not clear	COVID-19 negatively affected QOL, with lower SF36 scores with severe and critical COVID-19 compared to moderate; age, comorbidities and residual symptoms were associated with QOL
Carta and Conversano[16]	Economic evaluation	1000 (simulated)	Published values for influenza/pneumonia	Base utility 0.851; hospitalised with no supplemental oxygen 0.581; hospitalised with supplemental oxygen 0.5; hospitalised patients with non-invasive ventilation 0.23; hospitalised with invasive ventilation 0.05	
Chakrabarti[17]	Cross-sectional	590	PHQ-9; ISI	40.1% had a PHQ-9 score over 24 indicating depression; depression was more likely among older people; females; unmarried/separated people; people with substance abuse issues and comorbidities; 28.8% of patients had ISI scores above 14 indicating insomnia; 5% indicated suicidal ideation	COVID-19 had a major psychological impact on patients
Cleary *et al.*[18]	Economic evaluation	N/A	DALYs: YLL from actuarial study, disability weights from GBDS severe lower respiratory tract infection/pneumoconiosis	Severe patients: disability weight 0.13, illness duration 1.5 months; critical patients: disability weight 0.41, duration of illness 2 months	
Congly *et al.*[19]	Economic evaluation	N/A	Published values for influenza/influenza (H1N1)2009	Base utility 0.851; severe COVID-19 0.23; moderate COVID-19 0.5616	
Covino *et al.*[20]	Prospective cohort study	368	EQ-5D-5L	All cases (n = 368) = 8[5,10]. Survived (n = 236) = 9[7,13]. The group is also split by who had a stable QOL over time and those who QOL worsened to look for associations	Factors most influencing a decrease in QOL were found to be the female sex, frailty status before COVID-19, age group and overall pre-existing EQ-5D-5L value
Dijk *et al.*[21]	Economic evaluation	N/A	Published HUI values for SARS; published EQ-5D-3L values for post-ICU/post-hospitalised patients	ICU 0.050; hospital ward 0.500; recovered from ICU 0.677; recovered from hospital ward 0.880	

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TABLE 1 Studies selected for inclusion (*continued*)

Study	Design	*N* analysed	Quality-of-life measures	Quality-of-life values	Quality-of-life conclusions
Gloeckl *et al.*[22]	Prospective cohort	50	SF-66; PHQ-9; GAD-7	For mild/moderate patients: SF-36 mental (31.8 vs. 31.7) and physical (48.6 vs. 54.2) components not significantly different pre/post intervention. For severe/critical patients: SF-36 physical component not significantly different pre/post intervention (30.2 vs. 34.7), mental component score significantly different (38.5 vs. 52.9, $p < 0.001$); PHQ-9 score significantly improved (4 vs. 7, $p = 0.002$); GAD-7 score significantly deteriorated (4 vs. 5, $p = 0.021$)	Pulmonary rehabilitation can improve QOL for patients with severe/critical COVID-19
Gunes and Sensoy[23]	Cross-sectional	94	PSQI; ESS; ISI	55.1% of confirmed COVID-19 patients had bad sleep quality (PSQI > 5) compared to 33.1% of suspected COVID-19 patients ($p = 0.02$); no significant differences between groups were seen for ESS or ISI	'[T]he psychosomatic aspect of this epidemic should not be overlooked and patients must be evaluated in detail in respect of sleep'
Hayden *et al.*[24]	Prospective cohort	105	EQ-5D-5L	Median EQ-5D-5L level sum was 11.65 pre intervention and 9.23 post intervention ($p < 0.001$); EQ-VAS improved pre/post intervention (medians 50.01 vs. 68.05, $p < 0.001$); PHQ-9 improved pre/post intervention (medians 4.39 vs. 2.69, $p < 0.001$); GAD-7 improved pre/post intervention (medians 6.39 vs. 4.00, $p < 0.001$)	Pulmonary rehabilitation can improve quality of life for patients with COVID-19
He *et al.*[25]	Cross-sectional	9 (expert panel); 2702 (patients)	DALYs: disability weights from expert panel.	Highest disability weight was 0.399 for severe expiratory dyspnoea; lowest disability weight was 0.004 for mild cough and sore throat; mean synthetic DALY was 2.29, mean daily DALY was 0.18	COVID-19 disease burden was higher for women than men, and higher in the younger than the older population
Huang *et al.*[26]	Prospective cohort	74	SSS-8; mMRC; PSQI	SSS-8, mMRC and PSQI scores declined over time	Symptomatic burden of COVID-19 and sleep quality improves over time up to 1 month post discharge
Jovanoski *et al.*[27]	Economic evaluation	N/A	Published utility values for *Clostridioides difficile*	Base utility: 0.9442-0.0027*age; non-hospitalised COVID-19 disutility: 0.19; hospitalised COVID-19 disutility: 0.61	
Kairu *et al.*[28]	Economic evaluation	20,836	DALYs: disability weights from GBDS severe respiratory infection/ICU admission	Severe patients: disability weight 0.133; critical patients: disability weight 0.655	
Karaogullarindan *et al.*[29]	Case-control	71 COVID, 71 non-COVID	PSQI; BDI; BAI	53.5% of COVID patients had poor sleep quality compared to 43.0% of non-COVID patients ($p = 0.011$); 66.2% of COVID patients had positive anxiety symptoms compared to 59.2% of non-COVID patients ($p = 0.088$); 63.4% of COVID patients had positive depression symptoms compared to 57.0% of non-COVID patients ($p = 0.127$); disparities were worse for older patients	Poor sleep quality, anxiety and depression were observed for COVID-19 inpatients aged > 65
Kelton *et al.*[30]	Economic evaluation	N/A	Published values for *C. difficile* and other unspecified conditions	Base utilities ranged from 0.922 for 18- to 29-year-olds to 0.736 for aged 80+; COVID-19 symptom disutility −0.190; mechanical ventilation disutility −0.600; non-invasive ventilation disutility −0.500; supplemental oxygen disutility −0.400; medical care without oxygen disutility −0.300	

TABLE 1 Studies selected for inclusion (*continued*)

Study	Design	*N* analysed	Quality-of-life measures	Quality-of-life values	Quality-of-life conclusions
Kokhan *et al.*[31]	Prospective cohort study	38	EQ-5D-3L	On the 21st day of the rehabilitation programme, the quality of life of the project participants questionnaire improved by 15.7% (from 8.9 ± 0.6 to 7.5 ± 0.5 points)	QOL scores improved over time for those undertaking the walking therapy intervention
Kowal *et al.*[32]	Economic evaluation	N/A	Published utility values	Unclear	N/A
J Li *et al.*[33]	Non-randomised controlled trial	75	SIM-C; PSQI; HADS	Mindfulness intervention significantly improved SIM-C scores from 30.1 to 35.2 ($p < 0.001$), no significant difference for standard of care (29.4 vs. 31.2); Anxiety score: no significant differences in either group (14.1 vs. 12.9, $p = 0.084$ for intervention, 13.6 vs. 13.3, $p = 0.629$ for control); Depression score: significant improvement for intervention (14.1 vs. 12.5, $p = 0.038$) but not control (14.0 vs. 13.5, $p = 0.568$); PSQI: significant improvement for intervention (12.9 vs. 9.4, $p < 0.001$) but not control (13.4 vs. 11.9, $p = 0.150$)	Mindfulness meditation improved sleep quality and depression
X Li *et al.*[34]	Cross-sectional	66	SDS; SAS; PSQI	27.6% were above SDS depression threshold; 22.7% were above SAS anxiety threshold; 25.5% had poor sleep	COVID-19 inpatients had mental health and sleep quality problems
Moretti *et al.*[35]	Cross-sectional study	23	mBDS	8 patients (34.8%) had no dyspnoea, 3 (13.04%) had mild dyspnoea, 10 (43.5%) had severe dyspnoea, 1 (4.3%) had very severe dyspnoea and 1 (4.3%) had critical dyspnoea	mBDS scores were moderately correlated with reduced muscle power functions (ICF code: b730, $p = 0.041$) and walking (ICF code: d450, $p = 0.011$)
Moseholm *et al.*[36]	Prospective cohort study	95	HADS; PSS-10; ISI; HTQ; SF-36	Baseline mean HADS-D score was 6.54; HADS-D scores were lower at 3-month (3.71, $p < 0.001$) and 6-month (3.29, $p < 0.001$) follow-up; baseline mean HADS-A score was 5.87; HADS-A scores were lower at 3-month (3.90, $p < 0.001$) and 6-month (3.93, $p < 0.001$) follow-up; baseline mean PSS scores were 11.11, with no significant changes at 3-month (11.47, $p = 0.67$) or 6-month follow-up (10.93, $p = 0.95$); baseline mean ISI scores were 8.58, with no significant changes at 3-month (9.41, $p = 0.67$) or 6-month follow-up (7.33, $p = 0.95$); 81% had no PTSD symptoms at baseline, with 82% at 3-month and 84% at 6-month follow-up; baseline mean SF-12 mental component was 46.35; SF-12 mental component did not change significantly at 3-month follow-up (46.42, $p = 0.40$) but was significantly higher at 6-month follow-up (49.33, $p = 0.03$); baseline mean SF-12 physical component was 42.39; SF-12 physical component did not change significantly at 3-month follow-up (42.48, $p = 0.42$) but was significantly higher at 6-month follow-up (46.26, $p < 0.01$)	A high proportion of patients hospitalised with COVID-19 experienced psychological distress

continued

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TABLE 1 Studies selected for inclusion (*continued*)

Study	Design	*N* analysed	Quality-of-life measures	Quality-of-life values	Quality-of-life conclusions
Ohsfeldt *et al.*[37]	Economic evaluation	N/A	Published values for influenza/*C. difficile*	Base utilities ranged from 0.922 for 18- to 29 year-olds to 0.736 for aged 80+; COVID-19 symptom disutility −0.190; mechanical ventilation disutility −0.600; non-invasive ventilation disutility −0.500; supplemental oxygen disutility −0.400; medical care without oxygen disutility −0.300	
Oksuz *et al.*[38]	Economic evaluation	78	Published values for unspecified conditions	Standard of care disutility: −0.515; remdesivir disutility: −0.341	
Ouanes *et al.*[39]	Case-control study		SF-36	SF-36 physical component scores were 58.1 (inpatients), 58.2 (quarantined) and 57.2 (general population) with no significant differences; SF-36 mental component scores were 51.2 (inpatients), 49.5 (quarantined) and 47.9 (general population) with general population significantly lower than the other two groups	COVID-19 patients' QOL was better than expected, possibly due to support, access to mental health care and enhanced resilience on recovering from COVID-19
Pass *et al.*[40]	Retrospective cohort study	123 COVID; 3610 non-COVID	EQ-5D-3L	EQ-5D-3L values were higher for non-COVID-positive patients than COVID-positive patients (0.701 vs. 0.291, $p = 0.001$)	A COVID-19 infection was associated with reduced QOL
Rafia *et al.*[41]	Economic evaluation	N/A	Published values for influenza/*C. difficile*	Utility value for patients undergoing invasive ventilation assumed to be 0; hospitalised, not on oxygen disutility −0.36; hospitalised on oxygen disutility −0.58; increased comorbidities at entry disutility −0.116; 1-year post-discharge disutility −0.097	
Samushiya *et al.*[42]	Cross-sectional study	119	HADS; PSQI; MFI-20	11% of patients had HADS anxiety subscale scores above 8; 4% of patients had HADS depression subscale scores above 8; 73% of patients had MFI-12 scores above 20; 27% of patients had PSQI scores above threshold for sleep disorders	COVID-19 inpatients had poor mental health, fatigue and sleep quality; QOL = health-related quality of life
Sheinson *et al.*[43]	Economic evaluation	N/A	Published values for survivors of acute respiratory distress syndrome/unspecified conditions	Base utilities ranged from 0.920 for 18- to 29-year-olds to 0.740 for aged 80+; COVID-19 symptom disutility −0.270; mechanical ventilation disutility −0.560; oxygen support without ventilation disutility −0.360; no oxygen support disutility −0.110	
Tapan *et al.*[44]	Cross-sectional study	105	PSQI; HADS	Patients with severe COVID-19 had worse sleep quality than those with non-severe COVID-19 (PSQI 12.64 vs. 8.43, $p < 0.001$), worse HADS anxiety subscale score (13.18 vs. 8.01, $p < 0.001$) and worse HADS depression subscale scores (11.76 vs. 9.00, $p < 0.001$)	Patients with COVID-19 had sleep quality and mental health problems, which were worse for patients with a more severe form of the disease
Taskesen *et al.*[45]	Cross-sectional study	100 inpatients, 100 outpatients	CPTS-RI; CDI; SCARED	CDI values were comparable for inpatients/outpatients (7.34 vs. 10.13; $p = 0.13$); inpatient CPTS-RI was significantly lower than outpatient (10.7 vs. 16.63, $p = 0.01$); SCREAM values were not significantly different for inpatients and outpatients (15.64 vs. 14.8, $p = 0.57$)	COVID-19 can have psychopathological effects on paediatric patients

TABLE 1 Studies selected for inclusion (*continued*)

Study	Design	*N* analysed	Quality-of-life measures	Quality-of-life values	Quality-of-life conclusions
Whittington *et al.*[46]	Economic evaluation	N/A	Published values for influenza/*C. difficile*	COVID-19 symptom disutility −0.190; mechanical ventilation disutility −0.600; non-invasive ventilation disutility −0.500; supplemental oxygen disutility −0.400; medical care without oxygen disutility − 0.300	
Wimmer *et al.*[47]	Prospective cohort study	61	Fatigue Severity Scale-7 (FSS-7); HADS; EQ-5D-5L	No significant differences were seen between baseline and discharge for FSS-7 (2.8 vs. 2.9, $p = 0.970$) or HADS-A (5.0 vs. 4.0, $p = 0.142$); significant improvements were seen between baseline and discharge for HADS-D (4.0 vs. 3.0, $p = 0.026$), EQ-VAS (52.3 vs. 67.4, $p < 0.001$) and EQ-5D-5L index value (0.554 vs. 0.749, $p < 0.001$)	Neurorehabilitation improves QOL for patients with severe neurological symptoms following COVID-19

N/A, not applicable; BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; CDI, Child Depression Inventory; CPTS-RI, Child Post-Traumatic Stress Reaction Index; DALY, disability-adjusted life-year; ESS, Epworth Sleepiness Scale; GAD-7, Generalised Anxiety Disorder-7; HADS, Hospital Anxiety and Depression Scale; HTQ, Harvard Trauma Questionnaire; ISI, Insomnia Severity Index; mBDS, modified Borg Dyspnea Scale; MFI-20, Multidimensional Fatigue Inventory; mMRC, modified Medical Research Council Dyspnea Scale; PHQ-9, Patient Health Questionnaire-9; PSQI, Pittsburgh Sleep Quality Index; PSS-10, Perceived Stress Scale; SAS, Self-Rating Anxiety Scale; SCARED, Screen for Child Anxiety Related Disorders; SDS, Self-Rating Depression Scale; SF-36, Short Form-36; SIM-C, Short Inventory of Mindfulness Capability; SSS-8, 8-item Somatic Symptom Scale; WHOQOL-OLD, World Health Organization Quality of Life Instrument-Older Adults Module; YLL, years of life lost; QALY, quality-adjusted life-year.

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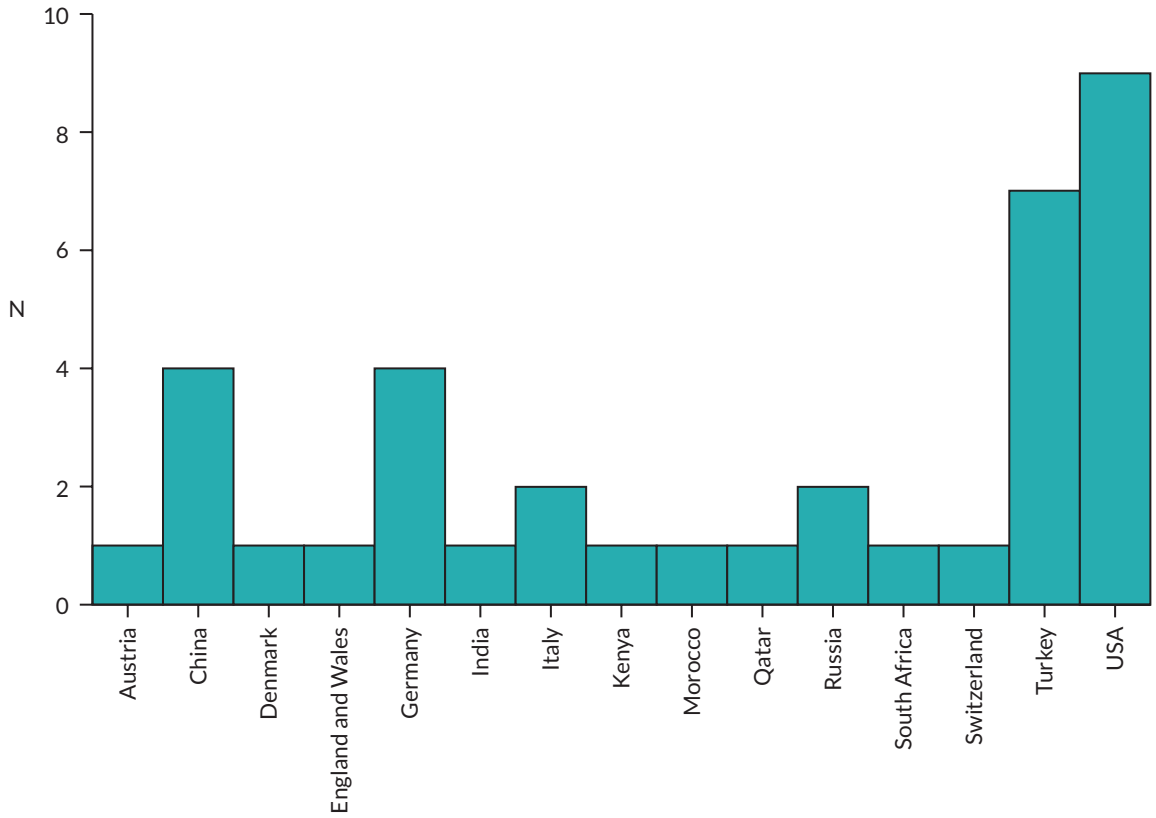

FIGURE 2 Which country studies took place in.

on the first and/or ended on the last day of the relevant month). The earliest data collection started in February 2020[33] and seven other studies also began collection in the first half of 2020,[13,23–26,29,34] with the majority using sleep and/or mental health-related measures. The first study to be published was Cleary *et al.*,[18] who used published utility values. The first study to be published which reported data collected from COVID-19 inpatients was Akinci *et al.*,[13] who used PSQI and HADS.

For studies where it was clear what mode was used for data collection, two used paper surveys,[25,44] six collected responses online,[17,26,34,39,42,45] three collected responses via phone[36,39,42] and one used in-person interviews.[23,36]

In general, studies found that being an inpatient with COVID-19 negatively affected QOL and, in particular, many studies found a negative impact on mental health[13,17,29,34,42,44] and/or sleep quality.[13,17,23,26,29,33,34,42,44] However, many studies did not formally include a comparator group of those without COVID-19, making it difficult to isolate the causal effect of the disease. This is particularly problematic with sleep quality and anxiety where hospitalisation for any condition may be expected to have an impact. A differential impact on some groups was found by several studies, in particular older inpatients,[15,20,29] women[20,25] and those with comorbidities.[20] The four studies examining inpatient rehabilitation programmes[22,24,31,47] all showed a significant post-intervention improvement in QOL compared to baseline.

Discussion

The results show that collecting data on COVID-19 inpatients' QOL was feasible, even in the early stages of the pandemic. Given the disruption that the pandemic caused to healthcare systems, as well as wider society, this is an encouraging finding for QOL research.

It is positive that many studies were from low- or middle-income countries. However, sample sizes, especially for studies collecting data directly from patients, were often relatively low, with a median of under 100. In addition, many studies were cross-sectional. While this design provides much useful information, it is difficult to get a picture of how QOL has varied over the course of the COVID-19 pandemic.

A large fraction of the included studies used sleep and/or mental health-related survey instruments. However, there was a lack of consensus on what survey measures to use,

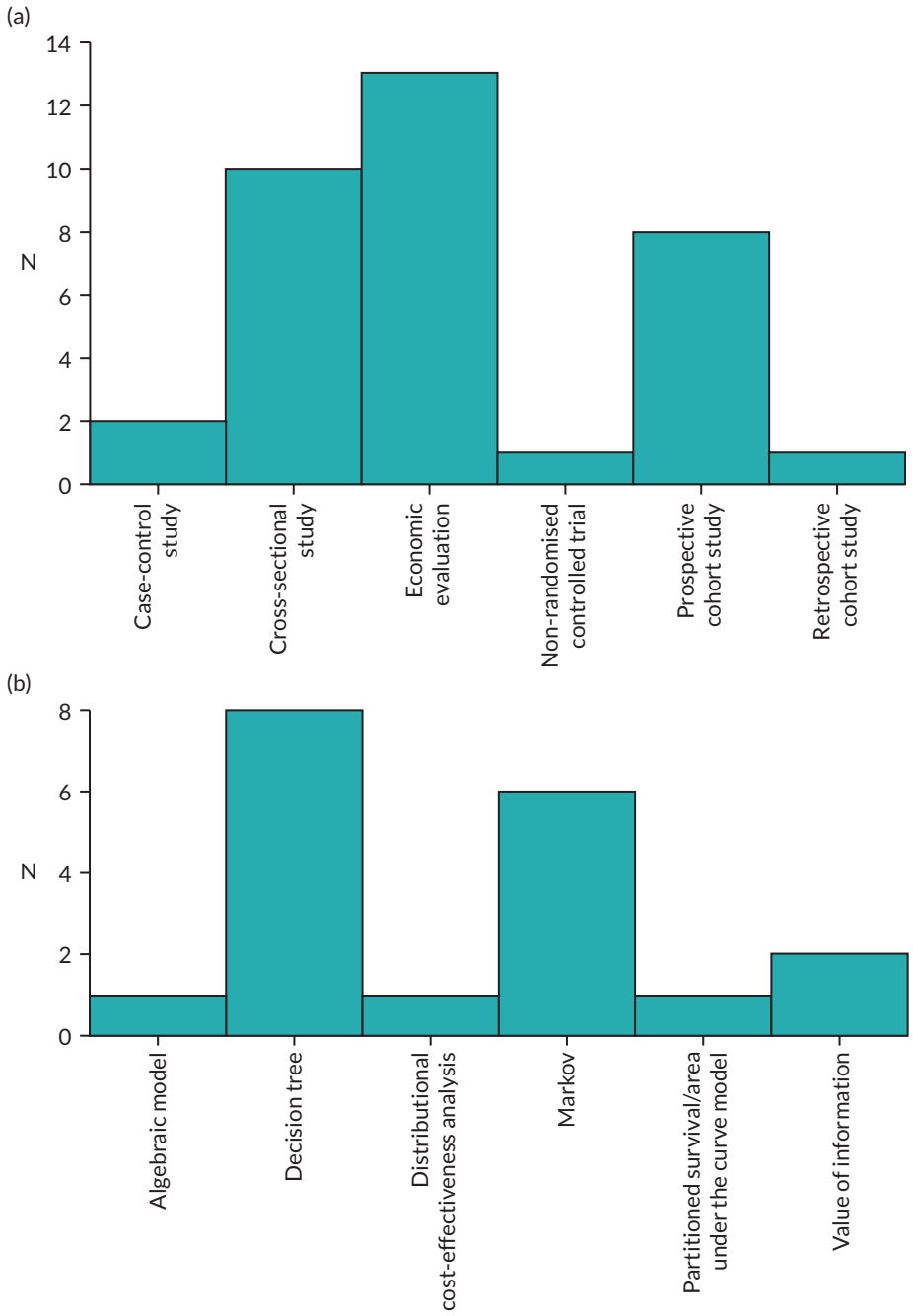

FIGURE 3 (a) Frequency of using study design; (b) frequency that economic evaluation studies used different modelling approaches.

with a large number employed. Some variation was clearly necessary, for example using child-specific instruments for studies in children, but the wide variety of surveys used hinders comparison of results across different studies.

While sleep and mental health are undoubtedly important topics, there is a lack of data on the overall QOL impact of being hospitalised with COVID-19. For example, only five studies used the EQ-5D measure commonly used in other areas of health research. Only one study targeted the general population of people hospitalised with COVID-19, with the others targeting specific sub-populations (older people,[20] those undergoing surgery[40] or people in rehabilitation programmes[24,31]).

The paucity of general QOL data for people hospitalised in the acute phase of the disease meant that economic evaluations used published utility values of disability weights for people with other conditions. This represents a serious knowledge gap, especially given the demonstrated feasibility of collecting such data. Research to fill this gap would be useful, not just for economic evaluation,

TABLE 2 Overview of survey measures used in studies

Survey	Abbreviation	Description	Reference
Beck Anxiety Inventory	BAI	21-item measure of anxiety severity	50
Beck Depression Inventory	BDI	21-item measure of depression severity	51
Child Depression Inventory	CDI	10-item measure of child psychological health	52
Child Post-Traumatic Stress Disorder Reaction Index	CPTS-RI	48-item structured interview assessing child's trauma history	53
Epworth Sleepiness Scale	ESS	8-item measure of sleepiness	54
EQ-5D	EQ-5D	Generic health-related quality of life measure with three-level (EQ-5D-3L) and five-level (EQ-5D-5L) versions	55
Generalised Anxiety Disorder-7	GAD-7	Condition-specific measure assessing generalised anxiety disorder	56
Harvard Trauma Questionnaire	HTQ	Checklist measuring exposure to traumatic events	57
Hospital Anxiety and Depression Scale	HADS	14-item scale measuring anxiety and depression separately	58
Insomnia Severity Index	ISI	7-item scale measuring sleep quality	59
Modified Borg Dyspnea Scale	mBDS	10-point scale measuring breathing difficulties	60
Modified Medical Research Council Dyspnea Scale	mMRC	5-item scale measuring severity of dyspnoea symptoms	61
Multidimensional Fatigue Inventory	MFI-20	20-item measure of fatigue	62
Patient Health Questionnaire-9	PHQ-9	9-item scale used to diagnose mental health disorders	63
Perceived Stress Scale	PSS-10	10-item measure of stress	64
Pittsburgh Sleep Quality Index	PSQI	19-item measure of sleep quality and disturbances	65
Screen for Child Anxiety Related Disorders	SCARED	41-item measure of anxiety in children	66
Self-rating Anxiety Scale	SAS	20-item measure of anxiety disorder symptoms	67
Self-rating Depression Scale	SDS	20-item measure of depression disorder symptoms	68
Short Form (36) Health Survey	SF-36	Generic health-related quality-of-life measure	69
Short Inventory of Mindfulness Capability	SIM-C	12-item measure of the describing, act-aware and non-judging factors of mindfulness	70
8-item Somatic Symptom Scale	SSS-8	8-item measure of somatic symptom burden, short version of the Patient Health Questionnaire-15	71
World Health Organization Quality of Life – Older Adults Module	WHOQOL-OLD	24-item measure of quality of life in older people	72

but also to see what the impact of being hospitalised with COVID-19 is on people's QOL, and what aspects of health are most affected.

The latest date on which any included study was open for data collection was September 2021, although results from some studies which collected data at later time points may not yet be available. COVID-19 has evolved during the course of the pandemic and widespread vaccination has also reduced the probability of serious illness for those infected.[73–75] Several studies have looked at how QOL evolved for the general population[76,77] or for specific groups such as carers.[78–80] However, the large number of survey measures used and the fact that generic measures were in a minority makes it difficult to track how the pandemic's evolution has impacted QOL for COVID-19 inpatients.

Several studies examined a group of COVID-19 inpatients, but without also measuring QOL for a comparison group of individuals without the condition. This made it difficult to quantify the impact of being hospitalised with COVID-19,

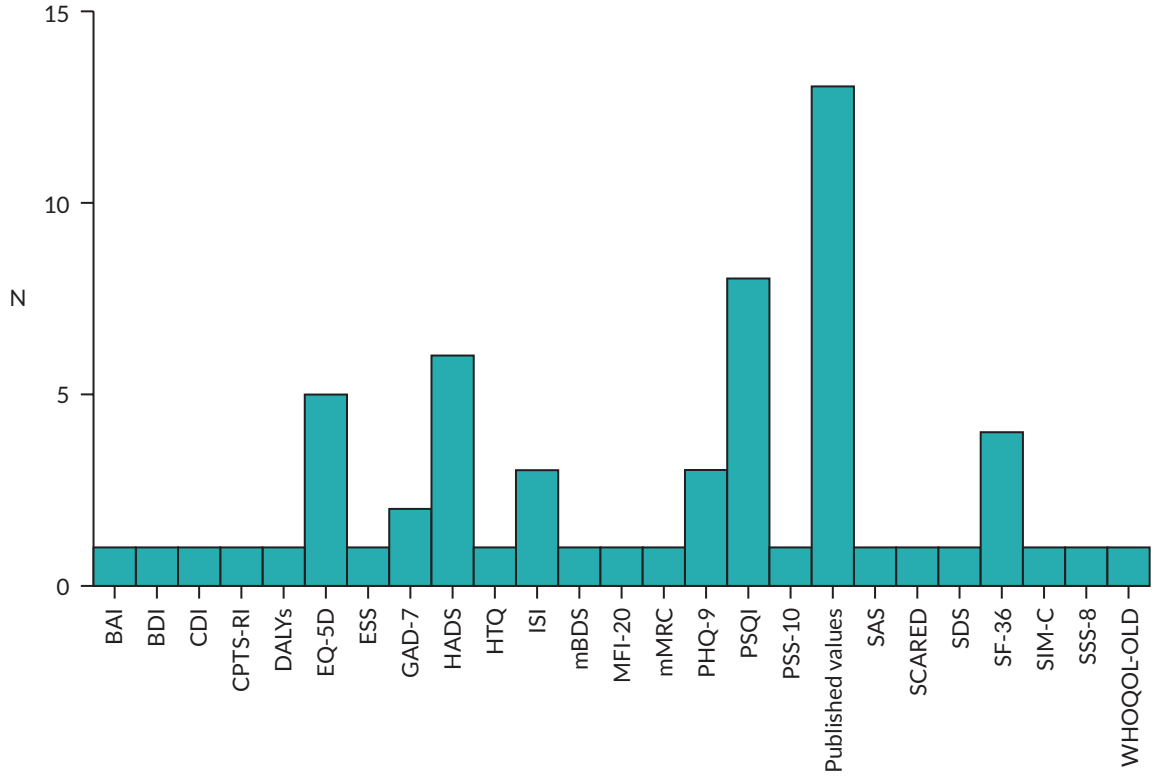

FIGURE 4 Frequency of using different quality-of-life measures. BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; CDI, Child Depression Inventory; CPTS-RI, Child Post-Traumatic Stress Reaction Index; DALY, disability-adjusted life-year; ESS, Epworth Sleepiness Scale; GAD-7, Generalised Anxiety Disorder-7; HADS, Hospital Anxiety and Depression Scale; HTQ, Harvard Trauma Questionnaire; ISI, Insomnia Severity Index; mBDS, modified Borg Dyspnea Scale; MFI-20, Multidimensional Fatigue Inventory; mMRC, modified Medical Research Council Dyspnea Scale; PHQ-9, Patient Health Questionnaire-9; PSQI, Pittsburgh Sleep Quality Index; PSS-10, Perceived Stress Scale; SAS, Self-rating Anxiety Scale; SCARED, Screen for Child Anxiety Related Disorders; SDS, Self-rating Depression Scale; SF-36, Short Form-36; SIM-C, Short Inventory of Mindfulness Capability; SSS-8, 8-item Somatic Symptom Scale; WHOQOL-OLD, World Health Organization Quality of Life Instrument – Older Adults Module.

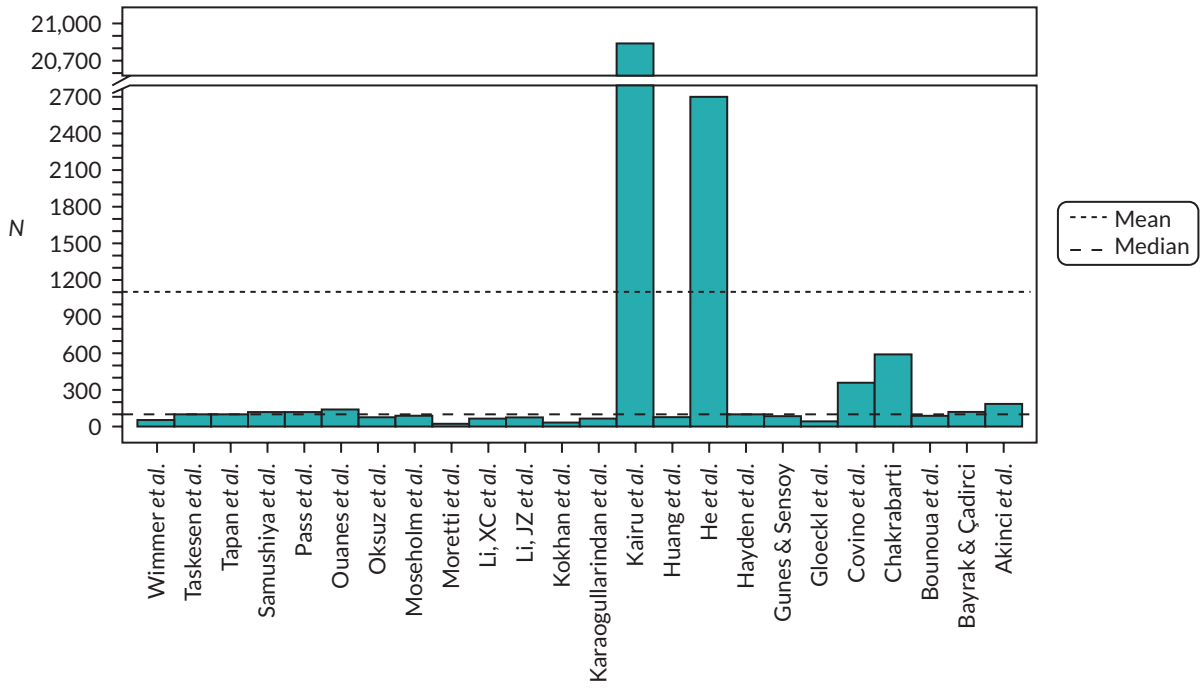

FIGURE 5 Analysis sample sizes of COVID-19 inpatients.

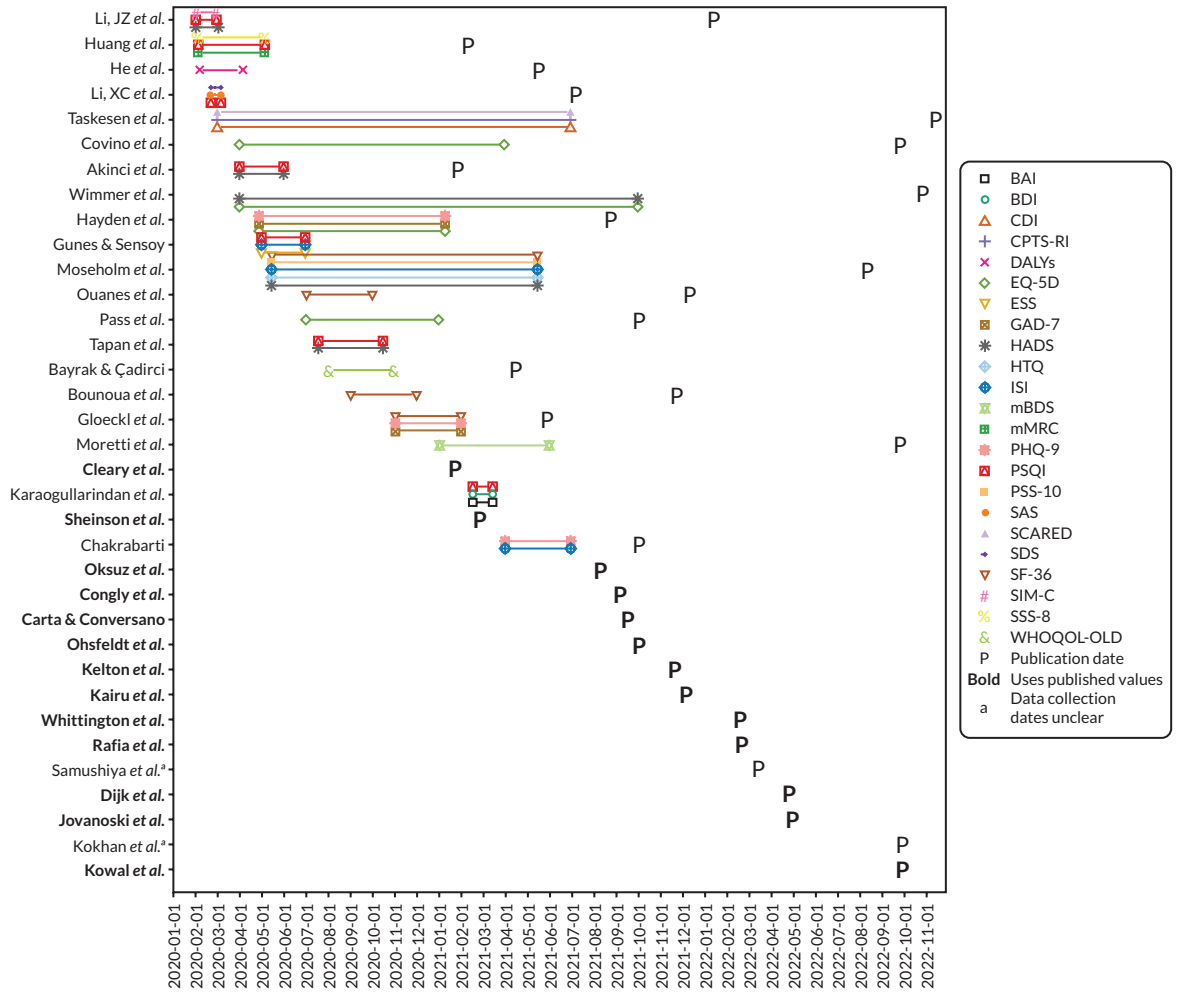

FIGURE 6 Timeline of data collection and study publication dates.

since there was no counterfactual to measure a decrement against. Several other studies had a cross-sectional design, which is a common approach and can give valuable insight. However, a longitudinal design can give additional information, albeit usually with greater resource costs.

A strength of our paper is that we jointly developed a search strategy involving those with health economic experience, but also information specialist expertise. We also searched a wide range of databases. This approach maximised our chances of finding all relevant studies.

While our systematic searches were an advantage, it is a weakness of this study that it is not a systematic review, and no protocol was registered in advance. This may potentially have introduced some bias into our findings. There were limitations to the conclusions that could be drawn from the external data. For example, it was not possible to synthesise data from the included studies to find values representing QOL for COVID-19 inpatients on a full health = 1, dead = 0 scale. Many included studies used published values for people with other conditions. Those that did survey patients used a wide range of measures that were difficult or impossible to directly compare, and often comparison groups were not included. There was also a wide range of settings studied, from ICU to inpatient rehabilitation. A final limitation to the extracted data is that it was often difficult to distinguish between people hospitalised due to COVID-19 and those hospitalised for another reason who had also acquired a COVID-19 infection (although given the time frame of most studies, patients were likely to mostly consist of the former group). Yet it is also a strength of our study that examining the above limitations has allowed us to make recommendations both for future COVID-19 and QOL research and for methodological approaches to measuring the QOL impact of future health crises.

Conclusion

We conclude by summarising some recommendations for COVID-19-related research, as well as for research during future health crises. On the former topic, we recommend

that such data be collected longitudinally, so that the QOL impact for patients hospitalised with COVID-19 can be assessed as the disease progresses throughout its acute phase. Several economic evaluations of COVID-19 treatments exist which use utility values from patients with other conditions. The cost-effectiveness of such treatments should be reassessed using data collected from COVID-19 patients.

In future health crises, researchers should be aware of early opportunities to collect QOL data from hospitalised patients, given the feasibility demonstrated during COVID-19. There should also be an effort on behalf of the research community to co-ordinate as much as possible, to enhance comparability of results between studies and to ensure that important knowledge gaps do not arise.

Additional information

CRediT contribution statement

Edward Webb: Conceptualisation (equal), Data curation (lead), Investigation (equal), Methodology (joint lead), Software (lead), Visualisation (lead), Writing – original draft (lead), Writing – editing and reviewing (lead). **Natalie King:** Investigation (equal), Methodology (joint lead), Writing – editing and reviewing (supporting). **Daniel Howdon:** Data curation (supporting), Investigation (supporting), Writing – editing and reviewing (supporting). **Enitan D Carrol:** Conceptualisation (supporting), Funding acquisition (joint lead), Writing – editing and reviewing (supporting). **Joanne Euden:** Funding acquisition (equal), Project administration (lead), Writing – editing and reviewing (supporting). **Philip Howard:** Funding acquisition (equal), Writing – editing and reviewing (supporting). **Philip Pallmann:** Funding acquisition (equal), Writing – editing and reviewing (supporting). **Martin J Llewelyn:** Funding acquisition (equal), Writing – editing and reviewing (supporting). **Emma Thomas-Jones:** Funding acquisition (equal), Writing – editing and reviewing (supporting). **Bethany Shinkins:** Conceptualisation (equal), Data curation (supporting), Funding acquisition (equal), Investigation (supporting), Supervision (lead), Writing – original draft (supporting), Writing – editing and reviewing (supporting). **Jonathan Sandoe:** Conceptualisation (supporting), Funding acquisition (joint lead), Writing – editing and reviewing (supporting). **Robert West:** Funding acquisition (equal). **Lucy Brookes-Howell:** Funding acquisition (equal). **Paul Dark:** Funding acquisition (equal). **Neil Powell:** Funding acquisition (equal). **Tamas Szakmany:** Funding acquisition (equal). **Mahableshwar Albur:** Funding acquisition (equal). **David Partridge:** Funding acquisition (equal). **Thomas Hellyer:** Funding acquisition (equal). **Helena Parsons:** Funding acquisition (equal). **Susan Hopkins:** Funding acquisition (equal). **Margaret Ogden:** Funding acquisition (equal). **Dominic Shaw:** Funding acquisition (equal). **Stacy Todd:** Funding acquisition (equal). **Stuart Bond:** Funding acquisition (equal).

Disclosure of interests

Full disclosure of interests: Completed ICMJE forms for all authors, including all related interests, are available in the toolkit on the NIHR Journals Library report publication page at https://doi.org/10.3310/ATPR4281.

Primary conflicts of interest: None declared.

Data-sharing statement

Full extracted data are provided as *Report Supplementary Material 1*. All requests for data should be directed to the corresponding author.

Ethics statement

Research approval for the PEACH study was provided by the Health Research Authority (HRA) and Health and Care Research Wales (HCRW). Ethics approval was provided by West Midlands – Solihull Research Ethics Committee (REC Reference 21/WM/0052).

Information governance statement

The University of Leeds is committed to handling all personal information in line with the UK Data Protection Act (2018) and the General Data Protection Regulation (EU GDPR) 2016/679. Under the Data Protection legislation, The University of Leeds is the Data Controller, and you can find out more about how we handle personal data, including how to exercise your individual rights, and the contact details for our Data Protection Officer are here: https://dataprotection.leeds.ac.uk/.

Study registration details

This study is registered as ISRCTN66682918.

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About this article

The contractual start date for this research was in October 2020. This article began editorial review in March 2023 and was accepted for publication in November 2023. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The *Health Technology Assessment* editors and publisher have tried to ensure the accuracy of the authors' article and would like to thank the reviewers for their constructive comments on the draft document. However, they do not accept liability for damages or losses arising from material published in this article.

This article was published based on current knowledge at the time and date of publication. NIHR is committed to being inclusive and will continually monitor best practice and guidance in relation to terminology and language to ensure that we remain relevant to our stakeholders.

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List of abbreviations

BAI	Beck Anxiety Inventory
BDI	Beck Depression Inventory
CDI	Child Depression Inventory
COVID-19	coronavirus disease 2019
CPTS-RI	Child Post-Traumatic Stress Reaction Index
DALY	disability-adjusted life-year
EQ-5D	EuroQol-5 Dimensions
EQ-5D-3L	EuroQol-5 Dimensions, three-level version
GAD	generalised anxiety disorder
GBD	Global Burden of Disease
HADS	Hospital and Anxiety Depression Scale
HTQ	Harvard Trauma Questionnaire
HUI	Health Utilities Index
ICU	intensive care unit
PHQ-9	Patient Health Questionnaire-9
PROM	patient-reported outcome measure
PSQI	Pittsburgh Sleep Quality Index
PSS	Perceived Stress Scale
QALY	quality-adjusted life-year
QOL	quality of life
SAS	Self-rating Anxiety Scale
SCARED	Screen for Child Anxiety Related Disorders
SDS	Self-rating Depression Scale

List of supplementary material

Report Supplementary Material 1 Full extracted data

Supplementary material can be found on the NIHR Journals Library report page (https://doi.org/10.3310/ATPR4281).

Supplementary material has been provided by the authors to support the report and any files provided at submission will have been seen by peer reviewers, but not extensively reviewed. Any supplementary material provided at a later stage in the process may not have been peer reviewed.

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Appendix

We searched the following academic databases for quantitative measures of quality of life in patients hospitalised with COVID-19 on 6 May 2022, with searches re-run on 7 December 2022:

- EMBASE Classic + EMBASE (Ovid) 1947 to 6 December 2022
- Ovid MEDLINE® ALL 1946 to 6 December 2022
- Scopus
- Web of Science Core Collection; SCI-EXPANDED 1900+, SSCI 1900+, A&HCI 1975+, CPCI-S 1900+, CPCI-SSH 1900+, and ESCI 2015 + searched simultaneously.

Searches were developed for the concepts: COVID-19, health utility measures and hospital patients. Subject headings and free text words were identified for use in the search concepts by the information specialist and project team members. Further terms were identified and tested from known relevant papers.

For the QOL measures concept, we based our search on the MEDLINE precision maximising health utilities filter (FSF3) designed by Arber *et al.*[11] with the addition of extra QOL measurement tools. The search was then translated into the other databases. We did not apply limits for language or publication date to the search. The search was peer-reviewed by a second information specialist using the PRESS checklist.[12] Duplicates were removed automatically and manually using Academic Unit of Health Economics, University of Leeds guidance.[81]

Search strategies

EMBASE Classic + EMBASE <1947 to 6 December 2022>

Search date: 7 December 2022

1 quality-adjusted life year/ 32,963
2 (quality-adjusted or adjusted life year$).ti,ab,kf. 31,924
3 (qaly$ or qald$ or qale$ or qtime$).ti,ab,kf. 25,432
4 (illness state$1 or health state$1).ti,ab,kf. 13,894
5 (hui or hui1 or hui2 or hui3).ti,ab,kf. 2939
6 (multiattribute$ or multi attribute$).ti,ab,kf. 1462
7 (utility adj3 (score$1 or valu$ or health$ or cost$ or measur$ or disease$ or mean or gain or gains or index$)).ti,ab,kf. 30,140
8 utilities.ti,ab,kf. 14,439
9 exp 'quality of life assessment'/ 98,410
10 (eq-5d or eq5d or eq-5 or eq5 or euro qual or euroqual or euro qual5d or euroqual5d or euro qol or euroqol or euro qol5d or euroqol5d or euro quol or euroquol or euro quol5d or euroquol5d or eur qol or eurqol or eur qol5d or eur qol5d or eur?qul or eur?qul5d or euro$ quality of life or european qol).ti,ab,kf. 28,819
11 (euro$ adj3 (5 d or 5d or 5 dimension$ or 5dimension$ or 5 domain$ or 5domain$)).ti,ab,kf. 8407
12 (sf36$ or sf 36$ or sf thirtysix or sf thirty six).ti,ab,kf. 44,163
13 (time trade-off$1 or time tradeoff$1 or tto or timetradeoff$1).ti,ab,kf. 3381
14 standard gamble/ or time trade-off method/ 451
15 or/1-14 [Health utilities based on Arber *et al.* Health State Utilities FSF3 Precision maximising] 206,779
16 disability-adjusted life year/ 3742
17 (DALY? or disability-adjusted life year$).ti,ab,kf. 7098
18 (HALY? or health-adjusted life year$).ti,ab,kf. 654
19 (sf20$ or sf 20$ or sf twenty).ti,ab,kf. 585
20 (sf12$ or sf 12$ or sf twelve).ti,ab,kf. 11,252
21 (sf8$ or sf 8$ or sf eight).ti,ab,kf. 1321
22 'health-related quality of life'.ti,ab,kf. 81,885
23 (HRqol or HR-QOL or HRQL or HR QL).ti,ab,kf. 42,963
24 or/16-23 [additional QOL terms] 103,844
25 15 or 24 [expanded Utility and QALY terms] 265,737
26 exp *coronavirus disease 2019/ 229,750
27 (coronavirus-19 or covid19 or covid-19 or covid 2019).ti,ab,kf. 304,433
28 exp *Severe acute respiratory syndrome coronavirus 2/ 35,387
29 (sars-cov2 or sars-cov-2 or sarscov2 or sarscov-2 or Sars-coronavirus2 or Sars-coronavirus-2 or SARS-like coronavirus*).ti,ab,kw. 117,021
30 or/26-29 [Covid 19 simplified] 340,238
31 25 and 30 3312
32 exp hospital patient/ 230,238
33 ((hospital* or in-hospital) adj2 patient*).ti,ab,kf. 226,115
34 (inpatient* or in-patient*).ti,ab,kf. 3,392,878
35 or/32-34 [inpatients] 3,560,099

36 31 and 35 703
37 exp juvenile/ not exp adult/ 2,824,192
38 36 not 37 688
39 limit 38 to conference abstract 252
40 38 not 39 [Covid inpatient QALYs] 436

Ovid MEDLINE(R) ALL <1946 to 6 December 2022>

Search date: 7 December 2022

1 Quality-Adjusted Life Years/ 15,263
2 (quality-adjusted or adjusted life year$).ti,ab,kf. 22,040
3 (qaly$ or qald$ or qale$ or qtime$).ti,ab,kf. 13,846
4 (illness state$1 or health state$1).ti,ab,kf. 7970
5 (hui or hui1 or hui2 or hui3).ti,ab,kf. 1882
6 (multiattribute$ or multi attribute$).ti,ab,kf. 1232
7 (utility adj3 (score$1 or valu$ or health$ or cost$ or measur$ or disease$ or mean or gain or gains or index$)).ti,ab,kf. 19,091
8 utilities.ti,ab,kf. 8946
9 (eq-5d or eq5d or eq-5 or eq5 or euro qual or euroqual or euro qual5d or euroqual5d or euro qol or euroqol or euro qol5d or euroqol5d or euro quol or euroquol or euro quol5d or euroquol5d or eur qol or eurqol or eur qol5d or eur qol5d or eur?qul or eur?qul5d or euro$ quality of life or european qol).ti,ab,kf. 16,100
10 (euro$ adj3 (5 d or 5d or 5 dimension$ or 5dimension$ or 5 domain$ or 5domain$)).ti,ab,kf. 5598
11 (sf36$ or sf 36$ or sf thirtysix or sf thirty six).ti,ab,kf. 25,754
12 (time trade-off$1 or time tradeoff$1 or tto or timetradeoff$1).ti,ab,kf. 2276
13 or/1-12 [Arber *et al.* Health State Utilities FSF3 Precision maximising] 89,086
14 Disability-Adjusted Life Years/ 153
15 (DALY? or disability-adjusted life year$).ti,ab,kf. 5576
16 Healthy Life Expectancy/ 42
17 (HALY? or health-adjusted life year$).ti,ab,kf. 681
18 (sf20$ or sf 20$ or sf twenty).ti,ab,kf. 429
19 (sf12$ or sf 12$ or sf twelve).ti,ab,kf. 6600
20 (sf8$ or sf 8$ or sf eight).ti,ab,kf. 738
21 'health-related quality of life'.ti,ab,kf. 56,432
22 (HRqol or HR-QOL or HRQL or HR QL).ti,ab,kf. 26,447
23 or/14-22 [additional QALY terms] 69,438
24 13 or 23 [expanded Utility and QALY terms] 137,390
25 COVID-19/ 202,332
26 (coronavirus-19 or covid19 or covid-19 or covid 2019).ti,ab,kf. 279,370
27 SARS-CoV-2/ 143,349
28 (sars-cov2 or sars-cov-2 or sarscov2 or sarscov-2 or Sars-coronavirus2 or Sars-coronavirus-2 or SARS-like coronavirus*).ti,ab,kf. 106,989
29 or/25-28 [covid 19 simplified] 313,388
30 24 and 29 1615
31 Inpatients/ 28,233
32 ((hospital* or in-hospital) adj2 patient*).ti,ab,kf. 123,506
33 (inpatient* or in-patient*).ti,ab,kf. 2,129,575
34 or/31-33 [inpatients] 2,214,076
35 30 and 34 [in patients - all] 285

Scopus

Search date: 7 December 2022

1 ((TITLE-ABS-KEY ((hospital* OR in-hospital) PRE/2 patient*)) OR (TITLE-ABS-KEY (inpatient* OR 'in-patient*'))) AND ((TITLE-ABS-KEY ('sars-cov2' OR 'sars-cov-2' OR sarscov2 OR 'sarscov-2' OR 'sars-coronavirus2' OR 'sars-coronavirus-2' OR 'sars-like coronavirus*')) OR (TITLE-ABS-KEY ('coronavirus-19' OR covid19 OR 'covid 19' OR 'covid 2019'))) AND (((TITLE-ABS-KEY (daly* OR 'disability-adjusted life year*')) OR (TITLE-ABS-KEY ('healthy life expectancy')) OR (TITLE-ABS-KEY (haly* OR 'health-adjusted life year*')) OR (TITLE-ABS-KEY (sf20* OR 'sf 20*' OR 'sf twenty')) OR (TITLE-ABS-KEY (sf12* OR 'sf 12*' OR 'sf twelve')) OR (TITLE-ABS-KEY (sf8* OR 'sf 8*' OR 'sf eight')) OR (TITLE-ABS-KEY ('health-related quality of life')) OR (TITLE-ABS-KEY (hrqol OR hr-qol OR hrql OR 'hr ql'))) OR ((TITLE-ABS-KEY (hui OR hui1 OR hui2 OR hui3)) OR (TITLE-ABS-KEY ('time trade-off*' OR 'time tradeoff*' OR tto OR timetradeoff*)) OR (TITLE-ABS-KEY (sf36* OR 'sf 36*' OR 'sf thirtysix' OR 'sf thirty six')) OR (TITLE-ABS-KEY (euro* PRE/3 ('5 d' OR 5d OR '5 dimension*' OR 5dimension* OR '5 domain*' OR 5domain*))) OR (TITLE-ABS-KEY (eq-5d OR eq5d OR eq-5 OR eq5 OR 'euro qual' OR euroqual OR 'euro qual5d' OR euroqual5d OR 'euro qol' OR euroqol OR 'euro qol5d' OR euroqol5d OR 'euro quol' OR euroquol OR 'euro quol5d' OR euroquol5d OR 'eur qol' OR eurqol OR 'eur qol5d' OR 'eur qol5d' OR eur?qul OR eur?qul5d OR 'euro* quality of life' OR 'european qol')) OR (TITLE-ABS-KEY (utilities)) OR (TITLE-ABS-KEY (utility PRE/3 (score* OR valu* OR health* OR cost* OR measur* OR disease* OR mean OR gain OR gains OR index*))) OR (TITLE-ABS-KEY (multiattribute* OR 'multi attribute*')) OR (TITLE-ABS-KEY ('illness state*' OR 'health state')) OR (TITLE-ABS-KEY (qaly* OR qald* OR qale* OR qtime*)) OR (TITLE-ABS-KEY ('quality-adjusted' OR 'adjusted life year*')))) 786 results [#22 AND #25 AND #28]
2 (TITLE-ABS-KEY ((hospital* OR in-hospital) PRE/2 patient*)) OR (TITLE-ABS-KEY (inpatient* OR 'in-patient*')) 2,538,425 results [#26 OR #27 Inpatients]
3 TITLE-ABS-KEY ((hospital* OR in-hospital) PRE/2 patient*) 233,554 results

4 TITLE-ABS-KEY (inpatient* OR 'in-patient*') 2,415,526 results
5 (TITLE-ABS-KEY ('sars-cov2' OR 'sars-cov-2' OR sarscov2 OR 'sarscov-2' OR 'sars-coronavirus2' OR 'sars-coronavirus-2' OR 'sars-like coronavirus*')) OR (TITLE-ABS-KEY ('coronavirus-19' OR covid19 OR 'covid 19' OR 'covid 2019')) 415,224 results [23 OR #24 COVID –simple]
6 TITLE-ABS-KEY ('sars-cov2' OR 'sars-cov-2' OR sarscov2 OR 'sarscov-2' OR 'sars-coronavirus2' OR 'sars-coronavirus-2' OR 'sars-like coronavirus*') 173,817 results
7 TITLE-ABS-KEY ('coronavirus-19' OR covid19 OR 'covid 19' OR 'covid 2019') 402,727 results
8 ((TITLE-ABS-KEY (daly* OR 'disability-adjusted life year*')) OR (TITLE-ABS-KEY ('healthy life expectancy')) OR (TITLE-ABS-KEY (haly* OR 'health-adjusted life year*')) OR (TITLE-ABS-KEY (sf20* OR 'sf 20*' OR 'sf twenty')) OR (TITLE-ABS-KEY (sf12* OR 'sf 12*' OR 'sf twelve')) OR (TITLE-ABS-KEY (sf8* OR 'sf 8*' OR 'sf eight')) OR (TITLE-ABS-KEY ('health-related quality of life')) OR (TITLE-ABS-KEY (hrqol OR hr-qol OR hrql OR 'hr ql'))) OR ((TITLE-ABS-KEY (hui OR hui1 OR hui2 OR hui3)) OR (TITLE-ABS-KEY ('time trade-off*' OR 'time tradeoff*' OR tto OR timetradeoff*)) OR (TITLE-ABS-KEY (sf36* OR 'sf 36*' OR 'sf thirtysix' OR 'sf thirty six')) OR (TITLE-ABS-KEY (euro* PRE/3 ('5 d' OR 5d OR '5 dimension*' OR 5dimension* OR '5 domain*' OR 5domain*))) OR (TITLE-ABS-KEY (eq-5d OR eq5d OR eq-5 OR eq5 OR 'euro qual' OR euroqual OR 'euro qual5d' OR euroqual5d OR 'euro qol' OR euroqol OR 'euro qol5d' OR euroqol5d OR 'euro quol' OR euroquol OR 'euro quol5d' OR euroquol5d OR 'eur qol' OR eurqol OR 'eur qol5d' OR 'eur qol5d' OR eur?qul OR eur?qul5d OR 'euro* quality of life' OR 'european qol')) OR (TITLE-ABS-KEY (utilities)) OR (TITLE-ABS-KEY (utility PRE/3 (score* OR valu* OR health* OR cost* OR measur* OR disease* OR mean OR gain OR gains OR index*))) OR (TITLE-ABS-KEY (multiattribute* OR 'multi attribute*')) OR (TITLE-ABS-KEY ('illness state*' OR 'health state')) OR (TITLE-ABS-KEY (qaly* OR qald* OR qale* OR qtime*)) OR (TITLE-ABS-KEY ('quality-adjusted' OR 'adjusted life year*'))) Show less 794,919 results [#21 OR #12 All QOL measures]
9 (TITLE-ABS-KEY (daly* OR 'disability-adjusted life year*')) OR (TITLE-ABS-KEY ('healthy life expectancy')) OR (TITLE-ABS-KEY (haly* OR 'health-adjusted life year*')) OR (TITLE-ABS-KEY (sf20* OR 'sf 20*' OR 'sf twenty')) OR (TITLE-ABS-KEY (sf12* OR 'sf 12*' OR 'sf twelve')) OR (TITLE-ABS-KEY (sf8* OR 'sf 8*' OR 'sf eight')) OR (TITLE-ABS-KEY ('health-related quality of life')) OR (TITLE-ABS-KEY (hrqol OR hr-qol OR hrql OR 'hr ql')) 81,375 results [or/13-20 additional QOL]
10 TITLE-ABS-KEY (hrqol OR hr-qol OR hrql OR 'hr ql') 28,146 results
11 TITLE-ABS-KEY ('health-related quality of life') 61,618 results
12 TITLE-ABS-KEY (sf8* OR 'sf 8*' OR 'sf eight') 1003 results
13 TITLE-ABS-KEY (sf12* OR 'sf 12*' OR 'sf twelve') 7128 results
14 TITLE-ABS-KEY (sf20* OR 'sf 20*' OR 'sf twenty') 652 results
15 TITLE-ABS-KEY (haly* OR 'health-adjusted life year*') 1976 results
16 TITLE-ABS-KEY ('healthy life expectancy') 853 results
17 TITLE-ABS-KEY (daly* OR 'disability-adjusted life year*') 9278 results
18 (TITLE-ABS-KEY (hui OR hui1 OR hui2 OR hui3)) OR (TITLE-ABS-KEY ('time trade-off*' OR 'time tradeoff*' OR tto OR timetradeoff*)) OR (TITLE-ABS-KEY (sf36* OR 'sf 36*' OR 'sf thirtysix' OR 'sf thirty six')) OR (TITLE-ABS-KEY (euro* PRE/3 ('5 d' OR 5d OR '5 dimension*' OR 5dimension* OR '5 domain*' OR 5domain*))) OR (TITLE-ABS-KEY (eq-5d OR eq5d OR eq-5 OR eq5 OR 'euro qual' OR euroqual OR 'euro qual5d' OR euroqual5d OR 'euro qol' OR euroqol OR 'euro qol5d' OR euroqol5d OR 'euro quol' OR euroquol OR 'euro quol5d' OR euroquol5d OR 'eur qol' OR eurqol OR 'eur qol5d' OR 'eur qol5d' OR eur?qul OR eur?qul5d OR 'euro* quality of life' OR 'european qol')) OR (TITLE-ABS-KEY (utilities)) OR (TITLE-ABS-KEY (utility PRE/3 (score* OR valu* OR health* OR cost* OR measur* OR disease* OR mean OR gain OR gains OR index*))) OR (TITLE-ABS-KEY (multiattribute* OR 'multi attribute*')) OR (TITLE-ABS-KEY ('illness state*' OR 'health state')) OR (TITLE-ABS-KEY (qaly* OR qald* OR qale* OR qtime*)) OR (TITLE-ABS-KEY ('quality-adjusted' OR 'adjusted life year*')) 738,857 results [or/1-11 Arber *et al.* Health State Utilities FSF3 Precision maximising]
19 TITLE-ABS-KEY ('time trade-off*' OR 'time tradeoff*' OR tto OR timetradeoff*) 4189 results
20 TITLE-ABS-KEY (sf36* OR 'sf 36*' OR 'sf thirtysix' OR 'sf thirty six') 29,327 results
21 TITLE-ABS-KEY (euro* PRE/3 ('5 d' OR 5d OR '5 dimension*' OR 5dimension* OR '5 domain*' OR 5domain*)) 11,323 results
22 TITLE-ABS-KEY (eq-5d OR eq5d OR eq-5 OR eq5 OR 'euro qual' OR euroqual OR 'euro qual5d' OR euroqual5d OR 'euro qol' OR euroqol OR 'euro qol5d' OR euroqol5d OR 'euro quol' OR euroquol OR 'euro quol5d' OR euroquol5d OR 'eur qol' OR eurqol OR 'eur qol5d' OR 'eur qol5d' OR eur?qul OR eur?qul5d

OR 'euro* quality of life' OR 'european qol') Show less 19,652 results
23 TITLE-ABS-KEY (utilities) 643,014 results
24 TITLE-ABS-KEY (utility PRE/3 (score* OR valu* OR health* OR cost* OR measur* OR disease* OR mean OR gain OR gains OR index*)) 29,903 results
25 TITLE-ABS-KEY (multiattribute* OR 'multi attribute*') 15,559 results
26 TITLE-ABS-KEY (hui OR hui1 OR hui2 OR hui3) 5075 results
27 TITLE-ABS-KEY ('illness state*' OR 'health state') 12,568 results
28 TITLE-ABS-KEY (qaly* OR qald* OR qale* OR qtime*) 14,986 results
29 TITLE-ABS-KEY ('quality-adjusted' OR 'adjusted life year*') 35,680 results

Web of Science Core Collection

Search date: 7 December 2022

Performed a simultaneous search of the following databases:

- Science Citation Index Expanded (SCI-EXPANDED)–1900–present
- Social Sciences Citation Index (SSCI)–1900–present
- Arts & Humanities Citation Index (AHCI)–1975–present
- Conference Proceedings Citation Index – Science (CPCI-S)–1990–present
- Conference Proceedings Citation Index – Social Science & Humanities (CPCI-SSH)–1990–present
- Emerging Sources Citation Index (ESCI)–2015–present.

Data updated 5 December 2022

1 'quality-adjusted' OR 'adjusted life year*' (Topic) Results: 21,592
2 qaly* OR qald* OR qale* OR qtime* (Topic) Results: 13,741
3 'illness state*' OR 'health state' (Topic) Results: 7234
4 hui OR hui1 OR hui2 OR hui3 (Topic) Results: 3535
5 multiattribute* OR 'multi attribute*' (Topic) Results: 11,488
6 utility NEAR/3 (score* OR valu* OR health* OR cost* OR measur* OR disease* OR mean OR gain OR gains OR index*) (Topic) Results: 41,056
7 utilities (Topic) Results: 476,812
8 eq-5d OR eq5d OR eq-5 OR eq5 OR 'euro qual' OR euroqual OR 'euro qual5d' OR euroqual5d OR 'euro qol' OR euroqol OR 'euro qol5d' OR euroqol5d OR 'euro quol' OR euroquol OR 'euro quol5d' OR euroquol5d OR 'eur qol' OR eurqol OR 'eur qol5d' OR 'eur qol5d' OR eur?qul OR eur?qul5d OR 'euro* quality of life' OR 'european qol' (Topic) Results: 17,634
9 euro* NEAR/3 ('5 d' OR 5d OR '5 dimension*' OR 5dimension* OR '5 domain*' OR 5domain*) (Topic) Results: 6128
10 sf36* OR 'sf 36*' OR 'sf thirtysix' OR 'sf thirty six' (Topic) Results: 30,354
11 'time trade-off*' OR 'time tradeoff*' OR tto OR timetradeoff* (Topic) Results: 3609
12 #11 OR #10 OR #9 OR #8 OR #7 OR #6 OR #5 OR #4 OR #3 OR #2 OR #1 Results: 55,1076 [based on arber HSU precision maximising]
13 daly* OR 'disability-adjusted life year*' (Topic) Results: 7348
14 'healthy life expectancy' (Topic) Results: 592
15 haly* OR 'health-adjusted life year*' (Topic) Results: 1857
16 sf20* OR 'sf 20*' OR 'sf twenty' (Topic) Results: 347
17 sf12* OR 'sf 12*' OR 'sf twelve' (Topic) Results: 6651
18 sf8* OR 'sf 8*' OR 'sf eight' (Topic) Results: 810
19 'health-related quality of life' (Topic) Results: 63,430
20 hrqol OR hr-qol OR hrql OR 'hr ql' (Topic) Results: 27,090
21 #20 OR #19 OR #18 OR #17 OR #16 OR #15 OR #14 OR #13 Results: 80,329 [additional QALY terms]
22 #21 OR #12 Results: 608,391 [All QALY]
23 'coronavirus-19' OR covid19 OR 'covid 19' OR 'covid 2019' (Topic) Results: 348,006
24 'sars-cov2' OR 'sars-cov-2' OR sarscov2 OR 'sarscov-2' OR 'sars-coronavirus2' OR 'sars-coronavirus-2' OR 'sars-like coronavirus*' (Topic) Results: 105,265
25 #24 OR #23 Results: 370,141 [COVID]
26 inpatient* OR 'in-patient*' (Topic) Results: 2,184,563
27 (hospital* OR in-hospital) NEAR/2 patient* (Topic) Results: 177,489
28 #26 OR #27 Results: 2,297,088 [inpatients]
29 #22 AND #25 AND #28 Results: 715 [QALY in covid hospital patients]