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Strategies to ensure continuity of nutritional care in patients with COVID-19 infection on discharge from hospital: a rapid review

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Strategies to ensure continuity of nutritional care in patients with Covid-19 infection on discharge from hospital: a rapid review.

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Key words

Nutritional care; COVID-19; Malnutrition; Dietetics; Systematic review; guidelines

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Abstract

Background & Aims:

The risk of malnutrition in people with Covid-19 is high; prevalence is reported as 37% in general medical inpatients, 53% in elderly inpatients and 67% in ICU. Thus, nutrition is a crucial element of assessment and treatment. This rapid review aimed to evaluate what evidence is available to inform evidence-based decision making on the nutritional care of patients hospitalised with Covid-19 infection.

Methods:

Cochrane Rapid Reviews guidance was followed; the protocol was registered (CRD42020208448). Studies were selected that included patients with Covid-19, pneumonia, respiratory distress syndrome and acute respiratory failure, in hospital or the community, and which examined nutritional support. All types of studies were eligible for inclusion except non-systematic reviews, commentaries, editorials and single case studies. Six electronic databases were searched: MEDLINE, Embase, Cochrane Central Register of Controlled Trials, PubMed, CINAHL and MedRxiv.

Results:

Twenty-six articles on Covid-19 were retrieved, including 11 observational studies, five guidelines and 10 opinion articles. Seven further articles on pneumonia included three RCTs, one unblinded trial, three observational studies, and one systematic review on rehabilitation post-ICU admission for respiratory illness. The evidence from these articles is presented narratively and used to guide the nutritional and dietetic care process.

Conclusions:

Older patients with Covid-19 infection are at risk of malnutrition and addressing this may be important in recovery. The use of nutritional management strategies applicable to other acute conditions are recommended. However, traditional screening and implementation techniques need to be modified to ensure infection control measures can be maintained. The most effective nutritional interventions require further research and more detailed guidance on nutritional management post-discharge to support long-term recovery is needed.

Introduction

Covid-19 infection continues to spread across the world with 140 million reported cases and over 3 million deaths globally since the start of the pandemic (20/04/2021) (1). In the UK, it has affected over 4 million people and resulted in 127,307 deaths so far (20/04/2021) (2).

The coronavirus affects certain groups disproportionately with higher risk of complications and death in people of black and ethnic minority background, the elderly, overweight and obese, and those with underlying health conditions (3, 4). Oral intake is significantly impacted secondary to anorexia, gastrointestinal disturbances, dyspnoea and anosmia and in the most severe cases respiratory failure (5). This combined with the heightened inflammatory response leads to rapid muscle wasting and a high risk of malnutrition (6). Prolonged Intensive Care Unit (ICU) stay, post-extubation dysphagia, anorexia and weakness contribute towards a cycle of impaired nutrition and prolonged recovery (7).

The prevalence of malnutrition (as undernutrition) in people infected with Covid-19 is reported to be 37% in general medical inpatients (8), 52.7% in older inpatients (9) and 66.7% in patients admitted from ICU (10). The average length of hospital stay varies from less than a week to nearly two months and stay in ICU from one to three weeks (11). Length of hospital stay for malnourished patients with Covid-19 has been shown to be significantly higher (almost double) than that of non-malnourished patients (12). This supports recommendations that nutrition support should be initiated as soon as possible for hospitalised patients (13).

Nutrition support, including oral nutritional supplements (ONS), enteral and parenteral nutrition, plays an important role in meeting nutritional requirements and aiding recovery (14). Nutritional inadequacy during hospitalisation exacerbates the risk of malnutrition, increasing the likelihood that any deficiency may persist beyond discharge with potentially long-term effects on functionality and health (14). Continuity of nutritional care has a vital role in ameliorating these effects.

Benefits of nutritional support and follow-up post discharge have been reported in other conditions, including the use of individualised nutrition plans, nutritional supplementation and optimisation of protein intake in patients (15-17). A recent review of nutrition support guidelines (18) identified multiple themes essential to rehabilitation pathways for Covid-19 recovery including screening for malnutrition, care plans for nutrition support and continuity of nutritional care between settings. However, there is no clear evidence for post-discharge nutritional support in patients hospitalised with Covid-19 infection.

This rapid review aims to examine the evidence on nutritional management of patients infected with Covid-19 in hospital and on discharge to the community. The review question is: in patients hospitalised with Covid-19 infection, what is the best way of ensuring continuity of nutritional care post hospital discharge to minimise the nutritional consequences of infection and optimise recovery?

Methods

This review was conducted in accordance with the Cochrane Rapid Reviews guidance (19), and the protocol was registered on PROSPERO (registration number CRD42020208448).

Inclusion criteria

Studies were selected using defined eligibility criteria (Table 1). Due to limited research available on nutritional care in Covid-19 infection, the search criteria were widened to include pneumonia, respiratory distress syndrome and acute respiratory failure as potential complications of Covid-19 infection. To fully explore the focus of research, all types of studies were eligible for inclusion except non-systematic reviews, commentaries, editorials and single case studies.

Search strategy and study selection

Six electronic databases were searched: MEDLINE (Ovid), Embase (Ovid), Cochrane Central Register of Controlled Trials, PubMed, CINAHL and MedRxiv preprint database. A search strategy was

developed to combine key concepts (Table 1) (example in supplementary information). Search terms were combined with suggested MeSH terms wherever possible. Only articles published in English between 1st November 2019 and 20th March 2021 and including adults ≥18 years were accepted. The search strategy for Medline was reviewed by an information specialist (LB) using the Peer Review of Electronic Search Strategies (PRESS) checklist (20); suggested revisions were applied.

All identified studies were transferred into Endnote X8 (Clarivate, PA, USA), duplicates were removed and then data were transferred to Rayyan (QCRI, Doha, Qatar) (21) for screening. One author (JL) used the inclusion criteria to screen titles and abstracts. The decisions were checked by a second author (CEW or MH) who screened 20% of the included, and 100% of the excluded abstracts, resolving disagreements via discussion. Full text of each included article was re-assessed independently (JL and CEW), and a third author (MH) adjudicated on disagreements. Articles from critical care settings were included if nutritional care continued beyond ICU. Articles were excluded if they did not include outcomes of interest or where the focus was micronutrient supplementation, specific amino acids or fatty acids. Authors of articles with non-English full text were contacted for a translated version. Authors of protocols were contacted for preliminary data if available.

Further studies were identified by JL through hand-searching the reference lists of included studies, and the British Dietetic Association (BDA) and British Association for Parenteral and Enteral Nutrition (BAPEN) websites were checked for any potentially relevant articles. Identified articles were included following discussion with two other authors (CEW and MH).

Risk of bias and quality of evidence

Risk of bias was assessed independently by JL and judgements were verified by a second author (CEW or MH). The Cochrane Collaboration's Risk of Bias tool (22) was used for randomised controlled trials (RCT), Joanna Briggs Institute (JBI) critical appraisal tools (23) for cohort and cross-sectional studies and the Appraisal of Guidelines for Research & Evaluation tool (AGREE II) (24) was

used for clinical guidelines. The JBI Checklist for Text and Opinion (25) was used to make decisions regarding inclusion or exclusion of the remaining articles but was not used for quality appraisal.

RCTs, observational, cohort and cross-sectional studies, were quality rated according to the Grading of Recommendations, Assessment, Development and Evaluations (GRADE) criteria (26). RCTs were initially deemed high quality and downgraded or double downgraded for high risk of bias or indirectness of evidence; observational studies were initially deemed low quality and downgraded for high risk of bias.

Three reviewers (JL, MH and AJ) assessed the guidelines independently against the AGREE II tool organized into six domains (Scope and Purpose, Stakeholder involvement, Rigour of Development, Clarity of Presentation, Applicability, and Editorial Independence). Based on review authors' consensus it was agreed that guidelines scoring >60% for all six domains were considered high quality, those scoring >60% for three to five domains were moderate quality, >60% in only two domains were low quality and only one domain were very low quality.

Data extraction, data synthesis and statistical analysis

Data on population, intervention, duration and follow-up, comparator, outcomes and results were extracted wherever possible and displayed in a table (Table 2). A second author (CEW) checked the data for accuracy and completeness. All data were synthesised narratively by one author (JL) and checked by two others (CEW and MH). Data were grouped and reported according to the six steps of the Nutritional and Dietetic Care Process (27) (assessment, diagnosis, treatment strategy, implementation, monitoring and review, and evaluation).

Results

Study selection

Figure 1 shows the PRISMA diagram of the selection and screening process. In total, 34 articles were included in this review with 26 focussing on the nutritional care of patients with Covid-19 infection,

seven on pneumonia and one on rehabilitation post-ICU admission for respiratory illness. No RCTs or intervention studies were identified for nutrition and Covid-19, therefore this review focussed on assessing the guidance on nutritional management of Covid-19 infection and extrapolating indirect evidence from studies on respiratory illness.

Statistical pooling of data was not possible due to the heterogeneous nature of the articles identified. Variations in interventions, subjects and outcomes, as well as risk of bias, prevented meta-analysis. Therefore, the results are described qualitatively.

For this review, guidelines were defined as systematically developed recommendations produced to direct the management of patients (28). All other papers (excluding systematic reviews, RCTs and observational studies) were referred to as opinion articles.

Characteristics of included studies:

Table 2 provides details on study characteristics, extracted data and quality assessment. The 26 articles on Covid-19 included 11 observational studies (29-34) including four abstracts (35-38) and one cross sectional survey (39), five guidelines (39-44), ten opinion articles (45-53), including one abstract (54). The guidance provided by guidelines and expert-opinion articles is presented in the supplementary information.

The seven articles on pneumonia included three RCTs (55-57), one trial abstract (58) and three observational studies (59-61). The rapid systematic review presented evidence on rehabilitation in patients post-ICU admission for respiratory illness. The evidence from these papers will be presented together and used to produce guidance on the nutritional and dietetics care process.

Quality assessment:

GRADE quality appraisal was applied to the systematic review, RCTs, and observational studies. The systematic review and the three RCTs were judged to be of low quality mainly due to indirectness of evidence. Of the observational studies, four were judged to be low quality while the remaining six

were very low quality (see Table 2 for reasons). There was insufficient information to allow quality assessment of the six abstracts.

The five guidelines were assessed using the AGREE II tool, which requires users to produce an overall assessment and recommendation for use. Table 3 shows the final scaled domain scores for the three reviewers (JL, MH and AJ) and details of how each item within the domains scored. The scope and purpose, editorial independence and clarity of presentation scored highly in most guidelines, however stakeholder involvement was limited, partly due to a lack of information provision, but also because many of the wider healthcare team were not consulted. No patients were consulted in any guideline. This latter limitation was recognised by some guideline authors and perhaps understandable given the nature of the pandemic. The lowest scoring domains were rigour of development and applicability. Limits to the rigour of development reflect the urgency with which these guidelines were produced, and the lack of published data on the management of Covid-19. The applicability domain refers to advice on how the recommendations should be applied in practice, and low scores here also reflect the limited experience of Covid-19 and the rapid production of the guidelines. We do not recommend the guideline by Chen *et al* (2020) because of shortcomings in most domains, however we do recommend the use of the other guidelines.

Nutritional and Dietetic Care process

Assessment

Studies on Covid-19

Six studies (30-32, 34, 37, 38) including two abstracts (37, 38) suggest a significant proportion of patients with Covid-19 are at high risk of malnutrition. A variety of screening and diagnostic tools were used including NRS-2002 (30, 38), MNA (32), Modified NRS-2002 tool (34), GLIM criteria (34, 38), and low BMI with or without weight loss (31) were used as indicators of risk. Risk of malnutrition or undernutrition ranged from 74% to 92% (30-32, 34, 38). Weight loss was variable; 61% patients in

one study (32), 24-53% patients with ≥5-10% weight loss in others (32, 34), and one study (30) reported weight loss was seen in 'only a few patients' and only 4% had a BMI ≤18.5kg/m^2, thus other factors were driving malnutrition risk. Prevalence of low BMI ranged from 9-15% (32, 34) and patients with severe COVID-19 were more prone to have low BMI, higher weight loss and greater nutritional risk (31).

The importance of the acute disease effect (defined as no, or unlikely to have, adequate nutritional intake for more than five days) in assessing nutritional risk in patients with Covid-19 infection was emphasised (30).

Two studies reported patients with Covid-19 have reduced oral intake: consuming <50% requirements in 39-56% patients (31, 34). The risk of weight loss and sarcopenia post ICU discharge was also reported (37). One study (30) reported nutritional risk linked to mortality; higher NRS scores had significantly higher mortality and a longer stay in hospital.

Studies on pneumonia

Shirado et al (60) compared patients with low energy intakes to those with adequate intakes, finding lower energy intake was associated with higher mortality, higher pneumonia recurrence rate during hospitalization, and lower discharge home rate. Suggesting assessment of energy intake is relevant.

Eekholm et al (59) reported 6-month consecutive prospective data on 15 patients with community-acquired pneumonia and found discrepancies in clinical practice compared to evidence-based recommendations for nutritional care: only 53% of patients were screened on admission (only 27% within 24-hours); nutrition plans were developed for 55% of nutritionally at-risk patients which were 'incomplete and unsystematic' and not developed according to evidence-based guidelines; incomplete documentation meant patients' intake and adherence to recommendations for nutrition support could not be assessed. The authors recommended consideration of barriers and enablers to

improve evidence-based nutritional care. The nutritional care of patients with covid-19 may be similarly hampered by the difficulties highlighted.

Guideline and opinion articles

All guidelines agreed that screening using a validated tool was an important initial step in the process and a variety of tools were recommended (Table 4).

The practical difficulties in obtaining measurements for a nutrition risk assessment e.g. body weight, were widely acknowledged and alternatives suggested. Limitations of these alternative measures due to access restrictions or infection control policies were acknowledged (45, 49).

Other articles

Lawrence et al (39) carried out a survey of nutritional care pathways on Covid-19 and reported that the majority of the pathways included MUST for screening (table 2). For assessment, the focus was on Covid-specific symptoms (hunger or skipping meals, poor appetite and taste changes) and physical symptoms (weight loss, energy levels, weakness, shortness of breath and muscle loss) while emotional or psychological symptoms were included in only 32-63% of pathways. The outcomes most frequently monitored routinely were weight and food intake while patient specific goals including ADLs, physical function and handgrip strength were monitored less frequently. Management of Covid-19 symptoms included mainly advice or resources for eating and drinking with breathlessness, managing a dry mouth and loss of taste and smell or prescription of ONS while a few reported advice on purchasing nutritional supplement drinks and managing gastrointestinal issues.

Diagnosis

None of the studies provided guidance directly on diagnosis however two guidelines (41, 42) and five opinion articles (46, 48, 49, 51, 52) on Covid-19 described conditions associated with higher nutritional risk, poorer outcomes and higher mortality i.e. immune-compromised individuals, older

adults, polymorbid individuals, malnourished people, those with underlying conditions (e.g. diabetes), and patients in ICU. One study (41) noted the potential "double burden" of over- and under-nutrition which exacerbates severity of infection and recommended that general guidance on the prevention and treatment of malnutrition is fully applicable to Covid-19 infection.

Treatment and strategy

This evidence comes from six observational studies (four as abstracts only) (31, 34-38), five guidelines (40-44) and eight opinion articles (45-52) on Covid-19, and three RCTs (55-57), one unblinded trial (abstract) (58), and two observational studies (30, 61) on pneumonia, and one systematic review.

Systematic review:

Evidence for the efficacy of rehabilitation interventions in patients with severe respiratory illness post-ICU was assessed. Only two of the included studies tested nutritional interventions; one tested an individualised expert programme (lectures, counselling, fortified foods, oral nutritional supplements or parenteral or enteral nutrition plus physical rehabilitation), and one simply reported as 'nutritional care'. The meta-analysis showed significant improvements in activities of daily living. This could be generalizable to Covid-19.

Studies on pneumonia:

Three RCTs looked at different dietary interventions and outcomes. Yang et al (55) (n=82) reported on dietitian-led individualised nutrition plans (details not provided), combined with caregiver and patient education about post-discharge diet, compared to ONS only, in malnourished older adults with pneumonia. Groups were followed-up at six months via phone calls. No between-group differences were found for any anthropometric measures (triceps skinfold thickness, arm muscle circumference, upper arm circumference, or arm muscle area) or length of stay (LOS). However,

MNA-SF scores were significantly higher in the intervention group, as was daily energy intake, and lower readmission rate.

Baumgartner et al (57) (n=378) compared protocol guided individualised dietetic support with routine hospital care in patient with pneumonia, and measured mortality. Protein and energy in the intervention group improved compared to control but there were no differences in mortality rates.

Yuanyuan et al (56) (n=94) compared enteral nutrition (nasogastric feeding) to basic nutritional guidance in elderly patients with severe pneumonia. Outcomes were collected before and after treatment. Between group analysis showed improvement in arm muscle circumference, a decrease in LOS, and a lower incidence of adverse events in those receiving enteral nutrition.

Honda et al (61) examined, in a retrospective cohort of older people with pneumonia (low quality), the outcomes in patients fed via NG compared to PN. Patients with NG feeding had lower in-hospital mortality, fewer complications, shorter LOS and more discharges home.

Together these studies suggest benefits to nutritional support including fewer re-admissions, shorter LOS, fewer adverse events and complications, lower mortality, as well as improved quality of life. Nutrition support combined with rehabilitation may improve performance of ADLs.

Studies on Covid-19

Six observational studies (including three abstracts) (30, 31, 34-36, 38) (n=724) reported data on nutritional support requirements. The number of patients requiring ONS ranged from 6-74% (30, 34-36, 38), and patients at nutritional risk received more frequent ONS than patients without (31). The number of patients requiring EN ranged from 6-15% (30, 34, 35), PN ranged from 5-12% (30, 34) and patients requiring both EN and PN 8% (30). Zhao et al (30) reported that critically ill patients were more likely to receive nutritional support than severely ill patients and had higher mortality and longer hospital stays.

The presence of dysphagia was high at 52% (38) and the number of patients requiring texture modified diets ranged from 55-89% (35, 38), the majority because of post-extubation dysphagia, 45% (37).

Guidelines and opinion articles

All recommendations were based on opinion and no data were presented to support these strategies (table 4). All guidelines and opinion articles on Covid-19 (40-52) provided guidance on dietary interventions and agreed on the optimisation of oral intake as the first line intervention. Six articles offered different strategies for this including the use of dietary counselling and individualised nutrition from an experienced professional (41, 42), and standardized health education and training for patients and families (43, 46, 48, 49). Food fortification was advised by four papers, as a general strategy (41), in the community (47, 51) or at home (43).

Recommendations for ward-based strategies are listed in Table 4. In underlying conditions e.g. diabetes, relaxation of previous dietary restrictions may be temporarily necessary in the presence of a poor appetite or unintentional weight loss (51).

Four guidelines (41-44) and seven opinion articles (46-52) provided guidance on oral nutritional supplements although the criteria for their use varied. Nutritional treatment should continue with ONS (41, 46, 51) in cases where required. Guidance for initiation of ONS in the community was also provided by four papers (46-48, 51). ONS should be stopped when goals have been met and malnutrition risk is resolved (51). Three guidelines (41, 42, 44) and three opinion articles (49, 50, 52) provide guidance on artificial nutrition. The criteria for escalation to EN varied (41, 42, 50, 52) but all articles advised consideration of PN if EN is not tolerated. Two opinion articles (50, 52) stated a preference for PN in patients with expected respiratory complications.

Three guidelines (41, 42, 44) and three opinion articles (46, 50, 52) provided advice on nutritional requirements, of which five (41, 44, 46, 50, 52) advised broadly similar energy targets with adjustment for various groups, and one (42) focused on ICU.

Optimisation of protein intake was emphasised by two guidelines (41, 44) and six opinion articles (46, 47, 49-52), with individual adjustment for various groups. The changing nutritional needs during different phases of recovery were acknowledged by only one article (49), suggesting the possible need for up to 35-40kcal/kg and 1.5-2g/kg protein for several months post discharge to optimise recovery. These authors cautioned against the provision of extra nutrition in the later stages of recovery to prevent fat rather than muscle gains and advised individualised dietary counselling and increased physical activity.

Three opinion articles (46, 47, 51) made recommendations on goal setting. The BDA (51) advised patient-centred goals should be discussed and agreed. In hospital appropriate goals include improved intake, weight maintenance, preservation of muscle mass and function (46). During acute illness goals may be to minimise weight loss, muscle mass and strength (51). During recovery, goals may be to gain muscle strength, return to a desirable weight, resume hobbies or to improve stamina (51).

Implementation

The only evidence on implementation comes from two guidelines (41, 42) and five opinion articles (47-49, 51, 52). Collaboration between healthcare professionals, catering and family was recommended by all articles to provide joined-up care and minimise face-to-face contact (table 4).

Monitoring, review and evaluation

The following evidence comes from two observational studies (29, 33), three guidelines (40, 42, 44) and six opinion articles (46-49, 51, 52) all on Covid-19.

Studies on Covid-19:

Two studies (29, 33) (n=1976) reported on rehabilitation needs of patients post Covid-19 infection in predominantly older people. Li et al (29) used a self-designed questionnaire and reported ongoing physical and psychological dysfunction during recovery including sleep disorders (64%), anxiety (62%), decreased activity endurance (61%), respiratory dysfunction (58%) and loss of appetite (55%). Up to 40% patients indicated the need for dietary instructions.

Leite et al (33) used data from a post-discharge tele-rehabilitation programme following Covid-19 infection to identify self-reported disability and rehabilitation needs of mainly ICU patients. Patients in ICU presented longer hospital stay, lower independence for activities of daily living, greater prevalence of weight loss with lack of appetite, more oxygen therapy, more shortness of breath during routine and non-routine activities and greater difficulty standing up for 10 minutes.

Together these data indicate patients hospitalized due to COVID-19 present high levels of physical and psychological disability which is exacerbated in those admitted to the ICU.

Guideline and opinion articles

Three opinion articles (47, 51, 52) suggested monitoring of anthropometric, nutritional, clinical and functional measures (Table 4).

One guideline (42) recommended frequency of monitoring during hospitalisation based on the degree of nutritional risk and another (51) advised regular monitoring built into clinical reviews by community healthcare professionals following hospital discharge.

Two guidelines (40, 44) and three opinion articles (46, 48, 49) recommended remote working and virtual monitoring of patients during hospitalisation and as part of rehabilitation teams post discharge (44). The BDA advised further discussion to support individuals unable to access or interact with technology or telephone consultation (48).

Discussion

This rapid review aimed to answer; in patients hospitalised with Covid-19 infection, what is the best way of ensuring continuity of nutritional care post-hospital discharge to minimise the nutritional consequences of infection and optimise recovery? We did not identify any RCTs or intervention studies relating to covid-19, but eleven observational studies provided new information. The remaining papers were guidelines and opinion articles produced rapidly at the start of the pandemic. We also found four intervention studies, three observational studies and a systematic review examining nutrition and pneumonia or respiratory illness recovery, which provided useful data to support nutritional interventions for Covid-19.

The observational studies involving patients with Covid-19 infection were of low quality and were predominantly hospital based. Two examined patient-reported nutritional needs post Covid-19 infection (29, 33), and the others evaluated the nutritional characteristics of patients with Covid-19 infection and the relationship between these factors and clinical outcomes (30-32, 34-38). They reported wide-ranging symptoms, a need for dietary information, high prevalence of risk of malnutrition, substantial use of artificial feeding and nutritional support, and higher mortality and longer hospital stay in those at higher risk of malnutrition. This reinforces what we already know about the influence of malnutrition on clinical outcomes; it is well established that those at higher nutritional risk have longer hospital stays leading to higher healthcare costs and higher mortality (62). These data show that older patients with Covid-19 infection are potentially a high-risk population for malnutrition, particularly those with ICU admission, with a requirement for dietetic input and nutrition support.

The data on pneumonia included three RCTs (55-57) (low quality), the unblinded trial (58), and the retrospective cohort study (61) (low quality) which suggested that individualised dietetic-led care during and after hospitalisation, and enteral nutrition during hospitalisation could improve both nutritional and clinical outcomes. This provides some evidence to support the effectiveness of ward-

based strategies to meet nutritional requirements in patients with acute lung infections. Previous research highlights the effectiveness of nutrition support in improving clinically important outcomes (63-65) and this can lead to net savings in healthcare costs (62). The cross-sectional study in hospitalised older patients with pneumonia (59), although very low quality, suggests that older adults with lung infections are at risk of readmission and nutritional care does not appear to be prioritised.

The five guidelines referenced the increased risk of malnutrition in patients with Covid-19 infection. Nutrition screening was consistently recommended, and all provided guidance on dietary interventions according to stage of disease, care setting or nutritional status of the patient. Only two guidelines (41, 44) recommended specific energy and protein targets for ward-based care, and only one (41) addressed the issue of dysphagia. Two guidelines (41, 42) considered goals and monitoring, and three (40, 41, 44) looked at continued and community-based care. Only one guideline (42) detailed the difficulties in obtaining access to patients with Covid-19 infection and proposed strategies to minimise contact whilst striving for optimum nutrition. Although nutritional management based on other clinical conditions can be applied to Covid-19, implementation must be given careful consideration for them to be effective. The quality of four guidelines (40-42, 44) was moderate based on consensus judgement and the reviewers were able to recommend the use of three with modifications (40-42) and one as it stands (44). These are useful sources of advice for practicing dietitians however, practitioners should be aware of the limitations of the guidance, in particular the need for them to be reviewed and updated.

The remaining papers were opinion articles, which offer further advice based on experience, most extrapolating from knowledge of lung disease and/or malnutrition. These address many of the same areas as the guidelines, with an emphasis on identification of nutritional risk and general advice on treatment. They also covered post-discharge procedures and ongoing community care in much more detail. Like the guidelines, advice on monitoring was limited.

The systematic review (66) suggested a benefit of multidisciplinary rehabilitation in combination with nutrition support, on functional outcomes in older adults. Multi-disciplinary working, in both community and hospital settings, was a recurring theme in most of the guidelines and opinion papers. This is especially relevant as evidence (67) from similar coronavirus infections shows that the long-term effects in hospitalised patients, or those that required ICU, persisted beyond 6 months post-discharge. Effects included psychological conditions (PTSD, depression, anxiety), lung function abnormalities and reduced exercise capacity. Given this mixed presentation, multi-component rehabilitation could help optimise recovery (68). The benefits of a nutrition component are well recognised in other services including cancer (69) and pulmonary rehabilitation (70) and should be considered for patients recovering from Covid-19 infection (68).

Wells Mulherin et al (53) reported a benefit of virtual clinics and telehealth technology in provision of home enteral and parenteral nutrition, through patient education and training by MDT teams including dietitians. Thus, this pandemic has helped highlight the convenience of telehealth in bringing together multiple healthcare professionals whilst minimising direct patient contact (71). Multiple expertise combined in this way can be an effective tool in tackling malnutrition as reported by a meta-analysis (72); there was a significant improvement in protein intakes (2 studies; 200 participants) and quality of life (4 studies; 248 participants) in malnutrition focussed telehealth interventions when compared to usual care, in older adults living at home. However, limited practical guidance was provided by the papers in this review. MDT rehabilitation through telehealth requires co-ordination to ensure effective communication. Guidance is essential to ensure effective use of resources.

This review highlights the need for further research in effective nutrition support interventions for patients post-Covid-19 and during rehabilitation. The lack of research on nutrition during rehabilitation is particularly surprising considering recent data which shows that up to 78% patient required dietetic input during rehabilitation (73). Our review adds to the evidence of knowledge

gaps highlighted by Mechanick et al (74) where an urgent need for well-designed research, particularly RCTs, was identified for nutrition support, registered dietitian nutritionist counselling (chronic or post–COVID-19), malnutrition and management (all stages) as well as enteral nutrition, protein-energy requirements, and home enteral and parenteral nutrition support (chronic or post–COVID-19).

Strengths of this review include adherence to relevant Cochrane guidelines (19), a peer reviewed search strategy and independent duplicate screening for most of the retrieved articles. The inclusion of BDA and BAPEN articles allowed post-discharge procedures and continuity of care to be explored in more detail. The use of a variety of relevant quality appraisal tools allowed appropriate assessment of the strength and relevance of the available evidence. Limitations include short timeframe and language restrictions. Although some grey literature was explored through hand searching of reference lists, it was not extensive due to time restrictions.

In conclusion, this review highlights the lack of high quality evidence available on nutritional management of Covid-19. There were no dietary intervention studies for Covid-19 and most of the evidence was from opinion articles and guidelines. The observational evidence described here showed Covid-19 in older adults presents a risk of malnutrition and addressing this may be important in recovery. Indirect evidence from studies on pneumonia provides some support for the recommended use of nutritional management strategies applicable to other acute conditions in patients with covid-19. However, traditional screening and implementation techniques need to be modified to ensure infection control measures can be maintained. More research is required on the most effective nutritional interventions, as well as more detailed guidance on nutritional management post-discharge to aid long-term recovery.

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Tables and figures (for the main manuscript)

Table 1: Eligibility criteria based on PICOS

PICOS	Inclusion Criteria
Population	Patients admitted to hospital with symptoms of COVID-19 infection, pneumonia, acute respiratory distress disorder, respiratory failure (ICU or acute) and then step-down or discharged OR Patients discharged from hospital with a confirmed diagnosis of COVID-19 infection, pneumonia, acute respiratory distress disorder or respiratory failure OR Patients in the community with a confirmed diagnosis of Covid-19 infection, pneumonia, acute respiratory distress disorder or respiratory failure Adults (18 years or more).
Intervention	Nutritional support to optimise dietary intake e.g. via artificial nutritional support (tube feeding or parenteral nutrition), oral nutritional supplements, dietary counselling, (nutritional), nutritional rehabilitation (not micronutrient or fatty acid or amino acid supplementation)
Control or Comparison	Usual care
Outcomes	Mortality, length of hospital stay, readmissions, quality of life, activities of daily living, nutritional status, weight change, handgrip strength, dietary intake, return to baseline functional status, reversal of COVID-19 associated symptoms e.g. poor appetite, loss of senses of smell or taste.
Type of Study	RCTs, cohort studies, cross sectional studies, systematic reviews, guidelines and pathways, audits and service evaluations, protocols

Table 2: All papers included in the Rapid Review

Study	Purpose of the article	Study design; Setting	Duration and follow up	Participant characteristics	sample size	Methods/Intervention	Comparator	Outcomes	Quality assessment	Key findings
Studies on Covid-19										
Observational studies										
Allard et al, 2020 (1)	To establish: (i) Percentage of malnutrition in patients admitted in COVID-19 units (excluding intensive care units (ICU)) (ii) Prognostic value of malnutrition parameters. Hospital setting	Retrospective study Avicenne Hospital, Bobigny, France	All acute Covid-19 patients admitted from 9 April to 29 May 2020	Inclusion criteria: all consecutive adult patients admitted for COVID-19 requiring hospitalization but not in an ICU Age 61.8 ± 15.8 years Male gender 64 (59.3%) BMI 28.8 ± 6.2Kg/m^2	108	Data analysed: • Malnutrition screening: BMI < 18.5 kg/m^2 (or < 21.0 kg/m^2 if aged ≥ 70 years), and/or weight loss ≥ 5% in the previous month, and/or ≥ 10% in the previous 6-months • Moderate malnutrition or food intake 50–75% for ≤ 1-week: referred to dietary team, provided with 2 ONS, oral supplementation to prevent refeeding • Severe malnutrition or food intake < 50% for ≥1-week: EN started or ≥3 ONS if EN not tolerated, intravenous supplementation for prevention of refeeding • Nutritional risk calculated using nutrition risk index (NRI)*** • Explored the causes of malnutrition: (i)	None	• Length of stay • Mortality	**Low quality**	• Malnutrition observed in 42 patients (38.9%); 30 (27.8%) moderate and 12 (11.1%) severe. • Food intake assessed in 103 patients: >75% in 20 (19.4%) patients; 50–75% in 25 (24.3%) patients, <50% in 58 (56.3%) patients. • Nutritional risk: 83 (84.7%) out of 98 patients; 48 (49.0%) moderate and 35 (35.7%) severe risk • Patients at nutritional risk received more frequent ONS than patients not at risk: 62 (74·7%) Vs 3 (20·0%) respectively, p = < 0.01. • Patients with severe COVID-19 were more prone to have low BMI (p = 0.03) and higher weight loss in the last month (p = 0.05 and 0.08 after adjustment for age), than patients with non-severe Covid-19 • Nutritional risk was positively associated with severe COVID-19; NRI was significantly

						Questioned patients on reduced food intake over the last week compared with usual meals (<50%, 50–75%, >75%), (ii) inflammatory disease burden through biomarkers, and (iii) malabsorption syndromes and diarrhoea.				lower in patients with severe COVID-19, even after adjustment for age (p = 0.03) • Malnutrition not associated with length of stay or mortality
Haraj et al., September 2020 (2)	To assess nutritional status, the factors influencing undernutrition, and nutritional management of patients with COVID-19 after a stay in intensive Care Hospital setting	Descriptive observational study A university hospital, Morocco	From 17 April to 26 May 2020	Inclusion criteria: adult patients admitted to the endocrinology service for additional care after a stay in intensive care following Covid-19 infection Average age of 55 years, sex ratio of 1.05, 24.4% were aged over 70 years	41 patients	Data collection using a questionnaire	None	• Nutritional status via MNA scores • Patient autonomy via Katz autonomy scale for basic ADL score • Hamilton anxiety and depression scores, Hospital Anxiety and Depression Scale • Post-traumatic stress assessment via Post-Traumatic Checklist Scale	**Very low quality** Downgraded (GRADE) due to: Lack of information on data collection	• Weight loss: 61% had weight loss, 24.0% had weight loss greater than 10%, 14.6% under-nourished, 65.9% were at risk of undernutrition • Positive correlation was found between poor nutritional status and a longer stay in intensive care (>5 days) (p = 0.011)
Lawrence et al., 2021 (3)	To provide new information about nutritional care pathways to help manage patients with Covid-19 prior to and following discharge from hospital	Cross-sectional survey UK	From 22 June to 12 July 2020	Inclusion criteria: dietitians involved in the planning and/or management of the nutritional care of patients with Covid-19 infection at their Trust or Health Board	57 responses	Questionnaire consisting of 26 questions: open and closed questions with categorical responses and Likert scales Dietitians were invited to complete the survey via an e-mail by the BDA and a survey	None	Questionnaire split into 6 main sections: i) eligibility and respondent details ii) pathways related to the nutritional management of patients with Covid-19 infection iii) assessment of	**Low quality**	• 73% used MUST **Assessment parameters** • **Covid symptoms**: not hungry and/or skipping meals (84% pathways), poor appetite (84%) and taste changes (79%); indigestion or heartburn (32%), bloating (37%) and chewing problems (37%)

				Convenience sample of UK HCPC registered dietitians and active members of the BDA		link shared via social media platforms and direct email to BDA Special Interest Groups. Reminders sent via social media platforms three times per week. Only one response per organisation		nutritional status and specific symptoms that could influence nutritional status iv) advice provided v) outcome measures used vi) plans for evaluation and training needs.		•**Emotional/psychological**: low mood (63%), anxiety (42%) or sleep disorders (32%) • **Physical symptoms**: weight loss (90% pathways); energy levels (74%), weakness (74%), shortness of breath (74%) and muscle loss (68%) • Written or online food first information and locally developed resources used • A variety of ONS used • **Outcomes monitored**: weight in 17 (89%) pathways; food intake was monitored in 14 (74%) pathways; 9 (64%) respondents used diet charts or tables and 7 (50%) used dietary recall • **Patient-specified goals**: ADLs monitored in 6 (33%) pathways; physical function in 5 (28%); handgrip strength in 2 (11%) pathways • **Difficulties:** measuring outcomes due to virtual clinics, reduced access, remote working issues – communicating with MDT, IT issues • **Alternative measures**: MUAC, also measured by other HCPs • Managing Covid specific symptoms: 12 (63%) respondents for eating and drinking with

										breathlessness, 10 (53%) for loss of taste and smell, 10 (53%) dry mouth, 10 (53%) ONS, 7(37%) on purchasing nutritional supplement, 6 (31%) on diarrhoea/GI disturbance, 1 (5%) multivitamin and mineral supplements
Leite et al, 2021 (4)	To report symptoms, disability and rehabilitation referral rates after COVID-19 hospitalization in a large, predominantly elderly population Pre and post-discharge hospitalisation	Cross-sectional study, with post-discharge telemonitoring of individuals hospitalized with confirmed COVID-19 A private healthcare network specialized in the elderly population, Brazil	From 15 March to 27 August 2020 Patients followed up for 21.8±11.7 days after discharge	Individuals hospitalized due to COVID-19, if discharged alive Age 71.8±13.0 years, 56.1% females	1,696 patients	• Data obtained from a comprehensive telerehabilitation program implemented for individuals discharged after COVID-19 hospitalization. • Each patient monitored using electronic health record. After discharge, telephone contact made by a physical therapist to identify symptoms and disability, and provide early referral to telerehabilitation services. • Data gathered using a structured form to identify self-reported disability and rehabilitation needs (physical and respiratory symptoms, mobility impairments, measures of independence and affect, nutritional, and swallowing symptoms)	None	• Dependence for basic and instrumental ADLs using Barthel's Index and Lawton's Scale. • Comparison of outcomes between participants admitted to the ICU vs. those admitted to the ward.	**Very low quality** Downgraded (GRADE) due to: Risk of bias due to confounding	• Patients in ICU presented longer length of hospital stay (median [IQR] 16 [11-25], vs. 6 [4-9] days, p<0.0001) **Post-discharge outcomes** • Independence for ADLs was lower in the ICU group (61.1% [95% CI 55.8-66.2%] vs. 72.7% [70.3-75.1]). • Dependence for instrumental ADLs was also more frequent in the ICU group (84.6%, [95%CI 80.4-88.2%], vs. 74.5%, [72.0-76.8%] p<0.001). • Individuals admitted to ICU required more oxygen therapy (25.5% vs 12.6%, p<0.001), presented more shortness of breath during routine (45.2% vs 34.5%, p<0.001) and non-routine activities (66.3% vs 48.2%, p<0.001), had more difficulty standing up for 10 minutes (49.3% vs 37.9% p<0.001). • Weight loss with inappetence: 143 (40.1%) ICU patients Vs

										423 (31.6%) p=0.003 • The 3rd most referred rehab professional referral was to dietitian with 6.8% patients referred
Li et al, June 2020 (5)	Dysfunctions and rehabilitation needs among Covid-19 patients in a stable condition Hospital setting	Cohort study Hubei Provincial Hospital of Integrated Traditional Chinese and Western Medicine, Wuhan, Hubei province, China	From 29 February to 2 March 2020	Inclusion criteria: hospitalized patients diagnosed with Covid-19 infection and in stable condition - selected by convenience sampling 145 men (51.8%), 135 women (48.2%) of which, 64.2% were aged over 51 years	280 patients	Survey - basic information, dysfunctions, and rehabilitation needs obtained using a self-designed questionnaire	None	• Self-assessment of previous physical condition • Awareness and willingness to do rehabilitation • Current dysfunctions • Self-evaluation of the needs for rehabilitation, based on a Likert five-point scale where the degrees of need were categorized as “no need,” “not much need,” “moderate need,” “need,” and “high need.”	**Very low quality** Downgraded (GRADE) due to: Risk of bias due to confounding and lack of information on excluded data	• Patients reported physical dysfunctions: sleep disorders (63.6%), decreased activity endurance (61.4%), respiratory dysfunction (57.9%), loss of appetite (55.4%), and pain disorder (47.5%). • Patient reported psychological dysfunctions: anxiety (62.1%), fear (50.0%), apathy (41.8%), depression (40.7%), and despair (32.5%). • Patient reported need for dietary instruction: 40.4% to be in ‘high need’ or ‘need’.
Zhao et al, 2020 (6)	Evaluation of clinical and nutritional characteristics of severely* and critically ill** patients infected with Covid-19; investigation of the relationship between nutrition risk and clinical outcomes Hospital setting	Retrospective, observational cohort study West Campus of Union Hospital, Wuhan. China	From 29 January to 19 February 2020 Clinical outcomes collected to 31 March 2020	Inclusion criteria: inpatients admitted to hospital, with confirmed SARS-CoV-2 infection, severely or critically ill according to the diagnosis and treatment protocol for COVID19 Average age was 60.3±12.7 years; 212 (51%) were men	Total 413 - 346 were diagnosed as severely ill and 67 as critically ill	Looked at differences in parameters in severely verses critically ill patients; nutritional risk assessment using NRS-2002 within 48 hours of admission; nutrition support (EN and PN) and use of dietary supplements during the entire hospital stay was recorded	None	• Hospital mortality • clinical outcomes of each participant, either discharge or death date, collected until March 31, 2020 • Hospital length of stay • Nutritional risk according to NRS-2002 criteria • Nutritional support requirements	**Low quality**	• 371 (92%) patients screened using NRS: 342 identified as at nutritional risk (NRS score ≥3) and 58 (16%) with high nutrition risk (NRS score ≥5). • 91 (25%) received nutritional support: 55 (15%) patients with EN, 44 (12%) patients with PN, and (8%) patients with EN and PN. • 45 (12%) patients were given dietary supplements • Compared with severely ill patients, critically ill patients were significantly more likely to receive

										nutritional support (46% vs 20% P<0.001), receiving PN (31% vs 8%, P<0.001), or receiving EN and PN (8% vs 1%, P=0.002). • Patients with NRS score ≥3, the ratio of those receiving nutrition support, EN, PN, or EN+PN was higher in critically ill patients than in severely ill patients. • Mortality 37 of 413 (9%) in severely ill; 30 of 64 (47%) in critically ill. • Average length of hospital stay 30.2±11.1 days. • Critically ill patients had significantly higher mortality and longer hospital stay than severely ill (P<0.001 and P<0.001 respectively) • Higher NRS scores had significantly higher mortality and longer hospital stay (P<0.001 and P=0.002 respectively)
Pironi et al., 2020 (7)	Prevalence of malnutrition and the provided nutritional therapy evaluated in hospitalized COVID-19 patients Hospital setting	Cross-sectional study One-day audit ICU, ward and rehabilitation Sant'Orsola University Hospital of Bologna, Italy	April 2020: 1-day	Inclusion criteria: adult patients ≥ 18 years More than one-half of patients were males and 70.9% were older than 64 years	268 patients; intermediate care units (IMU 61%), sub-intensive care units (SICU 8%), intensive care units (ICU 17%) and rehabilitation units (RU 14%)	Clinical audit of nutritional status and nutritional therapy performed on patients hospitalized in the clinical settings designated for the treatment of COVID-19; relevant data recorded on each patient using a structured questionnaire	None	• Data collection including hospital diet intake, ONS, EN and PN. • Modified NRS-2002 tool and GLIM criteria used for nutritional risk screening and for the diagnosis of malnutrition • Data were compared between	**Very low quality** Downgraded (GRADE) due to: Risk of measurement bias and no information on controlling for confounding	• BMI: <18.5, 9% (higher in RU p = 0.008); weight loss ≥ 5%: 52% (higher in ICUs and RUs, p = 0.001) • Nutritional risk and Malnutrition: 77% (higher in ICUs and RUs, p < 0.001) and 50% (higher in ICUs, p = 0.0792) respectively • Hospital diet intake ≤ 50%: 39% (higher in IMCUs and ICUs, p < 0.001)

								intermediate care units, sub-intensive care units, intensive care units, and rehabilitation units		• ONS, EN and PN: prescribed to 6%, 13% and 5%, respectively. • Median energy and protein intake/kg BW: 25 kcal and 1.1 g (both lower in ICU, $p < 0.05$) respectively
Guidelines										
Aytür et al, 2020 (8)	Clinical practice guideline for acute and subacute rehabilitation recommendations for adult patients with COVID-19 infection Rehabilitation setting	Guidelines Turkish	N/A	N/A	N/A	N/A	N/A	N/A	**Recommended with modifications** (AGREE II)	• Clinical practice guideline includes pulmonary rehabilitation recommendations for adult COVID-19 patients Acute and subacute rehabilitation principles
Barazzoni et al, 2020 (9)	Concise guidance for nutritional management of patients with COVID-19 infection Hospital setting	Guidelines European	N/A	N/A	N/A	N/A	N/A	N/A	**Recommended with modifications** (AGREE II)	• 10 recommendations • Focus on prevention, diagnosis and treatment of malnutrition in the management of COVID-19 infection • 6 statements focussed on malnutrition in the presence of older age and poly-morbidity, which are independently associated with malnutrition and its negative impact on patient survival. • 4 statements focussed on patients in ICU
Chapple et al, June 2020 (10)	Guidance on managing critically and acutely unwell adult patients hospitalised with COVID-19 infection	Guidelines Australia and New Zealand	N/A	N/A	N/A	N/A	N/A	N/A	**Recommended with modifications** (AGREE II)	• Nutritional management of critically and acutely unwell hospitalised patients with Covid-19 infection • Focus on ICU guidance • Acute ward guidelines - focussed on identifying

	Hospital setting									nutritional risk early and managing via local protocol or individualised care accordingly • Acute ward - nutritional monitoring guidance • Contingency planning and additional workforce considerations for safe working practices
Chen et al., 2020 (11)	Recommendations for the prevention and treatment of the novel Coronavirus Pneumonia in the elderly in China - Home-based nutritional care for elderly with suspected or confirmed Covid-19 infection Hospital and home setting	Guidelines China	N/A	N/A	N/A	N/A	N/A	N/A	**Not recommended** (AGREE II)	• Older patients infected with 2019-Covid-19 tend to have higher rates of severe illness and mortality. • Malnutrition is one of the most important negative factors affecting the prognosis of disease among older patients. • Treatment: 1. During hospitalisation - ensure sufficient caloric intake for patients 2. Home-based care - the elderly should be very careful of nutritional balance
Jin et al., 2020 (12)	Rapid advice guidelines on methodology, epidemiological characteristics, disease screening and population prevention, diagnosis, treatment and control, disease nursing Hospital setting	Guidelines China	N/A	N/A	N/A	N/A	N/A	N/A	**Recommended** (AGREE II)	• Nutrition support guidance based on NRS-2002 scores for inpatients. • Nutrition support guidance for nursing • Nutrition support guidance on nursing in critically ill patients
Expert-opinion articles										
Wells Mulherin et al., 2020	Summary of clinician reports	ASPEN report	N/A	N/A	N/A	N/A	N/A	N/A	Not assessed	• Dietitians are discouraged from entering

(13)	on changed nutrition care processes during Covid-19 pandemic, including overall nutrition care, nutrition assessment, enteral nutrition and parenteral nutrition care, and food and oral supplement delivery. Hospital and homes setting									ICUs or patient isolation rooms • Some implementing modified examination and relying on other clinicians to collect physical data • Dietitians may contact patients or family members by telephone to obtain information for assessment • Difficult to get in touch with patients and providers, and assessments are based on medical record review. • Indirect calorimetry not being used, energy recommendations are based on predictive equations **Home EN:** • Big challenge has been for staff that provide inpatient education for patients being discharged with home EN • Telehealth technology is being used with support from hospital dietitians to provide patients with education on EN pumps and regimen, administration and device care • At home patient weights and other anthropometric measurements have been challenging to obtain •Virtual weights are ideal for follow-up stable patients **Home PN:** • The home PN team (physician, nurse, dietitian

										and pharmacist) have adapted to a virtual clinic during Covid-19 which has worked well • Challenges of obtaining weight, lack of resources when working remotely, availability of laboratory data because patients are not having them done or contaminated or haemolysed due to inexperienced personnel obtaining the samples
BDA (14)	Community setting	UK	N/A	N/A	N/A	N/A	N/A	N/A	Not assessed	Recommendations for community action by dietitians for older and vulnerable people living in their own home
BDA (15)	Nutritional considerations for community healthcare professionals (GP practices, clinical pharmacists, medicines management teams, specialist nursing and rehabilitation teams) Community setting	UK	N/A	N/A	N/A	N/A	N/A	N/A	Not assessed	Nutritional considerations for primary care teams managing patients with or recovering from Covid-19 infection
BDA (16)	Hospital setting and post-discharge	UK	N/A	N/A	N/A	N/A	N/A	N/A	Not assessed	Practical considerations for nutritional management of non-ICU Covid-19 patients in hospital Guidance on continuity of nutritional care on discharge

BDA (17)	Critical Care Specialist Group of the BDA Guidance on management of nutrition and dietetic services during the COVID-19 pandemic Hospital setting and post-discharge	UK	N/A	N/A	N/A	N/A	N/A	N/A	Not assessed	Planning and restructuring of dietetic services during the pandemic Nutritional management in the ICU Nutritional recovery and rehabilitation after critical illness including during ward stay and after discharge
BAPEN (18)	Detection and management of malnutrition using MUST tool in patients with Covid-19 All settings (ICU/critical care, hospital wards and care homes, home)	UK	N/A	N/A	N/A	N/A	N/A	N/A	Not assessed	Practical guidance for using 'MUST' to identify malnutrition during the Covid-19 pandemic Malnutrition Action Group update
Malnutrition Pathway (19)	Designed to assist healthcare professionals in identifying nutritional issues, including the likelihood of malnutrition, when undertaking virtual consultations. The resources - a pathway of care to support healthcare professionals and corresponding patient leaflets - It includes	UK	N/A	N/A	N/A	N/A	N/A	N/A	Not assessed	Community Healthcare Professional Guide to the Nutritional Management of Patients During and After Covid-19 Illness Dietary advice and use of oral nutritional supplements (ONS) to support patients during and after an infection of Covid-19

	Home setting and post-discharge									
Brugliera et al., May 2020 (20)	Nutritional management of Covid-19 patients in COVID-19 Rehabilitation Unit Rehabilitation setting	Rehabilitation Unit of the San Raffaele Scientific Institute Milan, Italy	N/A	Patients hospitalised due to Covid-19	32 patients with at least 10 days hospitalisation in Covid-19 rehab until	Three step nutritional protocol based on interdisciplinary and integrated management of the nutritional status of COVID-19 patient	None	• Nutritional status • BMI • Mortality	Not assessed	• Nutritional management strategies Preliminary data: • MUST improved in five patients (15.3%), while in the remaining it did not change. • No deaths were reported. • 14 patients (43.7%) experienced BMI improvement. • In 15 cases (46.8%) BMI was stable. • The mean BMI value was 20.3 (SD ± 5.8) at unit admission and 23.9(SD ± 5.8) at discharge [paired t-test; t[31]=2.5; p=0.02].
Caccialanza et al, March 2020 (21)	Protocol for early nutritional supplementation of non-critically ill patients hospitalized for COVID-19 disease Hospital setting	Rationale and feasibility of a shared pragmatic protocol Lombardy, Italy	N/A	Non-critically ill patients hospitalized for the 2019 novel coronavirus disease (COVID-19)	N/A	Nutritional protocol proposed	N/A	N/A	Not assessed	Upon admission: supplemental • oral whey proteins (20 g/d) and daily infusion of intravenous multivitamin, multi-mineral and trace elements solutions, • If vitamin D <20 or >20<30ng/ml - cholecalciferol supplementation • If BMI <22Kg/m^2 or weight loss in previous 3 months or expected reduced food intake - two to three bottles (125/200 mL/d) of protein-calorie ONS (600 900 kcal/d; 35 55 g/d of proteins) • If ONS not tolerated and/or worsening respiratory conditions - supplemental/total PN

Studies on pneumonia										
Randomised Controlled Trials										
Baumgartner et al., 2020 (22)	To test the hypothesis that protocol-guided individualized nutritional support to reach protein and energy goals, reduces the risk of mortality and other adverse clinical outcomes in the subgroup of hospitalized inpatients at nutritional risk with confirmed infection of the lung. Hospital based and post discharge	RCT Secondary analysis of the EFFORT trial(23) Eight secondary and tertiary care hospitals in Switzerland	Patients recruited and monitored from 1 April 2014 to 28 February 2018 Phone calls at day 30	Inclusion criteria: patients with community acquired pneumonia, viral pneumonia, exacerbation of COPD and bronchitis NRS 2002 ≥ 3 points, expected length of stay >4 days and written informed consent Intervention group: mean age 73.5 (SD 13.5) years, 55.1% make Control group: Mean age 75.3 (SD 12.7) years, 60.0% male	378 Intervention: 198 Control: 180	•Individual nutritional support by a registered dietician. • Energy predictions using Harris Benedict equation • Daily protein 1.2 - 1.5 g/kg body weight; lower targets for acute renal failure (0.8 g/kg of body weight). • Achievement of the individual nutritional plan was reassessed every 24 - 48 h. • If oral intake < 75% of goals within 5 days, escalation to EN or PN. • On discharge, patients received dietary counselling and, if indicated, a prescription for ONS in the outpatient setting. Patients did not receive dietary counselling in the outpatient setting after discharge	Standard hospital food according to ability and desire to eat, no nutritional consultation and no recommendation for additional nutritional support. The decision to prescribe nutritional support was at the discretion of the nursing and physician team.	• Primary: all-cause mortality up to day 30 after inclusion in the trial • Secondary: major adverse events, major complications, non-elective hospital readmission within the first 30 days, mean length of hospital stay	**Low quality** Downgraded twice (GRADE) due to: 1. Some concern on randomisation process, and measurement bias 2. Indirectness of evidence from pneumonia	• Energy and protein goals met in 79% and 76% in the intervention group, respectively • Energy and protein intake in the intervention group was significantly higher compared to control (mean difference in daily energy intake of 286 kcal (95% CI 226 to 541) and in mean daily protein intake of 13g (95%CI 6 to 20) • Weight adjusted individual targets - significantly higher calorie intake (adjusted mean difference of 4.1 kcal/kg/ day, [95%CI 3.3 to 4.9] and protein (adjusted mean difference of 0.14 g/kg/day [95%CI 0.11 to 0.17]) in intervention group compared to control group • No statistically significant differences between the intervention and control group for the other outcomes
Yang et al, 2019 (24)	To investigate the effects of an individualized nutritional intervention program when delivered through mutual care by a dietitian and patient family caregivers in older	RCT Kaohsiung Chang Gung Memorial Hospital Taiwan	During hospitalization and at 3 and 6 months after discharge	Inclusion criteria: malnourished (BMI <18.5 kg/m^2 or MNA-SF score ≤7) adults >65 years with primary diagnosis of pneumonia.	82 Intervention: 39 Control:43	Nutrition intervention: individualised nutrition by a dietitian according to energy and protein intake requirements and physical activity, in addition to dietary education and advice on post-discharge diet via face-to-face	Only provided standard nutritional supplements, and patients' family members were not provided dietary advice	Nutritional status • Anthropometry (BMI, limb circumference, and subcutaneous fat thickness) • Hospital stay • MNA-SF score • Targeted daily calorie intake, total calorie	**Low quality** Downgraded twice (GRADE) due to: 1. Risk of bias on reporting and measurement 2. Indirectness of evidence from pneumonia	• During hospitalisation: - Intervention group showed significant increases in daily and total energy intake, adherence rate and protein intake compared with the control group. - No significant differences in anthropometry, blood biochemical values, MNA-

	adults with pneumonia Hospital and 3- and 6-months post discharge follow-up			Intervention group: mean age 80.9±7.9 years, 89.7% male Control group: 82.2±7.7 years, 72% male		interviews with the family members and patients before discharge. After discharge, phone calls were adopted for prescribing individualised nutrition		intake adherence rate, and three-major nutrient intake • Rate of readmission resulting from pneumonia		SF scores and hospital stay. • At 3 and 6 months after discharge, - Intervention group showed significantly higher daily energy intake (mean diff=249Kcal/day, p<0.05) and MNA-SF scores (9.3 vs.7.6; p<0.05) than the control group. • After adjusting for sex, the readmission rate for pneumonia significantly decreased by 77% in the intervention group compared to the control group (p=0.03, OR: 0.23, 95% CI: 0.06-0.87)
Yuanyuan et al, 2020 (25)	Compared nutritional indicators, clinical efficacy, hospitalization days and cost of treatment of elderly patients with severe pneumonia by EN support or common diet support Hospital setting	RCT Ninth People's Hospital of Zheng-Zhou	Patients selected from January 2016 to June 2017	Inclusion criteria: aged 55-75 year with confirmed diagnosis of severe pneumonia Intervention group: age 56 - 74 years, average age 68.6 ± 6.5 years, 52.2% male Control group: Age 55 - 75 years, average age 66.7±6.6 years, 60% male	94 Intervention: 44 Control: 50	Enteral nutritional support	Normal diet	• TSF • AMC • Nitrogen balance • Other nutritional indexes • Length of hospital stay • Hospitalization cost • Treatment effect • Adverse reactions	**Low quality** Downgraded twice (GRADE) due to: 1. Some concern due to insufficient information on randomisation, and no protocol therefore risk of reporting bias and lack of information on intended adherence to intervention 2. Indirectness of evidence from pneumonia	• TSF, AMC (0.01cm SD=0.91 vs -0.51cm SD=0.98, p=0.02) of EN group were significantly increased compared with that of the same group before treatment. • AMC in the control group were significantly lower than in the same group before treatment (p<0.05). • Nitrogen balance in EN group was better than in control group (p=0.045). • Mortality rate in EN group (9.1%) was lower than in control group (16%). • Incidence of adverse reactions in EN group was significantly lower than in control group (2 vs 9 events; p=0.03). • Mean number of hospitalisation days in the EN group was significantly

										less than in the control group (25.7 SD=12.8 vs 34.2 SD=19.9 days p=0.03). • No significant difference in hospitalization costs between the two groups.
Observational studies										
Eekholm et al., 2020 (26)	To identify gaps between current clinical practice and evidence-based recommendations regarding diagnostic procedures, medical treatment and general management (nursing care interventions) for older patients admitted with community acquired pneumonia (CAP) Hospital setting	Descriptive cross-sectional university hospital, Denmark	Data analysed prospectively and consecutively in six months period from September 2016 to February2017	Inclusion criteria: patients (≥65 years) admitted with CAP and the staff who cared for them in the emergency department and the three medical units Median age for the patients was 74 years and 16 (53.3%) were males	15 patients, 86 HPs (40 physicians, 40 nurses and 6 physiotherapists)	Data collection via participant observations, individual ad hoc interviews during observations and audits of patient records	None	Adherence to evidence-based recommendations in: • Diagnostic procedures • Medical treatment • General management including **nutrition support** • LOS • Mortality • Readmission	**Very low quality** Downgraded (GRADE) due to: 1. Unclear risk of bias due to lack of clarity on controlling for confounding	• Median LOS: 6.5 days • Three (10%) patients died while admitted. • Of 27 surviving patients, 11 (40.7%) were readmitted within 1 month. • Incidence of 30 days mortality: 7.4%. • A nutritional support plan was developed for six (40%) patients. Due to lack of documentation of energy and protein needs and insufficient registration of nutritional intake, it was not possible to assess whether patients received nutrition in accordance with their needs • Nutrition support plans were found to be developed sporadically, and interventions to be performed unsystematically and sparingly.
Honda et al., 2020 (27)	Comparison of in-hospital outcomes between patients receiving nasogastric (NG) feeding and total parenteral nutrition	Retrospective cohort study Hospital based Japan	From April 2014 to November 2017	Inclusion criteria: consecutive older inpatients aged >65 years with a diagnosis of pneumonia who received PN or NG feeding	Total 459 patients: 336 patients received PN; 123 patients received NG feeding	A hospital-based database constructed using survey data from > 100 acute-care hospitals was used to compare in-hospital outcomes between	None	• In-hospital mortality • Complications • Length of hospital stay • Discharges home	**Very low quality** Downgraded (GRADE) due to: Indirectness of evidence	• Patients with NG feeding had lower in-hospital mortality (13.8% vs 27.1%, p = 0.003) and fewer complications (mean; 0.71 vs 1.44, p <0.001), shorter length of hospital stay (mean; 27.6 vs 48.9, p <0.001), more discharges

				within 7 days of admission 55.6% of patients were aged 75 - 89 years; 55.1% male patients		patients who received NG tube feeding and those who received PN.		• Discharges without oral intake		home (72.4% vs 35.1%, p <0.001), and more discharges without oral intake (65.9% vs 45.8%, p <0.001) than patients with total parenteral nutrition
Shirado et al., 2020 (28)	To investigate the influence of average energy intake at 1 week of hospitalization on prognosis for older adults with pneumonia	Retrospective observational cohort study Hospital based Japan	November 2015 to March 2018	Inclusion criteria: age over 65 years and pneumonia	315 patients Intervention: 182 Control: 133	Registry data that were entered into the Japan Rehabilitation Nutrition Database were analysed. Patients whose average energy intake for 1 week after hospitalization did not satisfy the basal energy expenditure were designated the lack of energy intake (intervention) group. Patients were categorised according to basal energy expenditure (BEE). Low intake were those with energy intake less than BEE (median 420Kcal/day; [interquartile range 210 – 718]). The comparator were patients with intakes higher than BEE (1316Kcal/day [1100 - 1528]) Energy intake determined as follows: nursing staff or	Patients whose energy intake satisfied the basal energy expenditure were designated the control group	• Mortality • Discharge home rate • Pneumonia recurrence rate during hospitalization	**Very low quality** Downgraded (GRADE) due to: 1. Risk of measurement bias affecting validity and reliability of data	• Patients in the low energy group were older (p= 0.033), had higher A-DROP score (p < 0.001), and showed higher malnutrition rate in MNA-SF at hospitalization (p < 0.001) than those in the control group • Risk of mortality was significantly higher in the low energy group than in the control group (odds ratio 5.07, 95% CI, 1.86 to 13.8, p = 0.002) • Low energy group had significantly lower discharge home rate (odds ratio 0.33, 95% CI 0.15 to 0.70, p = 0.007) than the control group • Low energy group had significantly higher pneumonia recurrence rate during hospitalization (odds ratio 3.26, 95%CI 1.39 to 7.68, p = 0.007) than in the control group

						dietitians record a visual % estimate of each item ingested. Dietitians then convert these data to energy intake.				
Systematic review										
Goodwin et al., 2021 (29)	To establish evidence for rehabilitation interventions tested in populations of patients admitted to ICU and critical care with severe respiratory illness, and consider whether the evidence is generalizable to patients with COVID-19	Rapid systematic review UK	Databases searched from inception to May 2020	Inclusion criteria: adults with respiratory illness that required ICU or critical care, received rehabilitation to restore physical impairment or disability. No summary data on systematic reviews RCTs: mean or median age between 60 and 69 years. The mean proportion of men was 53% (490/993) Qualitative studies: broad range of ages up to 89 years, with men accounting for 45% to 80%	Systematic reviews: 61 unique RCTs and 3 unique qualitative studies; total sample sizes ranged from 136 to 2510 participants RCTs: 11 additional RCTs that were not included in any of the reviews; 993 participants Qualitative studies: 8 additional to those not included in any of the Reviews: sample size ranged from 8 – 25 participants	Nutritional interventions described in 2 studies as: • Lectures, counselling, fortified foods, oral nutritional supplements or parenteral/enteral nutrition plus rehabilitation (defined as comprehensive or individualised expert programme) • Physical (MDT) rehabilitation (enhanced physiotherapy, nutritional care and information provision, case management. Usual care comparator	Various including usual care where stated in studies that included nutritional interventions	Various outcomes Outcomes related to studies that included nutritional interventions: • Impairments; ADLs (not specified); HRQoL; Adverse Events • Experiences of rehabilitation and quality of care	**Low quality** Double downgraded (GRADE) due to: 1. Lack of clarity on whether quality assessment was checked by a second reviewer 2. Indirectness of evidence from lower respiratory tract infections	• 2 of the included studies involved nutritional interventions in addition to other rehabilitation interventions: 1 systematic review (2 RCTs), and 1 mixed-methods process evaluation • Short-term benefits on the Barthel Index (SMD 0.28, 95% CI 0.00 to 0.56; P=0.05 at 3 months, 0.30; 95%CI, 0.02 to 0.58; P=0.03 at 6 months) in favour of intervention, but there were no differences at 9 and 12 months after discharge • Intervention had a positive effect on lean body mass (0.65; 95% CI, 0.36 to 0.93; P < 0.00001 at 3 months) • Nutritional supplementation in addition to rehabilitation in post-ICU hospital settings may improve performance of ADLs • No effect on HRQoL. Adverse events not reported • Individualised care and information highly valued by patients. Enabled greater access to

										physiotherapy and nutritional care • The evidence could be generalizable to Covid-19
Abstracts										
Bursi et al., 2020 (30)	A specific Nutritional Protocol for COVID-19 inpatients ICUs and general medicine wards.	Protocol - Expert opinion Maggiore Hospital in Bologna (Italy)	Not specified	N/A	N/A	Publication from Scientific Association on Clinical Nutrition in ICU and Internal Medicine setting were searched online on PubMed. Recently published recommendations and guidelines regarding Clinical Nutrition and micronutrient function in COVID-patients were also screened and evaluated.	N/A	N/A	**Insufficient information to fully assess**	Multistep protocol considered three different scenarios depending on the route of nutrient administration: oral feeding, enteral feeding via NG and PN. The protocol was intended for use by non-nutrition specialists to start early nutrition therapy (ideally in the first 24-48 hours of hospitalization). Authors decided to use hypercaloric and high-protein Oral Nutritional Supplements, enteral formulas and parenteral formulas to restrict fluids
Alvarez Schettini et al., 2020 (31)	To describe basic aspects of nutritional care: diet prescription and use of nutritional support in older Covid-19 inpatients	Retrospective, cross sectional, descriptive study A tertiary hospital in Spain	Data analysed on the last day of April 2020	27 patients were included (70.4% female) (median age 84; IQR 68-87), but data on patients over 75 (n = 18; 66,6%) were finally analysed.		Medical records were analysed to review nutritional care related aspects in all the SARS-CoV-2 PCR positive patients	None	• Type of prescribed diet • Nutritional support (oral supplements/ tube feeding)	**Insufficient information to fully assess**	• Texture-modified (pureed) food was administered in 16 patients (88.9%). • Oral nutritional supplements were prescribed in 4 patients (22.2%) and tube feeding in 1 (5.6%)
Hoyois et al., 2020 (32)	To assess nutritional parameters in patients with COVID 19 following ICU	Prospective cohort study Rehabilitation setting	Until May 5th 2020	Inclusion criteria: All patients with COVID 19 requiring ICU stay (minimum 14 days) with mechanical ventilation and after ICU discharge	11 patients	Details not provided	None	• BMI • Weight loss • Hand Grip Test • Nutrition therapy modalities	**Insufficient information to fully assess**	**• ICU:** BMI at ICU admission was 25.7 (22.2-33.3) kg/m^2. Enteral nutrition was administered to all patients through a NGT; a PEG was placed in two patients. One patient required complementary PN.

				Age 58 (33-75) years old, and 5 men (45%)						• **Post ICU rehabilitation unit:** BMI at admission was 22.9 (19.1-32.9) kg/m^2. Nutrition dosage: median of 2553kcal/day (28 kcal/kg/ day) and 128 gr protein/day (1.3 gr/kg/day). Weight loss since ICU admission was estimated at 8.3% (4.3%>14%). Post-extubation dysphagia requiring texture adaptation was present in 5 patients (45%). Hand-grip was 12 (8-26) kg and 0 (0-20) kg respectively for men and women, reflecting significant sarcopenia
Hansen et al., 2020 (33)	To investigate if individual nutritional guidance combined with a long-term protein-based nutritional supplement during hospital stay and after discharge could influence the 60 days re-admission rate and improve nutritional status in patients with community acquired pneumonia	Unblinded trial Hospital based and post-discharge Location not specified	Time period of intervention during hospital stay was not specified. **Post discharge:** intervention continued for 2 months (follow up at 30 and 60 days)	Inclusion criteria: Patients aged > 65 years admitted with CAP	40 Intervention 21 Control: 19	• Randomized to receive oral supplementation and individualized nutritional guidance in addition to standard care. • ONS: 1.5 g protein/kg/day as a whey-protein enriched milk product (Protino®, Arla Foods) + a multivitamin-mineral tablet. • After discharge, nutritional guidance continued by weekly phone-calls, and the ONS as a fixed dose of 28 g protein daily + multivitamin-	Standard care in the department. No intervention but weekly contacts by phone after discharge. Outpatient follow-up after 30 and 60 days.	• Weight • Lean body mass (bioelectrical impedance analysis) • Handgrip strength (HGS) • Quality of life (QOL) • Normal daily living functions (ADL)	**Insufficient information to fully assess**	• 60 days re-admission-rate was significantly lower in the intervention compared to the control group (4.8 vs. 36.8%, p=0.01). • Several outcomes improved in the intervention group: HGS (p<0.01), QOL after 30 and 60 days (p<0.01), loss of lean-body mass after 60 days (p = 0.02), and during the admission QOL (p<0.01). •During admission, the control group experienced a larger weight loss compared to the intervention group (0.9 vs -0.1 kg) (p<0.01).

						mineral supplement for two months. • Outpatient follow-up after 30 and 60 days				
Formisano et al., 2020 (34)	To explain the nutritional management of non-critically ill hospitalized patients with COVID-19 carried out by dietitians	Type of study not specified – likely observational Civil Hospital of Sanremo, Italy	Not specified	Non critically ill patients with Covid-19 at risk of malnutrition	53	• Risk of malnutrition using a short-age adjusted NRS-2002. • Personalised nutritional management by dietitians. Evaluated weight, height and malnutrition signs. • Nutrition-related laboratory parameters collected. • Energy needs were estimated. All patients were administered with a fractionated high calorie, high protein pureed diet	None	• Weight, height and malnutrition signs •Reaching of estimated nutritional targets • Mortality	**Insufficient information to fully assess**	• 53 patients at risk of malnutrition: 18 patients supplemented with ONS. • Pureed diet and ONS well tolerated and accepted by 92.5% of patients. • 32 (60.4%) reached their nutritional needs with the personalized nutritional management. • Mortality: 9/21 (42.9%) patients not reaching nutritional target vs 1/31 (3.1%) meeting nutritional target (p<0.001)
Ortega et al., 2020 (35)	To assess the prevalence and pathophysiology of oropharyngeal dysphagia, malnutrition, nutritional risk, and the needs of compensatory treatments in patients admitted due to COVID-19	Prospective observational study Hospital de Mataro, Catalonia, Spain.	Not specified	Details not provided.	268 hospitalized patients, 52.2% men, with a mean age of 70.2±17.0 years	• Clinical assessment of oropharyngeal dysphagia, and nutritional screening with NRS2002 and GLIM criteria. • Clinical characteristics and need of compensatory treatments for oropharyngeal dysphagia and malnutrition were assessed at baseline and will be followed up at 3 and 6 months.	None	• Presence of oropharyngeal dysphagia • Malnutrition and nutritional risk • Number of patients that received texture modified diets • ONS provided	**Insufficient information to fully assess**	**Baseline dat**a: • Prevalence of oropharyngeal dysphagia was 52.4%. • 43.7% of patients needed thickeners • 54.5% needing texture-modified diets • 74.2% patients presented with NRS2002 score >3 and were at risk of malnutrition • 46% had malnutrition and 73.8% patients received ONS Follow up data not yet available

*severely ill criteria: 1) respiratory distress and respiratory rate 30 times/min, 2) oxygen saturation in a resting state 93%, 3) arterial partial pressure of oxygen (PaO2)/fraction of inspired oxygen (FiO2) 300 mm Hg; **critically ill criteria: 1) respiratory failure and need for mechanical ventilation, 2) shock, and 3) other organ failure requiring ICU monitoring; ***nutritional risk index (NRI): 1.519 x albumin (g/L) + 0.417 × (measured weight/usual weight) × 100; IQR: interquartile range ; BMI: Body Mass Index; AMC: Arm Muscle Circumference; TSF: Triceps Skin Fold thickness; BAPEN: British Association of Parenteral and Enteral Nutrition; BDA: British Dietetic Association; NG: nasogastric feeding; EN: Enteral Nutrition; PN: Parenteral Nutrition; PEG: percutaneous endoscopic gastrostomy; ICU: Intensive Care Unit; MNA-SF: Mini-Nutritional Assessment-Short Form; MUST: Malnutrition Universal Screening Tool; NRS-2002: Nutrition Risk Score 2002; ONS: Oral Nutritional Supplements; RCT: Randomised controlled Trials; GRADE: GRADE Working Group criteria; AGREE II: Appraisal of Guidelines for Research & Evaluation tool; COPD: chronic obstructive pulmonary disease; ADLs: activities of daily living; PTSD: post-traumatic stress disorder; HCPC: Health and Care Professions Council; BDA: British Dietetic Association; GI: gastrointestinal; QoL: Quality of life; HRQoL: Health related quality of life

Table 3: Agree II quality assessment - standardised scores of each domain for guidelines

Column1	Barazzoni et al, 2020	Chapple et al, June 2020	Aytür et al, 2020	Chen et al., 2020	Jin et al., 2020
Domains	**Scaled domain scores (%)**				
1. Scope and purpose	100	98	100	72	87
2. Stakeholder involvement	44	70	69	43	74
3. Rigour of development	30	41	61	25	73
4. Clarity of presentation	83	94	80	48	50
5. Applicability	46	83	50	42	56
6. Editorial independence	78	78	100	75	100
R1: overall quality (1-7)	4	6	4	3	5
R1: recommendation for use	Y+mod	Y+mod	Y+mod	N	Y+mod
R2: overall quality (1-7)	4	5	5	3	6
R2: recommendation for use	Y+mod	Y+mod	Y+mod	N	Y
R3: overall quality (1-7)	4	6	5	3	6
R3: recommendation for use	Y+mod	Y	Y+mod	N	Y
Overall recommendation	Y+mod	Y+mod	Y+mod	N	Y
Overall quality judgement* (Very low, Low, Moderate, High)	Moderate	Moderate	Moderate	Low	Moderate

R - reviewer; Y - yes; mod - modifications; N – no; *based on 60% threshold

Table 4: *Nutritional care process strategies from guidelines and opinion articles*

Nutritional care process	Strategies	References
Identification and assessment	Nutrition screening and assessment should be undertaken using validated tools e.g. MUST, NRS-2002, Subjective Global Assessment, Mini Nutritional Assessment for geriatric patients, NUTRIC score for ICU patients, GLIM criteria, MNA-SF, or a local validated tool	(9, 10, 12, 14-16, 18-20)
	Estimation of risk by assessing oral intake and potentially impacting symptoms	(17)
	Consider at nutritional risk if BMI <22Kg/m^2 and/or weight loss in the last three months and/or reduced food intake	(21)
	Alternative measures (in the absence of measurements of weight and/or height): • patient or family reported values of height, previous weight and weight loss • measurement of ulna length and mid arm circumference • subjective criteria e.g. loose clothing, history of decreased food intake, reduced appetite, reported dysphagia or underlying psycho-social or physical disabilities • Patients Association Nutrition Checklist (based on self-report)	(15, 17-19)
	Discharge: • Reassess nutritional risk on discharge and handover to community • Ongoing dietary counselling and individualised nutrition plans in nutritionally high risk, frail, sarcopenic, post ICU or critical care recovery patients • Ongoing assessment of muscle mass	(15-18)
Diagnosis	Identify malnutrition: • Focus on immunocompromised, older adults, poly-morbid, malnourished individuals, people with underlying long term conditions (diabetes), ICU patients, patients who are unable to eat • Identify dysphagia – particular attention to patients discharged from ICU (post-extubation dysphagia) • Identify refeeding syndrome	(9, 10, 14, 16, 17, 19, 20)
Treatment strategies	Use protocols, algorithms, existing local policies or pathways to direct nutritional support once nutrition risk status is established.	(10, 16, 17, 19, 21)
	Link with existing pathways e.g. NICE rehabilitation pathway or community malnutrition pathway	(16, 17, 19) (36)
	Ward-based strategies: • High energy, high protein, easy to chew menu options • Snack boxes • Snack rounds • Symptom relief • Taste or smell changes - Strong-flavoured foods • Dry mouth - sugar-free fruit sweets	(16)
	ICU stepdown:	(16, 17)

	• Maintain enteral nutrition until review by a dietitian • Use supplemental enteral feeding or ONS if required • Offer ONS after rehabilitation • Educate ward staff about optimising nutrition • Enteral feeding regimens structured around physiotherapy sessions	
	ONS criteria: Hospital: • Early high protein nutritional supplementation (20g/day) in all nutritionally high-risk patients • To meet nutritional targets • Poor appetite and inadequate eating • Dysphagia • Dysphagia – texture adapted diets according to advice of SLT Community: • Food intake (including food fortification) does not meet nutritional goals and if there is significant unplanned weight loss, and where the ACBS criteria are met • Consider self-purchase and use of powdered ONS options (consider patient's ability to manage preparation at home) • Assess level of independence including access to food and availability of help from family or neighbours	(9, 10, 12) (21) (17) (11) (20) (9, 20) (15) (14, 16, 19) (15)
	Energy and protein provision: • 400 - 600kcal/day, ≥30g protein/day • 600-900kcal/day, 35-55g/d protein Give in periodic doses	(9, 10) (21) (17)
	Artificial nutrition: Consider EN if oral intake: • <half of energy and protein requirements met orally for 3-7 days • <65% for malnourished patients • <50-60% for 3 days • where ONS intake is less than two bottles on two consecutive days • Consider PN if EN not tolerated	(9, 10, 20) (10) (20) (21) (9, 10, 12, 17, 20, 21)
	Nutritional requirements: Energy: • 25-30Kcal/kg/day	(9, 10, 12, 16, 20, 21)
	Protein: • 1-2g/kg body weight	(9, 12, 20, 21)
	Adjust according to nutritional status, physical activity level, disease status, comorbidities, and tolerance	(9, 20)

	Caution for refeeding syndrome	(9, 10, 16)
	On discharge: • Provide resources e.g. BDA Older Adults Factsheets and Guide to Nutrition and Hydration in Older Age	(14)
	• Continue ONS if intake severely impacted, ongoing breathlessness, fatigue or if using a mask or nebulisers, or medium/high risk of malnutrition	(9, 16, 19)
	• Review by a dietitian to establish need for ongoing ONS and to ensure prescriptions meet the UK ACBS indications	(16)
	• Arrange community dietitian or GP review and communicated in writing	(15)
	• Artificial nutrition if patient has ongoing severe swallowing dysfunction, neurological dysfunction, or gastrointestinal dysfunction	(17)
Implementation	MDT working: • Team could include clinical psychologists, speech and language therapists, physiotherapists, occupational therapists, and dietitians • Nurses for patients at risk of pressure ulcers • Podiatrists for diabetic foot injuries • Falls prevention • Mental health services	(9, 10, 14, 15, 17, 19, 20) (9, 14, 15, 17, 19, 20)
Monitoring and review	Body weight, BMI, food intake, compliance to dietary advice and ONS, blood tests, clinical condition, and functional tests (such as sit to stand), self-reported activity, progress towards agreed goals and ability to undertake activities of daily living.	(15, 19, 20)
	Monitor prescription compared to delivery of EN and PN; avoid under and overfeeding.	(17)
	Prescription of ONS for at least one month (post discharge) and regular monitoring if compliance is in question	(9)
	Frequency: During hospitalisation: • weekly for low to moderate nutrition risk • every 2-7 days for high risk	(10)
	Community: • 1 week to 3 months intervals	(19)
Evaluation	No guidance	

NICE: National Institute for Health and Care Excellence; ACBS: Advisory Committee on Borderline Substances; BAPEN: British Association of Parenteral and Enteral Nutrition; BDA: British Dietetic Association; BMI: Body Mass Index; EN: Enteral Nutrition; ICU: Intensive Care Unit; MNA-SF: Mini-Nutritional Assessment-Short Form; MUST: Malnutrition Universal Screening Tool; NRS-2002: Nutrition Risk Score 2002; ONS: Oral Nutritional Supplements; PN: Parenteral Nutrition; GLIM: Global Leadership Initiative on Malnutrition; NUTRIC: Nutrition Risk in Critically ill; MDT: multidisciplinary team

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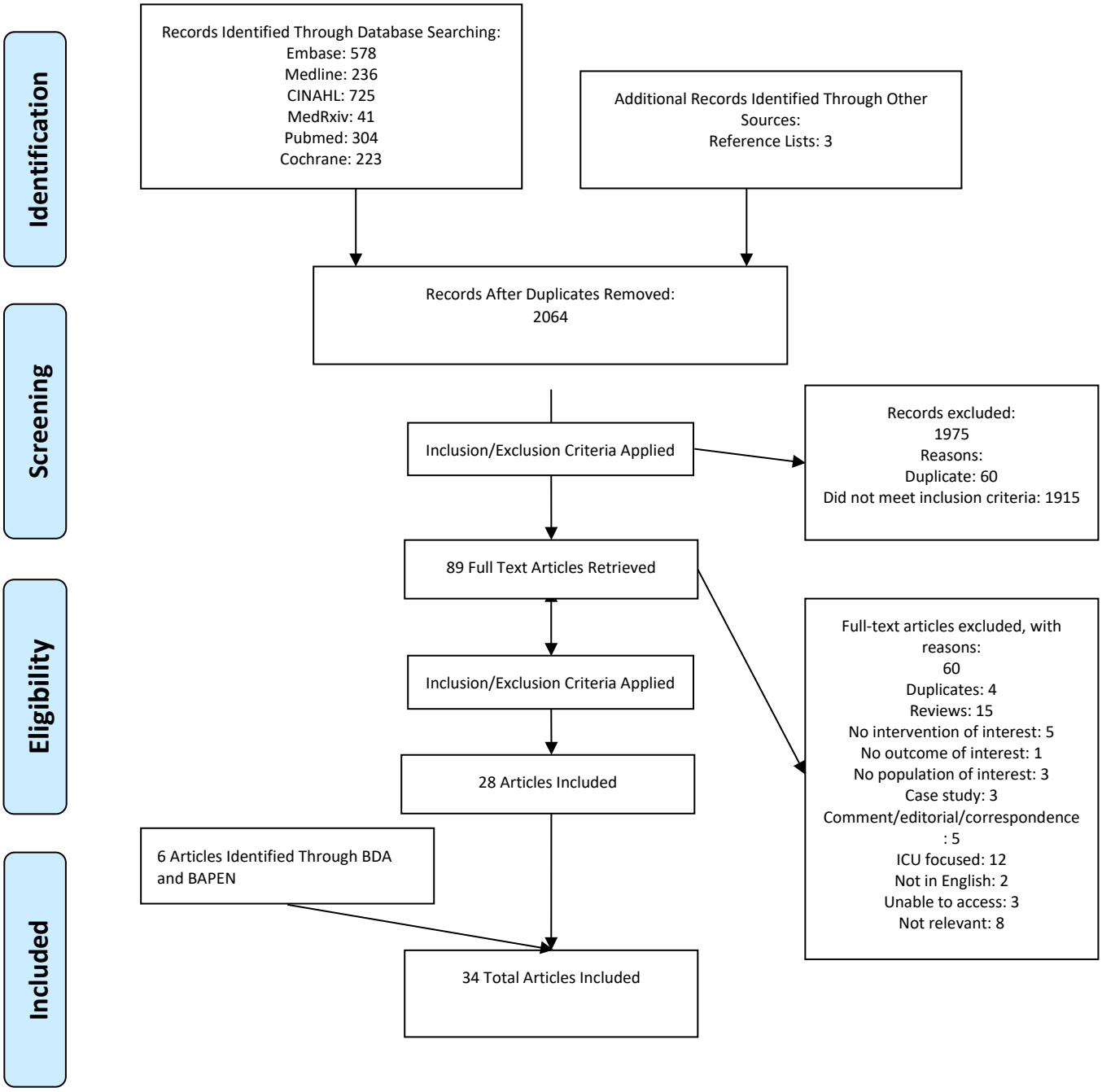
Figure 1: Prisma flow diagram of search and selection process



PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	1
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	6-7
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	7
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	7; 9
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	8-9
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	8-9
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	8-9
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	8-9
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	8-9
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	9
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	8-9
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Na
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	9
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	9
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	9
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	9
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Na
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Na
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Na
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Na

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Fig 1; p10
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Fig 1; p10
Study characteristics	17	Cite each included study and present its characteristics.	Table 2; p10
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Table 2; p11
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Table 2; p11-18
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Na
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Na
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Na
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	Na
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Na
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Na
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	18-22
	23b	Discuss any limitations of the evidence included in the review.	22
	23c	Discuss any limitations of the review processes used.	22
	23d	Discuss implications of the results for practice, policy, and future research.	22
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	1
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	PROSPERO
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	Na
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	3
Competing interests	26	Declare any competing interests of review authors.	3
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Table 2

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

For more information, visit: http://www.prisma-statement.org/

Supplementary information

Contents

Example search strategy for Embase

Embase: total hits 437 (Filter: English + last year)

1. discharge*.mp.
2. step down.mp.
3. step-down.mp.
4. post critical illness.mp.
5. exp hospital patient/
6. hospital patient.mp.
7. inpatient*.mp.
8. post-critical illness.mp.
9. critical illness.mp.
10. critical* ill*.mp.
11. (discharge* adj3 (hospital* or ICU or intensive care or ITU or intensive therapy)).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]
12. (post* adj3 discharge*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]
13. (Step-down* adj3 (ward or ICU or intensive care or ITU or intensive therapy)).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]
14. (Stepdown* adj3 (ward or ICU or intensive care or ITU or intensive therapy)).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]
15. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14
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17. nutrition* support.mp.
18. oral nutrition* supplement*.mp.
19. nutrition* supplement*.mp.
20. oral nutrition* support.mp.
21. nutrition* rehab*.mp.
22. enteral* fed.mp.
23. diet* therap*.mp.
24. nutrition* therap*.mp.
25. diet* advice.mp.
26. nutrition* advice.mp.

27. (nutrition* adj3 (artificial or enteral or oral)).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]
28. (counseling* adj3 (diet* or nutrition*)).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]
29. (feed* adj3 (sip or enteral or artificial or tube)).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]
30. (intake* adj3 (energy or protein or calorie or diet*)).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]
31. diet* input.mp.
32. diet*.mp.
33. (food* adj3 (fortif* or first)).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]
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36. PN.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]
37. 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36
38. Covid*.mp.
39. Corona virus.mp.
40. exp Coronavirinae/
41. coronavirinae.mp.
42. SARS*.mp.
43. coronavirus.mp.
44. exp SARS coronavirus/
45. SARS coronavirus.mp.
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51. SARS-CoV-2.mp.
52. 2019-nCov.mp.
53. Wuhan Virus.mp.
54. 2019 novel coronavirus.mp.
55. coronavirus disease 2019 virus.mp.
56. exp Coronavirus infection/
57. coronavirus infection.mp.
58. Wuhan seafood market pneumonia virus.mp.
59. pneumonia.mp.
60. Influenza.mp.
61. Flu.mp.

62. ARDS.mp.
63. acute respiratory distress syndrome.mp.
64. Acute Respiratory Failure.mp.
65. respiratory tract infection.mp.
66. respiratory failure.mp.
67. acute respiratory failure.mp.
68. SARS virus.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word]
69. 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67 or 68
70. 15 and 37 and 69
71. limit 70 to (english language and last year)

Comparison of published guidelines for management or treatment of Covid-19 infection

Guideline	Aytür et al, 2020(1)	Barazzoni et al, 2020(2)	Chapple et al, 2020(3)	Chen et al, 2020(4)	Jin et al., 2020(5)
Description	Turkey.Ward and subacute rehabilitation. Published May.	ESPEN.ICU, ward, post-discharge and community Published March.	Australia and New Zealand ICU and ward. Published June	China. Ward and home-based care. Published April.	China. ICU and ward. Published February.
Nutrition screening	• Psychosocial and nutritional assessments are recommended before pulmonary rehabilitation and management of any problems should be provided. • Pulmonary rehabilitation recommended for individuals with special considerations (elderly, immunocompromised, or limited mobility or immobility due to stroke, etc.) and with primary pulmonary disease. • Program should be individualized. • Evaluation by a PMR specialist.	• Older adults and poly-morbid individuals should be checked for malnutrition through screening and assessment. • The check should initially comprise the MUST criteria or, for hospitalized patients, the NRS-2002 criteria. • Since malnutrition is defined not only by low body mass but also by inability to preserve healthy body composition and skeletal muscle mass, persons with obesity should be screened and investigated according to the same criteria.	• Use acute ward Nutrition Algorithm. • When there is capacity, use validated malnutrition screening tool to identify patients who are at risk of malnutrition (e.g., MUST, MST, MNA-SF) within 24 hours • Low Nutrition Risk - MST ≤ 1, MUST = 0 or <5% unintentional weight loss. • Moderate Nutrition Risk - MST = 2, MUST = 1 or 5-10% unintentional weight loss. • High nutrition risk - Requirements for EN or PN; Malnutrition or suspected malnutrition MUST≥3, MUST≥2, BMI<18.5 kg/m^2, recent weight loss 10%; anaphylactic food allergy; Considered at high risk of refeeding; Type 1 diabetes mellitus; Cystic fibrosis; Inborn errors of metabolism.	No specific guidance provided.	• Inpatients are screened for nutrition risk based on the NRS-2002 score when they are admitted to the hospital. • Nursing of critically ill patients: Dynamically assess patients' nutritional risks.
Dietary interventions	• Mild stage: Preventative measures including:- management of excess weight- Supportive measures including daily intake of 2 g/kg protein, vitamin C, zinc, selenium and high fibre content in the diet should be taken • Severe pneumonia (covid-19 positive or possible Covid-19) or	• If malnutrition - dietary counselling from experienced professionals • Assessment of energy needs - indirect calorimetry if safe or prediction equations or weight-based formulae. • Individuals infected outside of the ICU should be treated to	• Handover by ICU dietitian to ward dietitian within 24 hours of ICU discharge including nutritional status. • Patients admitted directly to the ward - local pathways to optimise nutrition provision as soon as possible, before full nutritional assessment, where appropriate:	• In home-based care, the elderly should be very careful of nutritional balance. • The elderly are recommended:- to have a balanced diet- balanced intake of calories, protein, vitamins, minerals and so on, with meat and vegetables to ensure adequate nutrition. - Eat foods	• If the total score is <3 points, it is recommended to eat protein-rich foods (such as eggs, fish, lean meat, dairy products) and carbohydrate-containing diets. • If the total score is ≥3 points, the patient should be given nutritional support as early as possible. It is recommended to increase protein

	ARDS:- individualised PR program basically include techniques used for acute stage pneumonia- Nutritional support; a carbohydrate-restricted diet should be introduced to decrease respiratory failure and carbon dioxide accumulation; attention should be paid to conditions including hypophosphatemia, hypomagnesemia, and hypocalcaemia that can aggravate respiratory failure.	prevent or improve malnutrition - use ONS. • Oral route is preferred - nutritional treatment to start within 24 - 48 hours. • Refeeding syndrome risk - nutritional targets should be met gradually. • Use ONS when dietary counselling and food fortification are insufficient - at least 400 kcal/day, ≥ 30 g protein/day - to continue ≥1 month. Monitor monthly. • If ONS compliance is questioned, more frequent evaluation e.g. weekly. • If requirements cannot be met orally for >3 days or expected to be low, half of energy requirements for >1 week - administer EN. PN should be considered when EN is not indicated or insufficient. • No limitations to the use of EN or PN based on patient age or diagnosis, in the presence of expectable benefit to improve nutritional status.	Low nutrition risk - Managed by nursing or other suitably trained staff- Moderate Nutrition Risk - Referral to Nutrition/ Allied Health Assistant/ Dietitian + Implement a protocol. • Add HEHP diet code. • Provide default supplements (e.g. 2 x 1.5 kcal or 2.0 kcal supplements per day). • Commence food chart for 3/7. • Ensure menu selections are implemented - High nutrition risk - referral to the Dietitian and individualised care plan. • Dietetic consultation to be conducted within 24-72 hours; those requiring EN should be seen within 24 hours. • Escalate to EN in patients who are meeting <50% of energy and protein targets orally for ≥ 5 - 7 days, or a malnourished patient with <65% of estimated requirements	that are easily digested, eat more vegetables and fruits, drink water frequently, and avoid eating wild animals and rotten or expired food. - Chilled poultry should be purchased through regular channels, and meat, eggs, and milk should be fully cooked before eating. - In case of poor appetite and inadequate eating - take some protein and trace elements appropriately through nutritionally fortified foods, special medical formula foods, or nutrient supplements.- Standardized health education and training, including nutrition and health knowledge for patients and families.	intake by oral nutrition supplement, 2–3 times/day (≥18 g protein/time). In order to reach the amount of 18 g protein/time, protein powder can be added on the basis of standard whole protein preparations. A tube should be placed and EN commenced when the patient cannot increase supplemental nutrition by oral route. • Disease nursing: high-protein, high-vitamin, carbohydrate-containing diets (e.g. eggs, fish, lean meat, milk, etc.) to improve physical condition. • Nursing of critically ill patients: timely nutritional support; a diet rich in protein and carbohydrates - EN for patients who cannot eat; PN if patient incompatible with EN to meet energy requirement.
Energy (Kcal)		• 27 kcal per kg body weight per day; total energy expenditure for poly-morbid patients aged>65 years. • 30 kcal per kg body weight per day; total energy expenditure for severely underweight poly-morbid patients; in severely underweight patients caution should be exercised due to high risk of refeeding syndrome.			• Ideal energy intake 25–30 kcal per kg body weight per day.

		• 30 kcal per kg body weight per day; guiding value for energy intake in older persons, this value should be individually adjusted with regard to nutritional status, physical activity level, disease status and tolerance.			
protein (g)		• 1 g/kg body weight per day in older persons; amount should be individually adjusted with regard to nutritional status, physical activity level, disease status and tolerance. • ≥ 1 g/kg body weight per day in poly-morbid medical inpatients in order to prevent weight loss, reduce the risk of complications and hospital readmission and improve functional outcome.			Ideal protein requirements 1.5g per kg body weight per day
Dysphagia	• No guidance provided	• Texture adapted food. • Unsafe swallow. • EN. • Very high aspiration risk. • Post-pyloric EN or temporary PN, or consider supplemental PN.	No guidance provided.	No guidance provided.	No guidance provided.
Goals and monitoring	No specific guidance on nutritional monitoring provided.	Monitoring for potential complications of EN should be performed.	• Low nutrition risk - monitor intake and weight weekly. • Moderate nutrition risk - monitor intake and weight weekly. • High nutrition risk - Dietitian review every 2-7 days depending on risk.	No specific guidance on nutritional monitoring provided.	No specific guidance on nutritional monitoring provided.
Continued care, post-discharge or community	Rehabilitation approach after discharge in covid-19: general rehabilitation principles by evaluating the impairments in physical, functional, cognitive, psychosocial, and occupational aspects associated with Covid-19. Depending on the scope of the	• Patients in quarantine should continue regular physical activity. • Nutritional treatment should continue after hospital discharge with ONS and individualized nutritional plan.	No guidance provided.	No guidance provided.	Throughout the period of home care, healthcare personnel should perform regular (e.g., daily) follow-up through face-to-face visits or phone interviews (ideally, if feasible) to follow the progress of symptoms and, if necessary,

	rehabilitation program, the place and model of application (i.e., inpatient, outpatient, hospital-centred control, home-based program, or tele-rehabilitation, etc.) should be determined				specific diagnostic tests should be conducted.

BMI: Body Mass Index; EN: Enteral Nutrition; ICU: Intensive Care Unit; MNA-SF: Mini-Nutritional Assessment-Short Form; MST: Malnutrition Screening Tool; MUST: Malnutrition Universal Screening Tool; NRS-2002: Nutrition Risk Score 2002; ONS: Oral Nutritional Supplements; PN: Parenteral Nutrition; ESPEN: European Society for Clinical Nutrition and Metabolism

Comparison of opinion articles for management and/or treatment of Covid-19 infection

Opinion article	**Caccialanza et al, 2020(6)**	**Brugliera et al, 2020(7)**	**BDA (8)**	**BDA (9)**	**BDA (10)**	**BDA (11)** Critical Care Specialist Group (CCSG)	**BAPEN (12)** Malnutrition Action Group (MAG) update	**Managing Pathway (13)**
Description	Ward based care.	Ward and rehabilitation unit.	Community - action by dietitians for older and vulnerable people living in their own home.	Community - nutritional considerations for primary care teams managing patients with or recovering from Covid-19.	Ward and post – discharge.	ICU, ward and post-discharge.	Practical guidance for using MUST in all settings to identify malnutrition.	Community - Healthcare Professional Guide.
Nutrition screening and/or assessment	At admission, record: • Body weight and height. • Relevant biochemical parameters. • Simplified nutritional risk screening: BMI<22Kg/m^2 or weight loss in last 3 months. Reduced or expected reduced food intake	• Nutritional assessment and malnutrition screening for all hospitalized Covid-19 patients - MUST at hospital admission and discharge • Weight - estimated if direct measurement not possible (i.e. immobilization). • Height . • Impedance and vector analysis. • Weight loss.	On hospital discharge: • Identify community follow up availability if at risk of malnutrition. • Identify who will be able to provide nutritional screening for older and vulnerable people in the community. • Is MUST still a feasible option for the MDT to use or is the nutrition checklist a simpler option.	• Assess nutrition risk on the first contact and when there is concern • MUST can be used across all care settings. • If regular weighing is not possible subjective measures of MUST or the Patients Association Nutrition Checklist (validated). • Consider symptoms associated with Covid-19 which could reduce ability to eat and drink.	• Continue to screen for risk of malnutrition as soon as possible on admission, using MUST or a local validated nutritional screening tool and repeat weekly. • Alternative measures can be used as part of MUST. • Class as high risk of malnutrition if no oral intake for more than 5 days. • Encourage MDT to be on the look-	No guidance provided.	• In ICU/Critical care - If no intake for > 5 days, consider patient at high risk of malnutrition • MUST screening at the earliest opportunity, including on movement to the hospital ward and on discharge from hospital. Hospital Wards and Care Homes: • use patient-reported current weight, height and	• Screening for malnutrition across all settings, including the community, in patients with and recovering from Covid-19 - use of a validated screening tool i.e. MUST • If physical measures are not possible: - Use patient-reported values of current weight, height, and previous weight to calculate Step 1 and

		• Haemato-chemical parameters. • Swallowing - Patients unable to eat must undergo artificial feeding. • Intake assessment.	• Assess the ability of individual or support network to self-identify and self-manage nutrition and hydration needs at home (e.g. using the nutrition checklist and signposting to local resources)	• Identify sarcopenia using a simple questionnaire. • Refer to dietitians if at risk of malnutrition or sarcopenia present or with specialist dietary requirements (e.g. diabetes, renal disease). • Assess level of independence and access to food. • Consider emotional or psychological factors that may impact intake.	out for patients with eating difficulties. • Utilise existing contacts with patients to seek information • Existing local policies, protocols and algorithms for the management of patients at risk of malnutrition can be applied for ward-based care.		previous weight to calculate Step 1 (BMI category) and Step 2 (Weight Loss category) of MUST as an alternative measurement. • Alternative physical measurements e.g. ulna length, mid upper arm circumference). • Use subjective criteria if physical or self-reported measures of weight or height not possible.	Step 2 of MUST - where physical measures are not available, use subjective criteria to form a clinical impression of nutrition risk • Community Nutrition Support Pathway using MUST is suggested • Underlying conditions (i.e. diabetes) may make patients prone to severe infections of COVID-19.
Dietary interventions	On admission: • If at nutritional risk (as per simplified screening) - provide two to three bottles (125/200 ml/day) of protein-calorie ONS (600-900 kcal/day; 35-55 g/day of proteins) to be consumed between or immediately after meals. • If ONS not tolerated (i.e. <2 bottles/day are consumed for 2	• Diet for each patient calculated using a computerized meal management system. •Patients' dietary assignment shared with all involved healthcare professionals. • Nutritional advice that can be followed by the patient in the hospital and after home discharge is warranted.	• Check supplies of non-perishable basic foods, pre-prepared and/or frozen meals. • Check access to supermarkets and shops to purchase food and drink. • Ensure individuals at risk of malnutrition have access to ingredients to increase the nutrient content of meals and fluid • Collaborate with	• Dietitians should work as key MDT members within Covid-19 rehabilitation services. • Food fortification - focus on nutrient-dense foods and include protein as part of all meals and snacks (links provided to NHS and other websites on leaflets for further guidance). • For patients unable to meet	• Timely handover from ICU dietitian to ward dietitian. • Identify Covid-19 symptoms that may impact oral intake; shortness of breath - offer soft/moist food and encourage little and often; loss of taste and smell - offer foods with a strong flavour; dry mouth - offer high energy, high protein soft/moist foods and drinks, sugar-free fruit sweets	• Educate MDT that EN tubes should not be removed without review by a dietitian. • Supplemental EN and/or ONS used during the ward-based phase to meet nutritional targets if required. • Ensure timing of EN regimens is structured around physiotherapy sessions to ensure minimal disruption. • Educating ward-	• If no oral intake for > 5 days -patient requires nutritional support (for example with tube feeding or parenteral feeding as indicated).	COVID-19 dietary advice leaflets focus on: • Maintaining a balanced diet. • Protein - especially due to increased needs for protein during illness and recovery. • Food fortification. • Incorporation of ONS into the diet when prescribed or self-purchased • Eating when short of breath

	consecutive days) and/or respiratory conditions are worsening (i.e.: NIV or CPAP are expected to be necessary), PN over EN), consider supplemental/total PN.	• During hospitalization, ONS are useful in case of malnutrition or where intake is 50–60% • If oral intake is <50–60% and is expected to be impossible for > 3 days, artificial nutrition must be started. EN has to be preferred. • Gastrostomy for EN administration, starting with 20 ml\h and gradually increase until the nutritional goal is reached • In case of respiratory complications and longer durations of NIV application, PN is preferred to EN.	voluntary sector / local meal delivery services to support food. • ONS should only be considered where clinically indicated and where people meet ACBS indications.	their nutritional needs from diet, discuss the use of over-the-counter nutritional supplements (e.g. Complan, Aymes Retail, Meritene, or Nourishment. • ONS should be considered when food intake (including food fortification) does not meet nutritional goals, and where the ACBS criteria are met – dietetics input for patients on ONS. • Utilise a range of strategies and be flexible in approaches used to enable nutritional rehabilitation.	between meals. • Risk of refeeding syndrome in patients with little or no food intake for >5 days - follow local policy. • Escalation to EN if oxygen therapy reduces the capacity for oral intake - refer to Dietetics. • EN if oral intake is or is expected to be impossible for > 3 days or < 50% of estimated energy requirements for > 5-7 days. •Dietetic resources for patients/family on taste changes, dry mouth, eating difficulties, diarrhoea.	based staff about nutrition issues faced by ICU survivors. • Small regular energy dense meals and snacks. • Ensure availability of overnight snacks. • Patient education on importance of nutrition and foods high in calories and protein for recovery. • Offer a supplement after rehabilitation or exercise to ensure adequate energy is provided.		• Managing dry mouth • Managing loss of taste and smell • Getting the foods you need (including social care support). • ONS may be required in patients at medium or high risk of malnutrition, especially if intake is severely impacted and ongoing breathlessness, fatigue or if patients are using a mask or nebulisers regularly (BDA). • In underlying conditions, relaxation of previous dietary restrictions may be necessary for the presence of a poor appetite and/or unintentional weight loss.
Energy (Kcal)	Estimate energy by multiplying the REE (calculated using Harris-Benedict equation by a correction factor of 1.5). (When	Predictive equations based on body weight, such as 27-30 kcal per kg body weight and day, adapted to the personal nutritional	No guidance provided.	No guidance provided.	Follow PENG and ESPEN guidelines.	Focus ICU.	No guidance provided.	No guidance provided.

	BMI>30kg/m^2 IBW [i.e. with BMI=23kg/m^2] should be used in the equation).	status, level of physical activities, clinical status, and comorbidities.						
Protein (g)	Amino acid requirements set to 1.5g/kg actual body weight. Except when BMI >30 kg/m^2, 1.5 g/kg IBW [i.e., with BMI 23 kg/m^2].	In the absence of chronic renal insufficiency, the protein intake is >1 g/kg/day (up to 1.5 g/kg/day), adapted on the personal nutritional status, level of physical activities, clinical status, and comorbidities.	No guidance provided.	No guidance provided.	Follow PENG and ESPEN guidelines.	Focus ICU.	No guidance provided.	No guidance provided.
Dysphagia	No guidance provided.	Mandatory to modify diet consistency in addition to ONS supplementation.	Contact and work in partnership with speech and language therapists for those requiring texture modified diet and fluids.	No guidance provided.	• If swallow impairment present - modified consistency as per Speech and Language Therapy and refer to dietitian. • Pay particular attention to patients who have transferred from ICU who may have post-extubation dysphagia. • Consider referral to Speech and Language Therapist.	• Post-extubation dysphagia is likely to be highly prevalent in patients and several patients may have tracheostomies in situ.	No guidance provided.	• Patients who have been in ICU and required mechanical ventilation should be assessed if dysphagia suspected - consult a dietitian and/or a Speech and Language Therapist. • Patients with swallowing problems may require specialised pre-thickened ONS or thickening powders.

Goals and Monitoring	No specific guidance on nutrition monitoring provided.	• Body weight, dietary intake, blood tests, and clinical condition are monitored by the MDT over time with variable frequency. • Outpatient continuous evaluations are provided.	No guidance.	• Patients on ONS should have a clearly documented nutritional care plan with goals, including when the product will be stopped. • ONS efficacy should be reviewed regularly (ideally monthly).	• Set appropriate goals of nutritional treatment e.g. improvement in intake, weight maintenance, preservation of muscle/function, and monitor. • Monitoring is essential. • Consider how to monitor patients remotely.	ICU focussed.	No guidance provided.	• Regular monitoring built into clinical reviews - 1-week interval to 3 months. • Monitor – Weight and/or BMI, functional tests (i.e. sit to stand), self-reported activity, ability to undertake ADLs, patient's report of progress towards agreed goals, compliance to dietary advice and ONS. • Patient-centred goals, including dietary advice with or without ONS.
Continued care, post-discharge care or community care	No guidance provided.	No guidance provided.	• Provide simple resources on discharge such as BDA Older Adults Factsheets, Guide to nutrition and hydration in older age. • Contact and work in partnership with other colleagues including physiotherapists, occupational therapists and falls teams to empower older and vulnerable	• Hospital teams discharging patients with identified nutritional concerns should communicate this in writing to primary care teams.	• Information for patients – access to ongoing food supplies and/or food deliveries. • Rescreen using MUST or an alternative local validated tool - dietitian review to assess need for ongoing ONS – consider ready-to-drink, low volume ONS if ongoing breathlessness, fatigue or if the patient is using a mask or nebulisers.	• Arrange follow-up to community service if required and provide relevant nutrition literature. • Provide adequate supply of ONS/EN feed on discharge. • Dietitians - to alert therapists and critical care staff in rehabilitation pathway on nutritional aspects to look out for. • Assessment of nutritional status/	• MUST screening should be undertaken on discharge from hospital.	• Follow BDA guidance on ONS in the community and on discharge • Consider self-purchase and use of powdered ONS • Consideration of stopping an ONS prescription • For complex patients, those at high risk of malnutrition and those who are at medium risk of malnutrition who do not improve despite preliminary

			individuals to be active at home.		• ONS prescription to meet ACBS criteria, and community dietetics or GP arranged for review. • Implementation of fast track telephone reviews. • Advise patients on titrating ONS according to appetite and progress, exercise during recovery and seeking help if ongoing problems with appetite and weight loss. • Further online links to resources for practical guidance on HEN discharge.	muscle mass or function (e.g. grip strength or 6-minute walk test) and baseline data from hospital stay. • Significantly more calories and protein (estimated 35 -40 kcal/kg, and 1.5-2g/kg) may be required for several months. • Advise nutrient-dense diet, especially protein, as periodic doses. • High protein ONS as required. • Dietary counselling -include increased physical activity alongside a healthy diet and sufficient protein. • Individualised nutritional advice.		intervention, consider a dietetic referral.

BDA: British Dietetic Association; BAPEN: British Association for Parenteral and Enteral Nutrition; BMI: Body Mass Index; EN: Enteral Nutrition; ICU: Intensive Care Unit; MNA-SF: Mini-Nutritional Assessment-Short Form; MUST: Malnutrition Universal Screening Tool; NRS-2002: Nutrition Risk Score 2002; ONS: Oral Nutritional Supplements; PN: Parenteral Nutrition; REE: resting energy expenditure; IBW: ideal body weight; PENG: Parenteral and Enteral Nutrition Group; HEN: Home enteral nutrition; ADLs: activities of daily living; ESPEN: European Society for Clinical Nutrition and Metabolism

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