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Why you should read this article:

- To read about the emerging evidence on long-COVID and its effects on nutritional intake and status
- To enhance your knowledge of how you can provide optimal nutritional care to patients with long-COVID
- To identify a free evidence-based knowledge hub around nutrition and recovery from COVID-19

Providing optimal nutritional care to patients with long-COVID

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Abstract

Long-COVID has emerged as a relatively common condition with symptoms that vary considerably in intensity and type. People with long-COVID experience signs and symptoms that develop during or after an infection consistent with coronavirus disease 2019 (COVID-19), continue for more than four weeks and are not explained by an alternative diagnosis. It has been estimated that up to one in seven patients who have COVID-19 will have long-COVID. Long-COVID can affect people's nutritional status, while optimal nutrition is essential for their recovery. The authors of this article have developed an evidence-based knowledge hub around nutrition and recovery from COVID-19 that offers reliable and up-to-date information to patients and professionals. This article explains the relationship between nutrition and COVID-19 and how primary care and community nurses can identify, assess, advise, monitor and/or refer patients as needed.

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Keywords

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A NEW condition has emerged during the coronavirus disease 2019 (COVID-19) pandemic, which has been described using a variety of terms, including 'long-COVID'. People with long-COVID experience 'signs and symptoms that develop during or after an infection consistent with COVID-19, continue for more than four weeks and are not explained by an alternative diagnosis' (National Institute for Health and Care Excellence (NICE) 2021). Long-COVID usually presents with clusters of often overlapping symptoms, which can fluctuate and affect any body system. It can have significant negative effects on people's long-term health and quality of life (NICE 2021).

Long-COVID appears to be a relatively common condition. In October 2022, an estimated 2.1 million people living in private households in the UK were experiencing self-reported long-COVID, which equates to 3.3% of the population (Office for National Statistics 2022). Data suggest that up to one in seven people who have COVID-19 will have long-COVID (NICE 2021). At least 10% of non-hospitalised COVID-19 patients have reported symptoms lasting more than four weeks (Maxwell 2020, Pavli et al 2021). People who have five or more symptoms at disease onset are more likely to have long-COVID than people who have fewer than five symptoms (Sudre et al 2020).

Long-COVID symptoms can affect food intake and increase the risk of nutritional issues, while optimal nutrition is essential to strengthen patients' immune system and support their recovery, so healthcare professionals caring for patients with long-COVID need to check their patients' nutritional status. In 2021, the authors of this article developed an online 'nutrition and COVID-19 recovery knowledge hub' to give health and social care professionals who are not nutrition experts access to reliable and up-to-date evidence about nutrition and COVID-19. This article provides an overview of nutritional issues associated with COVID-19 and explains how primary care and community nurses can provide optimal nutritional care to patients with long-COVID.

Long-COVID

Definition

In its guideline on managing the long-term effects of COVID-19, NICE (2021) recommends using the following clinical case definitions:

- Acute COVID-19 – signs and symptoms of COVID-19 for up to four weeks after symptoms started, regardless of whether there has been a positive test.
- Ongoing symptomatic COVID-19 – signs and symptoms of COVID19 from four weeks up to 12 weeks.
- Post-COVID-19 syndrome – signs and symptoms that develop during or after an infection consistent with COVID-19, continue for more than 12 weeks and are not explained by an alternative diagnosis.

NICE (2021) specifies that the term long-COVID is commonly used to describe 'signs and symptoms that continue or develop after acute COVID-19'. Long-COVID therefore includes both ongoing symptomatic COVID-19 and post COVID-19 syndrome.

Symptoms and long-term effects

Long-COVID is characterised by a range of symptoms and long-term effects on different body systems and on function. In 2020, Davis et al (2021) investigated the symptoms of long-COVID in a large international patient cohort over seven months and found that the ten most common symptoms were:

- Fatigue, headaches (systemic symptoms).
- Chest pain, cough, shortness of breath (respiratory symptoms).
- Joint pain, muscle pain (skeletal symptoms).
- Altered sense of smell, altered sense of taste, diarrhoea (gastrointestinal symptoms).

The long-term effects of COVID-19 are associated with an increased risk of chronic conditions such as depression, stroke, chronic renal disease and type 2 diabetes (National Institute for Health and Care Research (NIHR) 2021). Chronic inflammation resulting from prolonged effects of COVID-19 may exacerbate diabetes and heart disease (Mechanick et al 2021).

Data on the symptoms and long-term effects of long-COVID continue to emerge as research progresses. Some of these symptoms and long-term effects are listed in Table 1, while Table 2 summarises three ways of categorising long-COVID symptoms.

Relationship with nutrition and diet

Many symptoms of COVID-19, including loss of smell and altered sense of taste, can adversely affect food intake and nutritional status. COVID-19 causes inflammation of the nasal airways, blocks the nasal passage and may destroy the olfactory sensory neurons located in the nose (Glezer et al 2021). Inflammation of the oral mucosa and ensuing damage to the taste buds may be the mechanism that causes an unpleasant taste in the mouth (dysgeusia) (Mahmoud et al 2021) and loss of smell (anosmia). Severe COVID-19 causes catabolic muscle wasting, feeding difficulties and frailty, which are important considerations in terms of nutrition and rehabilitation (Nalbandian et al 2021).

Anyone who has had COVID-19 may experience prolonged symptoms that result in nutritional issues, but older people and clinically vulnerable patients are at the greatest risk. People in these two at-risk groups may experience significant deconditioning, muscle atrophy and anorexia (Mechanick et al 2021), potentially leading to immune system dysfunction (Ferrara et al 2020) and heightening their risk of malnutrition (Baic 2021) and adverse clinical outcomes (Nalbandian et al 2021).

Hyperactivation of the immune system – sometimes described, in the acute stage of COVID-19, as a 'cytokine storm' – is a major feature of COVID-19 (Zabetakis et al 2020). It is not yet understood why this immune system dysfunction sometimes persists beyond the acute stage, but diet could be a contributing factor. Evidence suggests that a diet high in saturated fat and free sugars can lead to chronic hyperactivation of the immune system, which can exacerbate immune system dysfunction in conditions such as COVID-19 (Butler and Barrientos 2020, Calder 2020).

Developing and maintaining the hub

In the early days of the pandemic, many organisations and individuals released information about COVID-19 at a rapid

Key points

- Symptoms consistent with coronavirus disease 2019 (COVID-19) that continue for more than four weeks are now classed as long-COVID
- It is estimated that up to one in seven people who have COVID-19 will have long-COVID
- Symptoms of COVID-19 such as loss of smell or taste can adversely affect people's nutritional status
- Optimal nutrition is essential to strengthen the immune system and support people to recover from long-COVID
- Nurses can support optimal nutrition through screening, assessment, advice, monitoring and referral

pace. The developers of the 'nutrition and COVID-19 recovery knowledge hub' decided to review the information on nutrition and COVID-19 and make it available to patients and professionals as an online resource. One of their aims was to assist health and social care professionals, including nurses, to identify nutritional issues in their patients and provide them with optimal nutritional care.

A survey was undertaken to explore how UK dietitians were managing nutritional issues in patients who had developed what was not yet known as long-COVID (Lawrence et al 2021). The literature was reviewed up to March 2021 to inform decision-making on the nutritional care of hospitalised patients with COVID-19 (Latif et al 2022). Two panels, one composed of patients and the other of professionals, were convened to examine the information gained from the survey and literature review and make recommendations to the developers of the hub.

The panels' recommendations were to:

- Spell out the role of nutrition in patients' recovery from COVID-19.
- Support professionals to provide optimal nutritional care to patients with long-COVID with the aims of managing symptoms, preventing and treating malnutrition, and strengthening people's immune system.
- Develop a resource to support safe recovery.
- Encourage and guide patients to self-screen, self-assess and self-refer.
- Provide advice and tools to non-nutrition experts on how to assess patients. Non-nutrition experts include people working in the third sector (such as voluntary and community organisations, charities, self-help groups and social enterprises) as well as health and social care professionals.

The hub was developed based on these recommendations and is freely available online (plymouth.ac.uk/research/dietetics-and-health/covid-knowledge-hub). It is managed by the University of Plymouth and funded by that university and the British Dietetic Association. Although the hub provides examples of best practice, it does not include local policy and guidelines, so when using it trusts and health boards need to consider their local resources. The hub's information is tailored for the UK but can be used worldwide.

The hub has two main sections, one for patients, the other for professionals. Some patients with long-COVID have identified a lack of clarity in professionals' knowledge about long-COVID and have reported dissatisfaction with their care (NIHR 2021). The hub is peer-reviewed and its contents have been scrutinised by professionals from physiotherapy, general practice, nursing, occupational therapy and pharmacy. A systematic and rigorous process for assessing the quality of new articles, policy documents and patient reports has been established. In addition, a cohort of patients with long-COVID have assessed the patient pages. This makes the hub a trustworthy resource for patients and the professionals supporting them.

New information regarding COVID-19 is being released at a rapid rate from a variety sources, which makes it challenging to keep up to date (Patel et al 2020). New evidence and policy are constantly reviewed and the hub updated accordingly – although there may be a time lag between the publication of new information and hub updates because of limited resources.

Hub information for professionals

The hub's information for professionals is formed of six sections: identification, assessment, symptoms, advice, monitoring and challenges. The hub explains how to undertake

Table 1. Symptoms and long-term effects of long-COVID

Gastrointestinal	Respiratory	Systemic, neurological and skeletal	Metabolic	Psychological and cognitive	Functional, social and occupational
» Diarrhoea, hyperactive bowel sensations » Loss of smell (anosmia), altered sense of smell » Loss of taste, altered sense of taste » Lack of enjoyment of food and eating » Dry mouth » Feeling full » Gas trapping » Reduced or increased appetite » Reduced food intake » Swallowing difficulties (dysphagia), particularly in patients who have been intubated while in intensive care	» Shortness of breath, breathlessness » Cough » Chest pain » Dry mouth » Early satiety	» Fatigue, tiredness » Low energy » Dizziness » Weakness » Muscle loss, weight loss » Joint pain, muscle pain » Headaches » Decreased endurance » Post-exertional malaise	» High blood pressure » Diabetes » Heart disease » Obesity	» Anxiety » Apathy » Depression » Despair » Fear » Hallucinations » Low mood » Sleep disorders	» Inability to undertake activities of daily living » Low work productivity » Sedentariness » Mobility and self-care issues

(Adapted from Gemelli Against COVID-19 Post-Acute Care Study Group 2020, Davis et al 2021, National Institute for Health and Care Research 2021, Wise 2021)

a brief but effective nutritional assessment, when to seek advice from nutrition experts and how to refer patients to long-COVID clinics and the third sector. As yet, there are no reported trials on nutritional assessment in patients with COVID-19, so the hub's information is based on evidence in other patient groups. The hub's information can support nurses to conduct nutritional screening in different at-risk groups and assess, advise, monitor and refer patients in terms of their nutritional care.

Identification

It is crucial to identify people who are at risk of malnutrition so that they can get the right advice and support, since malnutrition leads to decreased immunity, poorer prognosis in long-term conditions and higher mortality from all causes (Managing Adult Malnutrition 2020).

Nutritional screening should be used at first contact (Cawood et al 2020) to identify people at risk of nutritional issues and patients should be screened again if there are significant changes in their clinical, psychological and/or social circumstances. If oral nutritional supplements or enteral nutrition are needed, screening should be repeated. If symptoms persist, patients should be regularly re-screened. People living in care homes, in whom optimal nutrition may be particularly challenging to achieve, and people who are overweight or obese are at particular risk of malnutrition and should be screened regularly.

Key questions that nurses can ask their patients to identify nutritional issues include:

- Have you changed your food choices due to specific symptoms or concerns about diet following COVID-19?
- Have you lost your appetite, or has your appetite changed, since you had COVID-19?
- Are you worried about an increase in weight or a loss of weight since you had COVID-19?

Assessment

Nutrition can be affected by factors such as ethnic background (Vaughan et al 2022), food insecurity (disruption of food intake or eating patterns due to lack of money and other resources) (Gundersen and Ziliak 2015), recent hospitalisation (Mechanick et al 2021), long-term conditions that lead to an inability to prepare food, such as breathlessness, pain and fatigue (Lawrence et al 2021) and social isolation (Baic 2021).

If a person is identified as being nutritionally at risk, further assessment is necessary. The assessment should establish the causes and duration of nutritional issues. Topics to explore with patients to determine whether nutritional support is needed include:

- Changes in and/or distortion of smell and/or taste (Lawrence et al 2021).
- Gastrointestinal symptoms such as gastrointestinal pain, bloating, constipation and diarrhoea.
- Decreased appetite and interest in eating and/or general challenges in maintaining weight (Barazzoni et al 2020, Cawood et al 2020).
- Actual food intake (Barazzoni et al 2020, Cawood et al 2020).
- Food allergies and/or bowel patterns that were not present before COVID-19.
- Adherence to dietary advice (Managing Adult Malnutrition 2020).
- Dietary preferences related to culture, religion and beliefs.

Patients who have been hospitalised need to be assessed for sarcopenia, respiratory support, cognitive status, dysphagia and weight loss (Brugliera et al 2021). After the assessment, it may be necessary to refer patients with more complex needs to a dietitian, a psychologist or an occupational therapist. When referring patients, it is important to use local pathways, since this can help prevent disjointed care. Referral to rehabilitation specialists is recommended when patients have worsening breathlessness, unexpected chest pain, new confusion, focal weakness and/or partial pressure of oxygen less than 96% (Greenhalgh et al 2020).

Symptoms

As explained above, long-COVID can cause a range of symptoms and long-term effects on different body systems and on function. Nutrition and diet will be affected to varying degrees according to the severity of symptoms and which body systems are implicated. One mild symptom may be tolerable, but several

Table 2. Three ways of categorising long-COVID symptoms

Sudre et al (2020)	Amenta et al (2020)	Ceravolo et al (2020)
» Fatigue, headache and upper respiratory symptoms (shortness of breath, sore throat, persistent cough, loss of smell) » Additional multi-system symptoms, including ongoing fever and gastrointestinal symptoms	» Residual symptoms, for example speech and swallowing difficulties after dysphagia » Organ dysfunction symptoms, for example pulmonary pathology leading to cough » Ongoing or new inflammatory symptoms, leading for example to cardiac issues, sustained low oxygen saturation, blood clotting issues and lung function issues	» Symptoms continuing from the acute stage of COVID-19 and its treatment » Late-onset symptoms appearing because of COVID-19 but after the end of the acute stage » Symptoms that worsen a pre-existing health condition or disability » Symptoms that cause a new health condition, for example neurological symptoms leading to the development of stroke-like symptoms

(Adapted from National Institute for Health and Care Research 2021)

FURTHER RESOURCES

Nutrition and COVID-19 recovery knowledge hub
plymouth.ac.uk/research/dietetics-and-health/covid-knowledge-hub

mild symptoms together may be incapacitating (Managing Adult Malnutrition 2020).

Different dietary strategies may be needed for different symptom types (NIHR 2020, Davis et al 2021, NICE 2021). For example, respiratory symptoms, such as cough or shortness of breath, can cause physical discomfort when eating, in which case cooking methods can be adapted to produce softer food textures that may be better tolerated. Diet can aggravate symptoms, so it can be useful for patients to keep a 'food and symptoms' diary.

Advice

As a rule of thumb, when giving dietary advice to patients, nurses should use the 'food first' principle, whereby nutritional needs are addressed through the use of food rather than dietary supplements (Barazzoni et al 2020, Managing Adult Malnutrition 2020). Food-first interventions include increasing food intake and fortifying food – food fortification involves using nutrient-rich foods to increase the nutritional content of meals, snacks, desserts and drinks without increasing portion sizes (Weekes et al 2009).

If food-first interventions are not sufficient, oral nutritional supplements may be needed. Oral nutritional supplements are rarely required for more than three months. Vitamin and mineral supplements can potentially cause harm (Patel et al 2020), so it is advisable to introduce one at a time, prescribe them for a fixed period and monitor the patient's response. The need for oral nutritional supplements is best assessed by an appropriately trained healthcare professional such as a dietitian (Calder 2020, NICE 2021). If that is not possible, nurses should try to discuss the patient's case with a dietitian. The use oral nutritional supplements in patients with swallowing difficulties may require the input of a dietitian or a speech and language therapist (Managing Adult Malnutrition 2020).

A systematic review has shown a relationship between vitamin D deficiency and increased mortality in patients with COVID-19 (Bassatne et al 2021), but the evidence was of moderate-to-low quality and the role of vitamin D in the recovery from COVID-19 is debated. Nevertheless, vitamin D deficiency should be checked for and corrected if found, keeping in mind that high doses of vitamin C may cause gut symptoms and the formation of renal stones (Kim and Yeom 2020).

The use of probiotics is controversial and studies on probiotics have been found to have several limitations (Gutiérrez-Castrellón et al 2022). Despite the lack of reliable evidence about the role of probiotics in the recovery from COVID-19, patients may want to try them. Fortunately, food products containing probiotic bacteria are safe and well tolerated, so the risk of harm is low.

Caution is needed with nutraceuticals (foods used as medicines) (Kalra 2003) and herbal remedies, since there are no human studies of their use in patients with COVID-19 (Naidu et al 2021). Evidence on complex diets, such as antihistamine diets, is also lacking (British Dietetic Association 2021).

Monitoring

Patients' nutritional status needs to be monitored over time to check that their nutrient requirements are met, ensure they eat a varied and balanced diet, and manage their symptoms by adjusting their diet. Monitoring also enables nurses to check whether patients may need oral nutritional supplements or whether the supplements already prescribed are having the intended effect (Barazzoni et al 2020) and determine when to stop them.

Patients who are nutritionally at risk should have a nutrition support plan in place (NIHR 2021). That nutrition support plan will include dietary advice and realistic, person-centred goals (Cawood et al 2020) that will have been discussed with patients. Monitoring enables nurses to follow patients' progress with their goals. Monitoring also enables checking whether patients need to be referred to a dietitian or possibly to an occupational therapist – for example, if they would benefit from coping strategies to help them manage symptoms such as fatigue or breathlessness that affect their ability to prepare meals.

Monitoring is particularly important in patients who had severe COVID-19, including those who were admitted to intensive care (Barazzoni et al 2020, Cawood et al 2020, Managing Adult Malnutrition 2020). Finally, it is important to monitor pre-existing comorbid conditions in patients recovering from COVID-19 to ensure rehabilitative interventions are safe and optimise patients' health (Spruit et al 2020).

Challenges

To minimise the transmission of COVID-19, face-to-face follow-up consultations have been discouraged. This presents nurses with challenges, notably regarding triaging, rehabilitation and patient access to communication technologies (Cawood et al 2020, Iannaccone et al 2020, Lee et al 2021). The hub makes suggestions on how to provide virtual consultations that consider nutritional risks (Lawrence et al 2021), use

telehealth to assess dysphagia (Miles et al 2021), maintain strong links between acute and community settings (Cawood et al 2020) and reach patients who do not have access to communication technologies.

Conclusion

Long-COVID is an emerging condition with a high symptom burden and negative long-term effects on patients' physical and psychological health. Long-COVID can increase nutritional risk, while optimal nutrition is essential to support patients' recovery. Research on long-COVID, including its relationship with diet and nutrition, is ongoing. Nurses in community and primary care settings have a role in providing optimal nutritional care to patients with the aim of preventing complications and supporting recovery. The use of the online knowledge hub around nutrition and recovery from COVID-19 described in this article can assist nurses in identifying, assessing, advising, monitoring and referring patients with nutritional issues as needed.

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