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PREHABILITATION (B RIEDEL AND S JACK, SECTION EDITORS)

Physical and Psychological Health Behavior Changes During the COVID-19 Pandemic that May Inform Surgical Prehabilitation: a Narrative Review

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Abstract

Purpose of Review Multimodal prehabilitation aims to improve preoperative health in ways that reduce surgical complications and expedite post-operative recovery. However, the extent to which preoperative health has been affected by the COVID-19 pandemic is unclear and evidence for the mitigating effects of prehabilitation in this context has not been elucidated. The COVID-19 pandemic has forced a rapid reorganization of perioperative pathways. Delayed diagnosis and surgery have caused a backlog of cases awaiting surgery increasing the risk of more complex procedures due to disease progression. Poor fitness and preoperative deconditioning are predictive of surgical complications and may be compounded by pandemic-related restrictions to accessing supportive services. The COVID-19 pandemic has forced a rapid reorganization of perioperative pathways. This narrative review aims to summarize the understanding of the effects of the COVID-19 pandemic on preoperative health and related behaviors and their implication for the need and delivery for prehabilitation to engender improved surgical outcomes. A literature search of Medline was conducted for articles related to preoperative health, prehabilitation, and surgical outcomes published between December 1, 2020 and January 31, 2021. Additional hand searches for relevant publications within the included literature were also conducted through October 15, 2021.

Recent Findings The COVID-19 pandemic, and measures designed to reduce the spread of the virus, have resulted in physical deconditioning, deleterious dietary changes, substance misuse, and heightened anxiety prior to surgery. Due to the adverse health changes prior to surgery, and often protracted waiting time for surgery, there is likely an elevated risk of peri- and post-operative complications. A small number of prehabilitation services and research programmes have been rapidly adapted or implemented to address these needs.

Summary During the COVID-19 pandemic to date, people undergoing surgery have faced a triple threat posed by extended wait times for surgery, reduced access to supportive services, and an elevated risk of poor outcomes. It is imperative that healthcare providers find ways to employ evidence-based prehabilitation strategies that are accessible and safe to mitigate the negative impact of the pandemic on surgical outcomes. Attention should be paid to cohorts most affected by established health inequities and further exacerbated by the pandemic.

Keywords Anesthesia · Anaesthesia · Rehabilitation · Prehabilitation · Physical and rehabilitation medicine · Perioperative care · Preoperative care · Preoperative period · Pandemic · COVID-19

Introduction

The COVID-19 global pandemic has had a profound and incalculable effect on surgical care and outcomes [1]. Originally identified in late 2019 in Wuhan, China, COVID-19 quickly spread across the world, forcing health-resource reallocation and reprioritization, including surgical service reductions [2, 3, 4]. The ramp down of surgical procedures resulted in countless delayed diagnostic and curative surgeries [5•], including for people with a life-threatening diagnosis such as cancer [6]. While distress and deconditioning are common in the preoperative period, many patients awaiting surgery within the context of COVID-19 containment measures were at risk of additional obstacles to health maintenance, such as forced social distancing, lack of access to fitness facilities, disrupted and/or inadequate supply of

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nutritious food, financial hardship, worry about contracting the virus, and decreased access to healthcare. These and other issues may have occurred quickly and unexpectedly, intermittently, and often simultaneously to varying degrees, depending on timing and infectious disease rates, geographic location, public health action (or inaction), hospital and critical care resources, and vaccine availability.

Prior to the pandemic, it was known that people who are frail, elderly, and/or have poor functional capacity are at a higher risk for morbidity and mortality following elective surgery [4, 5•]. Prehabilitation is recommended to reduce surgical risk in these populations and typically comprises a multimodal approach to reducing surgical vulnerability (e.g., physical fitness, nutritional status, mental health, etc.) [1, 7, 8, 9]. Prehabilitation research is not new, and physically and psychologically preparing people for upcoming surgery is irrefutably beneficial; however, its value to patients and the health system may have markedly expanded during the COVID-19 pandemic given the negative impact of the pandemic on many health outcomes that can increase surgical risk. For example, prehabilitation may have a specific role in preventing deconditioning in those having to self-isolate during prolonged lockdowns or from infection with COVID-19. The goal of this report is to explore the recent literature pertaining to changes in preoperative health during the pandemic, how these changes adversely affect surgery, and how prehabilitation may be incorporated and adapted to improve patients' well-being and surgical outcomes.

Methods

A systematic search in PubMed of studies published between December 1 2020 and January 31 2021 was conducted using the following keyword search string: novel coronavirus OR COVID-19 OR SARS-CoV-2 OR Coronavirus AND prehabilitation OR diet OR nutrition OR stress OR anxiety OR psychological stress OR depression OR mental health OR vaping OR smoking OR smoking cessation OR alcohol OR increased alcohol OR alcohol use OR alcohol abuse OR substance use OR substance abuse OR opioid OR opioid use OR opioid abuse OR exercise OR rehabilitation OR physical activity. Articles reporting on the impact of the COVID-19 pandemic on preoperative health as it pertains to surgical risk or outcomes, as well as the role, delivery, and effect of prehabilitation contextualized to the pandemic were included and summarized by content experts as a narrative review. Additional hand searches for relevant publications within the included literature were also conducted through October 15, 2021.

Preoperative Physical Activity, Exercise, and Fitness

Much of the world has reported significant reductions in physical activity and increased sedentary behavior during the COVID-19 pandemic [10, 11••]. For example, Tison et al. assessed the step counts from over 450,000 people across 187 countries using app-based data from smartphones between January 2020 and June 2021 [11••]. They observed a nearly 30% reduction in step counts worldwide with variability in the timing and magnitude of reduction attributed to regional differences in infection rates and virus containment strategies. Reported pandemic-related barriers to physical activity and exercise include COVID-19 containment measures such as social distancing, closure or use restrictions of healthcare and fitness facilities, concerns regarding contracting the SARS CoV2 virus while exercising in public, and costs associated with home-based exercise equipment [12, 13, 14, 15, 16]. The global reductions in physical activity and exercise are likely to contribute to reductions in physical fitness that is an independent predictor of surgical outcomes [17•]. Reduced physical fitness due to physical inactivity, combined with increased vulnerability to health ailments and chronic disease associated with sedentary behavior, will likely contribute to a "perfect storm" of increased perioperative risks for many patients undergoing elective surgery. This is exacerbated by the extended waiting times for surgery as procedure volume has been reduced to preserve resources for COVID-19 patients, creating a significant backlog of cases awaiting surgery [18].

Given the observed reductions in physical activity during the COVID-19 pandemic, research evaluating different strategies to recover physical activity and exercise levels is rapidly expanding [12]. Perhaps most notably, while rapid gains in its use were made prior to the pandemic, technology has emerged as an even more important component of assessment, instruction, engagement, and monitoring of people in exercise programs. Within the context of prehabilitation, virtual assessments have been used to develop individualized exercise prescriptions to optimize patient safety and treatment effect [6, 19, 20, 21]. For example, Sell and colleagues describe the use of a home-based 30-second sit-to-stand test/regimen monitored remotely by web-camera to assist with fitness level stratification and related exercise prescriptions [6]. In the UK, the SafeFit trial is investigating the use of virtual clinics to assess a person's exercise capacity, teach exercise routines, assess technique, and provide corrective feedback to enhance physical and emotional wellbeing for people with a cancer awaiting surgery [22]. In addition to connecting with exercise professionals virtually to support ongoing participation in exercise, the use of

exercise gaming (exergaming) and personal apps may also play an important role in motivating and tracking physical activity volume and changes in fitness [23, 24, 25]. While the use of technology provides an important solution for many patients, it also raises important inequity considerations related to the accessibility of such care given the need for the devices, competence with technology, availability of reliable internet, and concerns regarding privacy for vulnerable populations.

The global reductions in physical activity and its impact on physical fitness will likely negatively affect surgery and recovery outcomes for many patients. Encouraging exercise for those awaiting surgery aligns with international guidance on physical activity during the pandemic and is strongly recommended. Given the potential increase in volume of patients awaiting surgery, screening for the most at-risk patients may be especially important, with self-report tools such as the Duke Activity Status Index (DASI) or the Godin-Shephard Leisure Time exercise questionnaire recommended to identify those with low functional capacity or physical activity, respectively [26, 26, 27, 28]. For at-risk patients and where in-person assessments are not possible, virtual connections between exercise professionals and patients may be used to evaluate patients for exercise safety and to provide individualized, home-based, or socially distant exercise prescriptions.

The role of prehabilitation for those patients with a history of contracting COVID-19 infection also requires special consideration given the potential impact of the disease that may include short- and long-term sequelae. These sequelae are multifactorial and may be termed "long COVID" or "post-acute sequelae of SARS CoV-2 (PASC)." Newly developed vaccines are also demonstrating important protective effects against severe disease and mortality. Effects of PASC may be especially though not exclusively, relevant to exercise capacity and tolerance. Research evaluating the relationship of physical activity, exercise, and fitness with COVID-19 outcomes is emerging, and early findings suggest physical fitness may provide a protective effect against COVID-19 severity and hospitalizations [29, 30, 31]. Exercise is known to have immune-modulating effects that may confer protection from COVID-19, and as such, studies of exercise interventions have been acknowledged as a research priority. Furthermore, there is emerging evidence of significant physical deconditioning after infection with COVID-19, which may respond to exercise interventions [32], though caution is warranted in post-viral conditions particularly if patients report more fatigue post-exercise [33••]. Exercise is also known to reduce risk factors that increase vulnerability to severe COVID-19-related morbidity, through its role in preventing and managing chronic disease [34, 35, 36]. Beyond the benefits of physical activity and exercise directly related to COVID-19 infection, the importance of these health behaviors on mental health and quality of life amidst pandemic containment measures, such as lockdowns and social distancing, is emerging rapidly [37, 38, 39]. Collectively, these established and novel areas of research have prompted urgent calls to action to promote and support safe physical activity and exercise during the pandemic, which may be especially relevant to those who are also awaiting surgery.

Diet and Nutrition

Improving diet and nutritional intake is a fundamental principle of prehabilitation. Nutritional prehabilitation serves to prevent or correct malnutrition, support functional exercise capacity, and optimize body composition [40, 41, 42]. The pandemic has created several nutrition challenges, including food insecurity and changes in dietary behavior, that ultimately affect nutritional health and body mass status. Disruption in the food supply chain (e.g., temporary closure of food processing facilities), increases in food prices, disruptions to social protection programs, altered food environments (e.g., restaurant closures during lockdown), instability in the employment and income of families, and social isolation (e.g., reduced communal meals) widen nutritional disparities and impact access to food, ultimately, contributing to a reduction in the quality and quantity of food consumed [43, 44]. Furthermore, negative effects of confinement on dietary behavior and weight management have been well documented, globally. A multi-country electronic survey ($n = 1047$), comprised of several validated and crisis-oriented questionnaires, identified significant increases in sedentary behavior as well as self-perceived increases in consumption of unhealthy food, binge eating, snacking between meals, and increased total number of meals consumed per day during confinement [45]. A multi-center cross-sectional study of outpatients in Vietnam ($n = 8291$) identified that healthy eating scores were lower during lockdown, and that socioeconomic factors, including income and social status, were protective factors against the deterioration of these scores [46]. An Italian survey ($n = 3533$) revealed that nearly half of respondents observed weight gain during confinement [47]. A survey in Poland ($n = 1097$) found that increased snacking and weight gain had preferentially increased among the overweight and obese respondents, whereas those who were underweight reported further weight loss during confinement [48]. Similar findings were reported in an US survey ($n = 7753$), in which a greater portion of weight gain was reported in obese respondents during the pandemic. Interestingly, this survey found that scores for

healthy eating increased due to a reduction in restaurant meals consumed [49]. A Spanish survey ($n = 7514$) also observed better eating habits among respondents with closer adherence to the Mediterranean diet during confinement [50]. Altogether, these findings suggest that the pandemic has largely brought negative changes in eating patterns and new nutrition challenges that could contribute to a worsening of nutritional status in those who are vulnerable as well as exacerbate losses in fat-free mass and gains in fat mass (i.e., enhanced sedentary behavior together with overconsumption of food).

Those who have been diagnosed with COVID-19 have additional nutrition challenges. Taste and olfactory impairments, including dysgeusia, were reported in 64% of a COVID-19 positive cohort; the majority experienced improvement in symptoms within 4 weeks of the initial diagnosis [51], but symptoms persisted in approximately 10% of the patients. Dysgeusia is a significant nutrition-impact symptom that impedes adequate food intake [52]. Additionally, rehabilitation post-COVID diagnosis represents another significant challenge [53]. The persistent fatigue characterized by many with COVID-19 can further promote sedentary behavior, which has several metabolic consequences [54]. Abrupt reduction in daily step count is associated with lean leg mass loss and promotion of insulin resistance [55]. Even in a young, healthy population, short-term immobilization was associated with losses of total thigh muscle volume by 1.7% and 5.5% of muscle volume after 2 and 7 days of disuse, respectively.

Given the reported effects of the pandemic, confinement, and a positive COVID-19 diagnosis on physical, nutritional, and mental health worldwide, the goal for nutrition prehabilitation during the pandemic may switch to simply maintaining nutritional status (rather than improving) to prevent further deterioration in metabolic status. For instance, attenuating the loss of fat-free mass and gain in fat mass that usually accompanies increased food intake and reduced physical activity may be a priority. Both sarcopenia and visceral obesity are associated with worse postoperative outcomes, including prolonged length of hospital stay and hospital readmissions [56]. Like prehabilitation exercises, remote nutritional consultations, assessment, and intervention, with shipment/delivery of nutritional supplementation if required, are likely to be essential components of nutritional prehabilitation within the pandemic. While it may not be possible to attain all nutrition measurements virtually, asking participants to periodically record their food intake and track their weight weekly is useful for monitoring progress and for identifying whether further nutrition support is required. The Patient-Generated Subjective Global Assessment can also be completed by a trained professional through a virtual platform (validation studies are in progress), and the continuous score offers an indication of improved/worsened nutritional status [57].

Stress and Mental Health

The need for psychological prehabilitation is growing as the impact of the COVID-19 pandemic impacts social, psychological, and emotional well-being worldwide. The implementation of measures that increase social isolation, such as regional or institutional lockdowns, has triggered increased psychological distress, including depressive and anxiety symptoms [58, 59]. A nationwide study in China revealed that over half of respondents rated the psychological impact of the pandemic as moderate to severe [60], and similar levels of psychological distress have been reported in Australia [61]. Increases in emotional eating related to stress [62] and the prevalence of sleep problems during the pandemic have also been observed [63], potentially indicative of disruptions in metabolic and circadian regulation due to psychological stress, which may affect healing. Distress and uncertainty related to pandemic concerns, such as worry for one's own or loved ones health, are likely to exacerbate both physical and psychological pathologies, impacting patient recovery [64].

As mental health undergoes new and exceptional challenges across all societies, the robust body of literature demonstrating the role of psychological factors on surgical outcomes has become more salient [65]. Indeed, evidence reflects pandemic-related stress and anxiety in patients waiting to undergo operations during the pandemic. Chronic pain patients report deterioration of self-reported pain, mental health, and ability to self-manage pain during indefinite postponement of elective spinal cord stimulation surgeries due to the pandemic [66]. Another study found that anxiety in neurosurgical patients awaiting non-urgent surgery is most strongly associated with concerns about contracting COVID-19, in addition to fears related to primary pathology, surgery, and disease worsening [67]. Bariatric surgery patients reported reduced quality of life and dietary compliance, along with high levels of pandemic-related worry [68]. Moreover, surgical patients may also be at a uniquely higher risk for psychological distress related to loneliness and isolation, as hospitals continue to implement visitor limitation policies [69]. Perceived loneliness and lack of social support are associated with higher rates of anxiety and depression, as well as risk of adverse physiological outcomes such as stroke or cardiac event [70].

Effective prehabilitation may therefore seek to integrate psychological interventions to buffer against negative effects of the pandemic and boost recovery by promoting

positive psychological factors, including perceived social support. Favorable recovery may also be enhanced by self-efficacy and optimism [71], and growing evidence suggests perioperative psychological interventions effectively improve wound healing, innate and adaptive immunity, and mood [72]. Conversely, negative psychological factors (e.g., trait anxiety and depression) are associated with measures of impaired postoperative recovery, including slower wound healing and increases in cytokine-mediated inflammation, risk of postoperative complication, and length of hospital stay [71]. For example, cardiac patients with anxiety and depression are at higher risk for morbidity and mortality following coronary artery bypass graft surgery [60]. Psychological stress can exert direct control over neuroendocrine and inflammatory pathways to modulate immune responses, which may contribute to patterns of immune dysregulation following surgical stress and hence alter recovery trajectories [1, 5•]. Ultimately, the interplay between positive and negative psychological factors contribute to the likelihood of favorable versus impaired surgical recovery (Fig. 1), where the pressures of the pandemic emphasize the importance of building psychological resilience.

Tobacco, Alcohol, and Other Substance Use

The COVID-19 pandemic has raised concern for increased risk of substance misuse as it may negatively impact physical function (e.g., respiratory status) and psychological health, and subsequently, impact efforts of surgical prehabilitation. In the USA, public health campaigning has decreased the prevalence of smoking; however, a significant percentage of the general population continue to use tobacco, which increases COVID-19 susceptibility and mortality [73, 74]. Smoking increases expression of angiotensin-converting enzyme-2, which appears to be linked to development of severe COVID-19 disease [73]. Some studies have found that increases in smoking during the pandemic are associated with younger age, lower education, second-hand exposure, or various psychosocial stressors [75, 76], whereas public awareness of the pandemic health crisis, including the negative outcomes of smoking on COVID-19 disease, incentivized many people to quit smoking [77, 78]. Additionally, government bans on tobacco sales in certain countries, such as South Africa and India, contributed to a reduction in tobacco

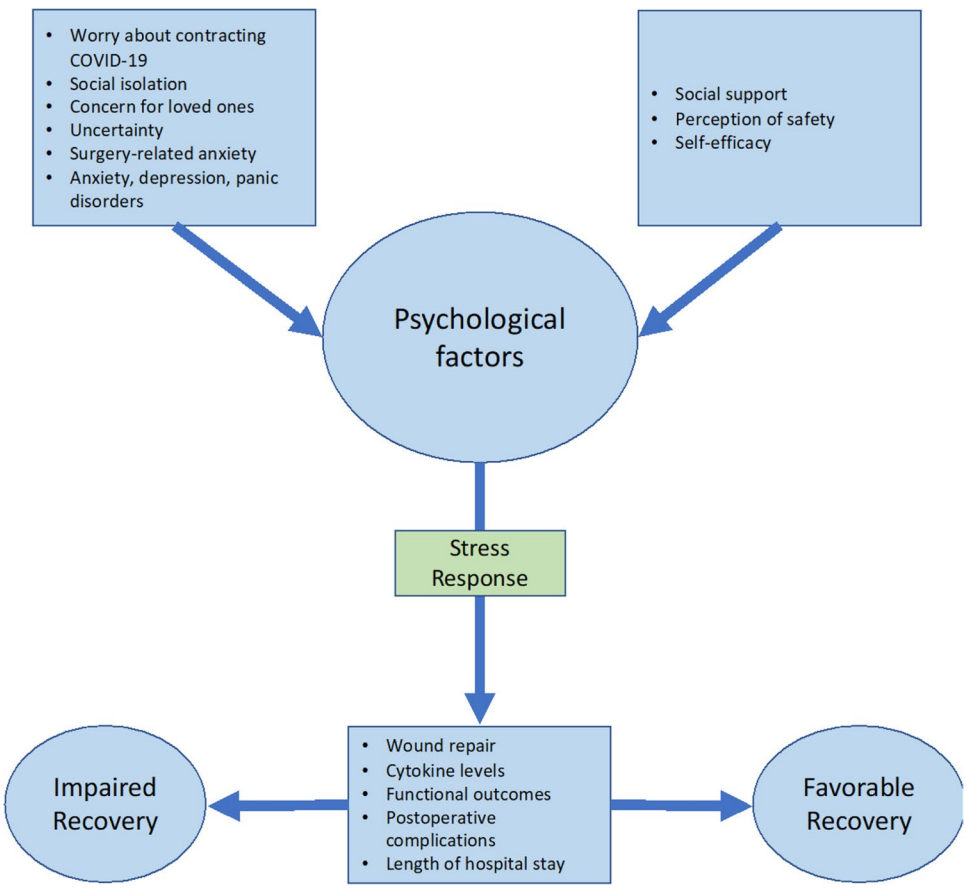

Fig. 1 Stress and surgery. This figure demonstrates how stress may impact surgery due to a host of physical and psychological factors and relationships

use [79]. Alcohol use during the pandemic has trended upwards in multiple countries, including Ireland, New Zealand, and France [80]. Proposed reasons included distress related to long-term social restrictions, potentially worsened symptoms of depression, anxiety, and a history of substance use disorder or mental health issues. As in prior global pandemics (e.g., the Severe Acute Respiratory Syndrome [SARS] outbreak in 2003), a decrease in alcohol consumption was expected during the COVID-19 pandemic likely related to financial limitations and reduced availability of alcohol purchase in select regions, such as Northern France and South Africa [79]. However, some high-income countries anticipated an increase in consumption as alcohol sales were maintained as essential business. In March 2020, national alcohol sales in the USA increased by 54% in comparison to the prior year, while online sales increased by 262% since 2019 [81]. The adverse effects of alcohol abuse include acute lung injury, neurotoxicity, and immune system dysfunction, which can reduce protection against the COVID-19 virus and increase risk of mortality [79, 82, 83].

Pandemic-related opioid use disorder has also been reported and has been associated with various socioeconomic stressors, as well as reduced healthcare access as priority was shifted to manage COVID-19 [84]. The Centers for Disease Control and Prevention reported over 81,000 opioid-induced deaths in the USA between May 2019 and 2020, corresponding to an 18% rise in overdose mortality [85]. This national drug epidemic influenced recent policy change by the US Department of Health and Human Services to reduce medical restriction on opioid use disorder management. Under new federal law, the exclusive "X-waiver" requirement for buprenorphine prescriptions was eliminated, expanding physician authority in opioid use disorder treatment to help decrease overdose trends [86]. However, buprenorphine is not an efficacious antidote for fentanyl, which is implicated in many overdose deaths [87]. To address this dilemma, Kosten et al. propose greater support and investment in antifentanyl vaccines, which potentially have superior relevance and efficacy to anticocaine and antinicotine vaccines that have been successfully used in the past 20 years [88].

Although studies are limited, opioid use disorder can result in respiratory depression and kidney injuries associated with poorer prognosis of COVID-19 infection [73]. The heightened risk of substance use disorder during the COVID-19 pandemic validates the need for improvement of public health education and medical access, in addition to destigmatization of addiction. Further research is required to understand the effects of substance use, particularly opioids and alcohol, on COVID-19 recovery and prehabilitation.

Pandemic-related changes in the use of tobacco, alcohol, and other substances may impact surgical outcomes (Table 1). Smoking cessation and substance abuse management in the pre-COVID-19 era has been an essential component of preoperative risk management [1, 89]; and recognizing the association with respiratory disease is important.

Discussion

Perhaps now more than ever, emphasizing and supporting health behaviors as secondary prevention in addition to prehabilitation should be a public health priority. General declines in health and health behaviors have been observed globally, and for those who may require surgery, a worsening of pre-morbid or underlying health conditions have likely worsened during the pandemic for many people. For example, for some oncology patients, neo-adjuvant protocols were altered,

Table 1 Substance use during the COVID-19 pandemic

	Tobacco Smoking	Alcohol	Opioids
Potential Correlates of Increased Substance Use During the COVID-19 Pandemic	Psychosocial stress, younger age, lower education, second-hand exposure	Psychosocial stress, mental health issues, financial constraints, maintenance of availability	Psychosocial stress, limited health care access, mental health issues
Potential Correlates of Decreased Substance Use During the COVID-19 Pandemic	COVID-19 health concerns, limited availability	Limited availability	Limited availability

This table provides a summary of some of the issues related to substance use during the COVID-19 pandemic. Prehabilitation protocols should include evaluations of substance use and abuse. Smoking cessation is typically recommended prior to surgery.

and operations delayed, putting them at higher risk for surgical complications and possible adverse oncologic outcomes [6]. Accordingly, routine screening and monitoring of patients over the preoperative period, however protracted it may be due to surgical backlogs, is likely very important to understand how the pandemic affected their health and surgical risk. These are also relevant to health systems as rapidly re-organized surgical services ramp up in the post-COVID period. Increases in surgical complications, extended length of stays, and increased needs for rehabilitation may assert significant strain upon already stressed healthcare systems. Accordingly, prehabilitation is gaining more attention as a standard of care component of surgical services and prehabilitation practice recommendations have recently been developed and endorsed by numerous perioperative organizations [90] (refer to Appendix Table 2 for an example). Numerous prehabilitation programs have adopted virtual models to meet the challenges of the pandemic and there is some evidence that these programs are feasible (high program adherence and patient satisfaction) [6, 19, 21, 22, 91, 92]. Further to these recommendations and examples, we summarize additional resources for screening, assessment, intervention, and COVID-19-related considerations for prehabilitation (Table 2).

Beyond the benefits of a multimodal prehabilitation program that addresses surgical risk, exercise, nutrition, mental health, and the cessation of unhealthy behaviors (e.g., tobacco/substance abuse, sedentary behavior) may also have a direct impact on COVID-19 infection and outcomes. Moreover, prehabilitation has a role in the prevention and management of co-morbidities, including but not limited to, cardiopulmonary conditions, obesity, and diabetes, as these risk factors associate with higher morbidity and mortality in patients who develop COVID-19 [93, 94]. Pandemic containment measures, such as lockdowns, infrastructure/facility restrictions, and social distancing also necessitate buffers against their negative impact on quality of life [37, 38, 39]. Thus, prehabilitation may have a role for the general population beyond surgery and include the prevention of severe COVID-19 outcomes [95].

It is important to consider that not all surgical patients will have comparable experiences, despite common health profiles and indications for surgery. Under usual circumstances, access to surgical care within a certain country or region may be affected by numerous factors such as patients' class, race, ethnicity, or gender [96, 97, 98]. Similarly, social determinants of health (SDOH) such as health insurance, or lack thereof, may affect people's health and access to surgical care and post-surgical care such as rehabilitation [99, 100, 101, 102]. During the pandemic, health disparities have been widely documented in the USA and numerous other countries [97, 98]. The COVID-19 pandemic has further exacerbated health inequities, with evidence of the requirement for hospitalization disproportionately affecting individuals from disadvantaged groups [103, 104], trends that have been observed previous infective outbreaks [105, 106]. It is essential that healthcare professionals address these socio-economic and racial disparities or the negative the effects of the COVID-19 pandemic will amplify pre-existing health inequities. Members of disadvantaged groups are likely a priority group for whom prehabilitation should be offered given their likelihood of poorer health entering and exiting the operating room.

While this narrative review sheds light on the current COVID-19-pandemic challenges to health as they pertain to prehabilitation for surgery, this disease and its variants are rapidly evolving. Scientific advances in prevention (i.e., vaccines) and treatments are also rapidly evolving. Therefore, we can expect that there will be new and/or changing models of care that will have wide geographic reach and make prehabilitation easier to deliver to patients who will benefit from these interventions. The lessons we learn during the COVID-19 pandemic will support our understanding of flexible programming strategies and incorporate technology (e.g., virtual care) in the event of future pandemics. Notwithstanding the insights gained specific to pandemics, the lessons we learn will also apply to future perioperative care as we explore remote strategies to engage people who are not proximal to the usual infrastructure that support programs like prehabilitation [107, 108].

Conclusion

We report emerging evidence of global health and health behavior changes that may impact surgical outcomes. We further highlight adaptations to prehabilitation programs to support the changing and growing need for preoperative health optimization which may play an important role in managing protracted surgical waiting times and minimizing further burden on health systems. Ongoing assessment of innovations to prehabilitation delivery as well as attention to gaps in care that may disproportionately affect some groups is a high priority for research and quality assurance mandates.

Appendix

Table 2

Table 2 Summary guidance for the recovery of elective surgical services following the pandemic

Action	Key recommendation	Detail	Additional resources
Shared decision making (SDM)	SDM should be embedded within the perioperative pathway from the point of contemplation of surgery, involving patient, family and the multidisciplinary team	• Clinicians should encourage patients to express what is important to them. Consider using BRAN format: Benefits, Risks, Alternatives, doing Nothing • Clinicians should use underlying principles of SDM such as motivational interviewing, risk communication, etc	•https://www.gmc-uk.org/-/media/documents/gmc-guidance-for-doctors—decision-making-and-consent-english_pdf •https://www.gmc-uk.org/-/media/documents/gmc-guidance-for-doctors—decision-making-and-consent-english_pdf •https://www.personalisedcareinstitute.org.uk/ •https://wintoncentre.maths.cam.ac.uk/
Patient self-screening	Patients should complete a validated self-assessment screening questionnaire, as soon as possible in the surgical pathway, in order to inform SDM, risk prediction and optimisation	• Electronic preoperative assessment tools can be developed and utilized quickly and efficiently, but care should be taken to ensure digital equality of access • Patients can then be triaged. Those identified as high risk can benefit from early preoperative assessment in a high-risk shared decision-making clinic	•https://www.digitalchampionsnetwork.com/content/learn-share-change-lives • QIPP Digital Technology, NHS Networks. Online preoperative screening solutions. Published online 2012. https://www.networks.nhs.uk/nhs-networks/qipp-digital-technology-and-vision/documents/Factsheet-20on-20Preoperative-20Screening-1.pdf
Preoperative assessment clinic	All patients who are likely to undergo surgery and/or anesthetic sedation should undergo formal preoperative assessment prior to the day admission	• Referrals to PreOperative Assessment Services (POAS) should include co-morbidities, recent results, COVID-19 status, and additional considerations deemed amenable to optimisation (smoking, alcohol intake, obesity, chronic pain) •Implement screening tools to identify clinically important conditions (e.g., sleep-disordered breathing, frailty, cognitive impairment) • Supply patients with information regarding procedure risk and recovery •For older patients consider Comprehensive Geriatric Assessment and optimisation and the Perioperative care of older people programme •Assess suitability for day case surgery •Record full social history, including care responsibilities for others •POAS should agree on service measures and robust clinical audit, to facilitate service improvement and minimize late cancelation	•https://www.nhs.uk/better-health/quit-smoking/ •https://www.nhs.uk/live-well/alcohol-support/ •https://www.nhs.uk/conditions/obesity/ •https://www.bgs.org.uk/sites/default/files/content/attachment/2018-07-05/rockwood_cfs.pdf •https://www.rcoa.ac.uk/gpas/chapter-2 •https://doi.org/10.1093/ageing/afab094 •https://www.popsolderpeople.org

Table 2 (continued)

Action	Key recommendation	Detail	Additional resources
Risk evaluation and enhanced care patient selection	POAS should include consideration of preoperative referral to critical and surgical high risk care	• Use a locally agreed, validated risk model • > 1% 30-day mortality risk should trigger referral to enhanced postoperative care • > 5% 30-day mortality risk should trigger referral to postoperative critical care • > 10% 30-day mortality risk should trigger consideration of preoperative critical care optimisation •Patients who are planned for critical care admission should be offered a preoperative orientation visit • High risk patients should be discussed with surgeons to further inform SDM and optimisation	•https://www.ficm.ac.uk/sites/default/files/enhanced_perioperative_care_guidance_v1.0.pdf •https://www.rcseng.ac.uk/-/media/files/rcs/news-and-events/media-centre/2018-press-releases-documents/rcs-report-the-highrisk-general-surgical-patient-raising-the-standard-december-2018.pdf • Protopapa KL, Simpson JC, Smith NCE, Moonesinghe SR. Development and validation of the Surgical Outcome Risk Tool (SORT). *Br J Surg*. 2014;101(13):1774–1783. https://doi.org/10.1002/bjs.9638
COVID-19 considerations	Where possible surgery should be avoided until 7-weeks after COVID-19 infection and/or if symptoms persist	• Decision to avoid surgery should account for increased complication risk associated with infection, and should involve the patient, surgeon and perioperative physician • Review medicines used to treat COVID-19, accounting for their implications for immune function • If COVID-19 symptoms are persistent, consider alternative diagnoses, including long COVID-19 and/or lung cancer	• COVIDSurg Collaborative, GlobalSurg Collaborative. Timing of surgery following SARS- CoV-2 infection: an international prospective cohort study. *Anaesthesia*. Published online March 9, 2021. https://doi.org/10.1111/anae.15458 • Greenland JR, Michelow MD, Wang L, London MJ. COVID-19 Infection: Implications for Perioperative and Critical Care Physicians. *Anesthesiology*. 2020;132(6):1346–1361. https://doi.org/10.1097/ALN.0000000000003303 • National Institute for Health and Care Excellence. COVID-19 rapid guideline: managing the long-term effects of COVID-19. Published online December 18, 2020. Accessed January 21, 2021. https://www.nice.org.uk/guidance/ng188
Co-morbidity management	Patients should be assessed for implications of co-morbidity on functional capacity and risk assessment. Where possible, optimisation of co-morbid conditions should begin as soon as possible in the preoperative pathway	• Specific consideration should be made in the presence of diabetes mellitus, endocrine disease, hypertension, coronary artery disease, cardiac arrhythmia, anaemia, heart failure, lung disease, renal or liver impairment, sleep disordered breathing, implantable pacemakers/ defibrillators, opioids, learning disability, autism, cognitive impairment, mental health problems, chronic pain •Balanced diet, weight management, smoking cessation, alcohol moderation and exercise should be assessed, and positive lifestyle changes recommended	•www.cpoc.org.uk/guidelines-resources-guidelines-resources/guideline-diabetes •https://cpoc.org.uk/guidelines-resources-guidelines-resources/addressing-preoperative-anaemia •https://pubs.asahq.org/anesthesiology/article/120/2/268/11781/Practice-Guidelines-for-the-Perioperative • Surgery and Opioids: https://fpm.ac.uk/sites/fpm/files/documents/2021-03/surgery-and-opioids-2021_4.pdf

Table 2 (continued)

Action	Key recommendation	Detail	Additional resources
Functional capacity assessment	Early functional capacity and physical fitness assessment can lead to preoperative improvements, associated with reduced postoperative complications	• Use validated screening tools such as Duke Activity Status Index, Godin-Shephard Leisure Time Exercise Questionnaire or the International Physical Activity Questionnaire • Patients undergoing high-risk procedures, those with self-reported or subjectively assessed reduced exercise capacity should undertake an objective assessment • Cardiopulmonary exercise testing is the gold standard •Where CPET is unavailable, consider 6-min walk test, incremental shuttle walk test, one-minute-sit-to-stand-test, timed up and go test	•https://www.poetts.co.uk
Exercise interventions	All patients should be advised that improving their physical fitness reduces their risk of postoperative complications, can reduce length of hospital stay and improve quality of life	• Where medically fit to undertake exercise patient should be advised that measurable fitness gains can be made in as little as 2-weeks • Based on functional capacity assessment, interventions can be categorized as universal (low risk), targeted (intermediate risk) or specialist – high risk • Universal exercise should include reference to the United Kingdom Chief Medical Officer guidance •Targeted exercise should be prescribed by a suitably qualified professional •Specialist exercise should be prescribed and supervised by a suitably qualified professional •Exercise should consist of combined aerobic and resistance, however if resources are limited aerobic exercise should be prioritized	•https://cdn.macmillan.org.uk/dfsmedia/1a6f23537f7f4519bb0cf14c45b2a629/1532-source/prehabilitation-for-people-with-cancer-tcm9-353994?_ga=2.114959175.1965553563.1634302063-1568578672.1633938648 •https://www.nhs.uk/oneyou/active10/home •https://www.nhs.uk/live-well/exercise/ •https://movingmedicine.ac.uk/wp-content/uploads/sites/5/2020/04/Chair-exercise-programme-v.3-final-2.pdf
Mental health and cognitive assessment and preparation	All patients should undergo a psychometric and cognitive screening using a validated tool as early as possible within the preoperative pathway	• Patients with suspected cognitive concerns should complete a validated assessment tool such as the Montreal Cognitive Assessment • Psychological distress may be detected using Patient-Health Questionnaire 9, Generalised Anxiety Disorder 7, or Hospital Anxiety and Depression Scale • According to level of risk patients should be signposted to widely available online resources, referred to local community services or if high risk, patients should be referred to a clinical or health psychologist for formal evaluation and support	•https://www.cntw.nhs.uk/resource-library/relaxation-techniques/ •https://velindre.nhs.wales/news/archived-news/the-velindre-mindfulness-app-has-now-officially-launched/ •https://www.nhs.uk/apps-library/worrytree/ • https://www.anxietycanada.com/resources/mindshift-cbt/ •https://www.rcn.org.uk/clinical-topics/supporting-behavior-change

Table 2 (continued)

Action	Key recommendation	Detail	Additional resources
Nutrition assessment and optimisation	All patients should be screened for risk of malnutrition, as early as possible, using a validated tool	• Validated malnutrition screening tools include Nutritional Risk Screening and Malnutrition Universal Screening Tool •Patients screened at risk should undergo a formalized assessment by a registered dietician or physician with interest in clinical nutrition • All preoperative patients should be signposted to widely available dietary advice • Targeted interventions such as oral nutrition supplementation should be dictated by severity of risk and determined by a registered dietician based upon principles outlined in the Macmillan-RCoA-NIHR Prehabilitation Guidance • Specialist interventions such as enteral tube feeding should be based upon multi-disciplinary team discussion	• **Eatwell: Healthy eating information:** https://www.nhs.uk/live-well/eat-well/ • **Eatwell: Healthy eating video** https://www.nutrition.org.uk/healthyliving/healthydiet/eatwellvideo.html • **WCRF Eat well with cancer:** https://www.wcrf-uk.org/sites/default/files/Eat-well-during-cancer-2019-WEB.pdf •https://www.bda.uk.com/food-health/food-facts/all-food-fact-sheets.html
Preoperative group education	All patients should be invited for an in-person or remotely delivered group surgery school	• Surgery school should contain information on the likely course of the planned admission, "what to expect," surgical preparation and principles of prehabilitation, and supporting behavior change •Patients report preference for "live" events, with the ability to ask questions, rather than recorded advice • Clinicians should consider and ameliorate digital and socio-economic health inequality as some groups are less likely to attend surgical school	• Manchester University Hospital surgery school video: https://www.youtube.com/watch?v=gVuF6J2nUjA&feature=youtu.be • Fecher-Jones I, Grimmett C, Edwards MR, et al. Development and evaluation of a novel preoperative surgery school and behavioral change intervention for patients undergoing elective major surgery: Fit-4-Surgery School. *Anaesthesia*. Published online February 3, 2021. https://doi.org/10.1111/anae.15393
Waiting list clinical surveillance and support	Patients should be encouraged to regard waiting times as "preparation time."	• Where possible, following POAS, date of surgery should not be changed •Delayed high risk patients or procedures should receive additional clinical oversight and repeat POAS where deemed necessary • A point of contact in the perioperative team should be identified to the patient and accessible by email or telephone •Additional support may be necessary for individuals from more deprived communities, to avoid widening health inequalities	

Table 2 (continued)

Action	Key recommendation	Detail	Additional resources
Emergency surgery – preoperative assessment and optimisation	Local emergency surgical care pathways should be developed, consistent with national recommendations. These will include prompt assessment and preoperative optimisation to avoid delay	• Emergency surgery pathways should be planned in advance, with particular consideration for risk assessment, high care referral, and COVID-19 testing and management • Emergency surgery specific risk assessment tools should be used to guide consent, postoperative high care referral and SDM prior to surgery	• https://www.nela.org.uk/downloads/TheSixthPatientReportoftheNELA2,020-FINALNovember2,020.pdf

Summary guidance for the recovery of elective surgical services following the pandemic

Adapted from 'Preoperative Assessment and Optimisation for Adult Surgery including consideration of COVID-19 and its implications'

Additional resources are primarily United Kingdom initiatives but are widely available on the internet

This summary table is not intended to be comprehensive, please refer to the original guidance at:

https://cpoc.org.uk/preoperative-assessment-and-optimisation-adult-surgery

Accessed on 14th October 2021

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• Of importance
•• Of major importance

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