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L Ambrosio, D Lambrick, J Faulkner & MC Portillo

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Accessibility and applicability of physical activity guidelines and recommendations for adults living with long term conditions during COVID-19

L Ambrosio^a, D Lambrick^b, J Faulkner^c and MC Portillo^a

^aNIHR ARC Wessex, Health and Life Sciences, University of Southampton, Southampton, UK; ^bSchool of Health Sciences, University of Southampton, Southampton, UK; ^cDepartment of Sport, Exercise and Health, University of Winchester, Winchester, UK

ABSTRACT

To review the applicability and accessibility of physical activity guidelines for adults living with long-term conditions whilst shielding during the COVID-19. A narrative review with systematic methodology was conducted between 2015 and 2021, with two stages: 1) Search of electronic databases PubMed/Medline, Web of Science, PsycInfo, and Cinahl; 2) search of long-term condition organisations. Sixty-five articles were identified, where nine included specific guidelines during the COVID-19, 28 specific guidelines to individuals living with long-term conditions and 7 identified the utilization of online resources. Twenty-one long-term condition organizations websites were reviewed where all of them included a section regarding physical activity guidelines and seven referred to online and offline accessible resources during COVID-19. Accessibility and applicability were variable across academic databases and long-term conditions organisation websites. Findings could inform long-term condition policy and guidelines development to better and more relevant support people living with long-term conditions to be physically active.

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KEYWORDS

Physical activity; long term condition; COVID-19 pandemic; guidelines

Introduction

Globally, having one or more long-term conditions (LTCs) is associated with 41 million deaths each year, which is equivalent to 71% of all deaths worldwide (World Health Organization 2020). In England, LTCs affect ~15.4 million people and this figure is expected to rise to 18 million by 2025 (Stafford et al. 2018; Rolewicz et al. 2020). Regular physical activity (PA) participation has been proven to help prevent and manage various LTCs, including heart disease, stroke, diabetes, and several cancers (World Health Organisation. Physical Activity 2021a), and has shown to be beneficial in improving mental health and/or people wellbeing (Sallis et al. 2020; Woods et al. 2020). PA and exercise participation may be prescribed, adjusted, and scaled to the needs and abilities of each individual across the lifespan (Siedler et al. 2021). The most recent UK Chief Medical Officers' Physical Activity Guidelines sets out the recommendations for adults (aged 19–64 years) and older adults (aged 65+ years), including those with LTCs (UK Chief Medical Officers' PA guidelines. 2019).

Coronavirus disease-2019 (COVID-19) is a contagious disease caused by severe coronavirus 2 acute respiratory syndrome (SARS-CoV-2), and since March 2020 has severely impacted the daily lives of UK residents. Throughout the COVID-19 pandemic, the UK's Prime Minister and Secretary for Culture, Media and Sport released regular guidance on how to limit the spread of COVID-19,

CONTACT L Ambrosio  lag1v19@soton.ac.uk  NIHR Applied Research Collaboration Wessex, School of Health Sciences, University of Southampton, Building 67, University Road, Southampton, SO171BJ, United Kingdom

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which included measures such as social distancing, self-isolation and/or shielding, with and without periods of 'lockdown' for the general population, including those living with LTCs. However, during times when restrictions were eased, some individuals, particularly those with LTCs, remained adhering to shielding guidelines as a precautionary measure. These strategies, aimed at reducing the spread of COVID-19, have been shown to exacerbate poor lifestyle behaviours, namely resulting in a reduction in PA, impaired physical and psychological health, and higher mortality (UK Chief Medical Officers' PA guidelines. 2019; Siedler et al. 2021). For example, with 48,440 adults who had a positive COVID-19 test or diagnosis, physical inactivity was associated with a higher risk for hospitalisations, admission to intensive care units and patient death (Sallis et al. 2021). Furthermore, physical and social distancing during COVID-19 has been linked with a decrease ($\leq 32\%$) in PA (Meyer et al. 2020; Faulkner et al. 2021) and this has resulted in poorer mental health compared to individuals who maintained or increased their PA (Faulkner et al. 2021, 2022). Mental health is an important parameter to monitor during the Covid-19 pandemic as it provides an indication of how people can cope with normal stresses of life (World Health Organization 2021c). Furthermore, recent research undertaken during a period of COVID-19 'lockdown', where individuals were advised to stay and/or shield at home (except for very specific reasons), showed that 17.3% of individuals with a self-reported LTC indicated a negative change in their overall exercise behaviour (Faulkner et al. 2021). There is also evidence that adults with LTCs engaged in less intensive PA during COVID-19 restrictions than before (Rogers et al. 2020). Indeed, such negative changes in PA and exercise behaviour may promote the development and/or worsening of many LTCs, which may also contribute to potentially poorer outcomes in those who contract COVID-19 (World Health Organization, 2021a). What is unclear in the literature, however, are reasons for this decrease in volume and intensity of PA with individuals living with LTCs.

Despite the UK government issuing advice for individuals living with LTCs to 'stay at home', no official guidance was provided on how these individuals could remain or improve their PA participation whilst doing so. It is important, therefore, to determine whether people living with LTCs had access to appropriate guidance and resources that could facilitate their engagement in PA throughout the COVID-19 pandemic, particularly whilst shielding at home. A lack in availability of appropriate resources would indicate areas for development to ensure maximum benefit, and optimal health, to individuals living with LTCs throughout future periods of movement restriction due to COVID-19 or other future pandemics. Consequently, the aim of this study was to review the applicability and accessibility of PA guidelines, recommendations and/or resources for adults living with LTCs whilst shielding during the COVID-19 pandemic. The following two review questions were proposed: i) what online/offline PA guidelines, recommendations and/or resources were accessible to adults living with LTCs during the COVID-19 pandemic? ii) how applicable were available guidelines, recommendations and/or resources for adults living with LTCs, and who may have been shielding at home, during the COVID-19 pandemic?

Methods

In accordance with Jahan et al. (2016), a narrative review with systematic methodology was conducted.

Search strategy

The search strategy encompassed two main stages:

Stage 1. Search of literature databases

The following electronic databases were systematically searched from January to September 2021: PubMed/Medline, Web of Science, PsycInfo and Cinahl. The included Mesh- and truncated terms are presented in Figure 1. Study eligibility criteria included: English and Spanish language studies,

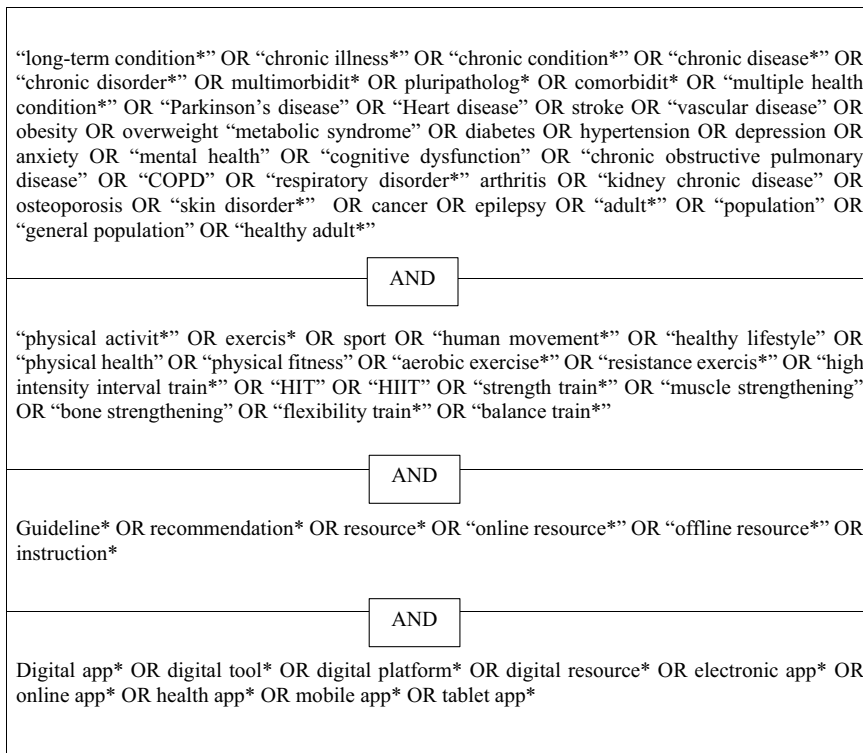


Figure 1. Search combination of key terms.

adults over 18 years of age, publication date between 2015–2021. Studies were included if they: i) referred to online or offline PA or exercise guidelines, recommendations, or resources for adults, including adults living with at least one LTC, pregnant adults, older adults (World Health Organization 2020), and/or ii) presented guidelines that include PA or exercise recommendations for the primary and secondary prevention of cardiometabolic diseases (e.g. Coronary heart disease, Diabetes Mellitus, Stroke). Exclusion criteria were: i) online or offline PA or exercise guidelines, recommendations, or resources for children and adolescents, ii) evidence that did not include primary presentation of PA or exercise guidelines, recommendations and/or resources.

Stage 2. Search of LTCs Organisations’ online and offline resources

Initially, a review of information provided on the websites of LTCs Organisations was conducted (Stansfield et al. 2016) to identify any relevant guidelines, recommendations and/or resources to facilitate PA engagement for individuals with LTCs, during the COVID-19 pandemic. The review of information was conducted between January to June (30th) 2021. The Quality and Outcomes Framework (2019) was used to identify the most prevalent LTCs within the UK, which then guided the review into the various organisational websites associated with these conditions. Freely available (published online) PA and exercise guidelines, recommendations and/or resources provided on organisations’ websites were reviewed by the authors for applicability for adults living with LTCs during the period of COVID-19 restrictions. LTC organisations, namely charities, professional organisations, and societies, and national or international government agencies, as well as non-profit health organisations, were contacted via email by LA to identify any unpublished offline PA or exercise guidelines, recommendations and/or resources offered by them (e.g. via newsletter, post, etc.) during the COVID-19 pandemic.

Data extraction

Data extraction during Stage 1 adhered to PRISMA guidelines (Moher et al. 2009), which included the screening of titles and abstracts from the relevant electronic databases. Articles that clearly did not meet the study inclusion criteria were rejected. All remaining full texts were read to determine their inclusion in the study (Figure 2). This process was led by LA and validated by DL. The methodological quality of the articles was not evaluated as the purpose of the review was to identify the accessibility and applicability of PA guidelines, recommendations and/or resources during COVID-19 pandemic.

For data extraction during Stage 2, authors LA and DL independently, systematically analysed the data on organisations' websites (Stansfield et al. 2016) for accessibility and applicability of PA information for individuals living with LTCs during COVID-19. Consensus was reached in relation to each organisation following subsequent discussion.

Results

Stage 1. Search of literature databases

Of the 10,634 articles identified, 5,317 were screened for inclusion. Sixty-four articles referred to PA guidelines for adults, either in relation to the general population and which were deemed applicable for individuals living with LTCs, or with a specific focus on individuals living with LTCs and were

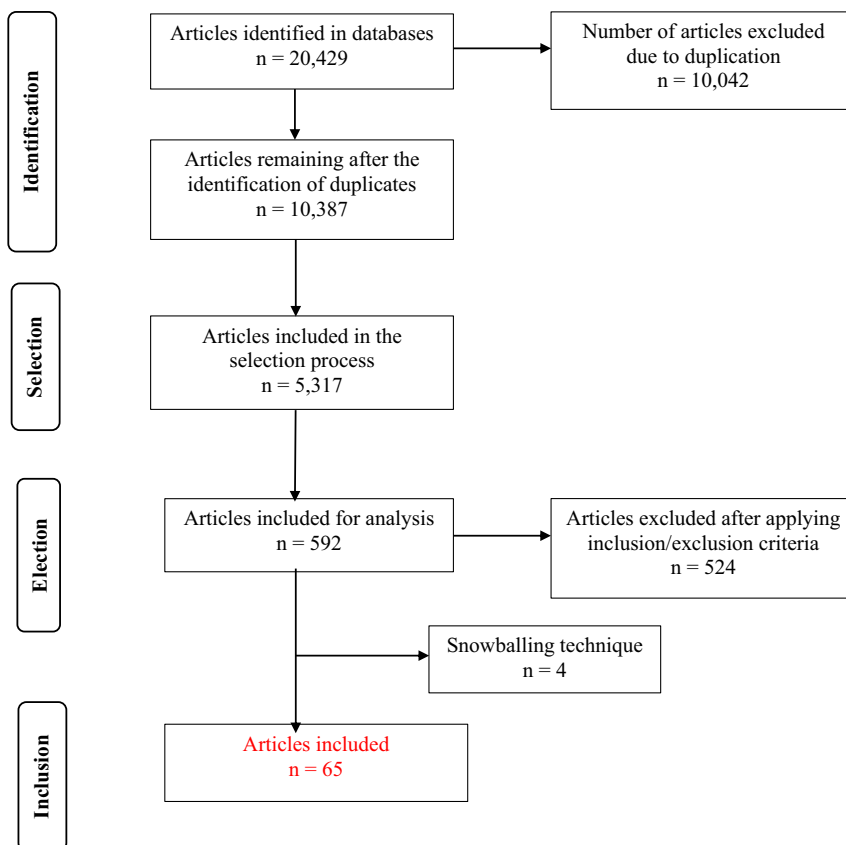


Figure 2. Flow diagram of the article selection process. Note: From: Moher et al. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Med* 6(7): e1000097. doi:10.1371/journal.pmed1000097

therefore included within this review (see [Figure 2](#)). All of the articles identified included at least one type of PA and/or exercise guidelines, recommendations and/or resources, which were applicable for adults living with at least one LTC during the COVID-19 pandemic. The majority ($n = 57$) of the 65 applicable articles were freely accessible to the general public, that is, these were not behind a paywall or accessible only via an institutional licensing agreement (see [Table 1](#)).

Of the 65 articles identified, 29 were reviews, 6 editorials, and 5 were original articles, while the remaining ($n = 25$) were official guidelines, discussion, or commentary articles. Thirty-six articles were relevant for the general population, which included pregnant women and/or individuals living with LTCs. In addition, 28 articles provided PA guidelines that were specific to individuals living with LTCs. For example, the European Society of Cardiology and the American Heart Association ([Hindieh et al. 2017](#); [Rausch Osthoff et al. 2018](#); [Macias-Rodríguez et al. 2019](#); [Kim et al. 2019](#); [Rock et al. 2020](#); [Sepulveda-Loyola et al. 2020](#)) provided specific PA guidance for individuals living with cardiovascular diseases.

Nine out of 65 articles ([Baisi-Chagas et al. 2020](#); [Ranasinghe et al. 2020](#); [Jurak et al. 2020](#); [Roschel et al. 2020](#); [Castañeda-Babarro et al. 2020](#); [Baena Morales et al. 2020](#); World Health Organization [2021b](#); [Polero et al. 2021](#)) included PA guidelines, recommendations and/or resources for adults during the COVID-19 pandemic, specifically (see [Table 1](#)). Of these, only two presented clear written text and visual images detailing how to stay active and reduce sedentary behaviour whilst at home in self-quarantine ([Baisi-Chagas et al. 2020](#); World Health Organization [2021b](#)).

Eight articles ([Sepulveda-Loyola et al. 2020](#); [Baisi-Chagas et al. 2020](#); [Castañeda-Babarro et al. 2020](#); [Baena Morales et al. 2020](#); [Srivastav et al. 2021](#); [Ranasinghe et al. 2020](#); World Health Organization [2021b](#)) identified the utilization of online PA and/or exercise resources, such as YouTube. With regard to online exercise platforms, YouTube and Zoom were identified as suitable technology from which to conduct both recorded and live sessions ([Castañeda-Babarro et al. 2020](#)). As for online applications, mobile-based or tablet-based apps ('Workout trainer', 'Fitocracy', 'Runstatic Pro' or 'Strava') and virtual reality-based media ('Wii Balance board with WiiFit', 'Nintendo Wii Training' or 'Dance video game with pad') were recommended to facilitate PA at home during the COVID-19 pandemic ([Srivastav et al. 2021](#)). The utilization of online PA and/or exercise applications was considered viable, safe, and effective to be physically active at home during COVID-19 restrictions for general population and for those living with LTCs, such as cardiovascular diseases or neurological conditions (e.g. Parkinson's disease) ([Baisi-Chagas et al. 2020](#); [Srivastav et al. 2021](#)).

Stage 2. Search of LTCs organisations' online and offline resources

[Table 2](#) presents the written resources, videos, and podcasts associated with PA and COVID-19 specific guidance provided by 21 LTC organisations. All of the 21 LTC organisations reviewed included a PA and exercise section on their websites, including exercise guidelines, recommendations and/or resources and other relevant exercise and disease-specific information. Seven of the 21 LTC organisations indicated that their online resources were also accessible offline, while all other LTC organisations ($n = 16$) did not have any accessible offline PA resources during the COVID-19 pandemic.

Written resources and information: Eighteen of the 21 LTC organisation websites provided written information about the general benefits of PA for health and/or in relation to their specific condition of concern. Only three organisations (MIND, Macmillan and Kidney Research UK) provided comprehensive information that was clear and easy to navigate and included ideas for physical activities that are applicable for individuals living with specific LTCs, as well as providing information on the positive relationship between increased PA and mental health.

There were nine organisations that presented PA guidance that was relevant and applicable to people living with LTCs during the COVID-19 pandemic, specifically. Some organisations acknowledged the change in circumstances (e.g. shielding/being at home more than 'normal')

Table 1. Main features of articles related to physical activity guidelines.

Reference	Type of study	Population	Based on PA guideline	Specify PA guideline(s)	Accessible for general public	COVID-19 specific
Abu-Omar et al. 2019	Review article	General population	Yes	<ul style="list-style-type: none"> Germany's Conference of Health Ministers and Germany's Conference of Sport Ministers (2015) WHO Global strategy on diet, physical activity, and health (2004) 	Yes	No
Armstrong et al. 2016	Communication	General population	Yes	<ul style="list-style-type: none"> The Osteoporosis Society of Hong Kong: 2013 OSHK guideline for clinical management of postmenopausal osteoporosis in Hong Kong Japanese 2011 guidelines for prevention and treatment of osteoporosis Taiwanese Guidelines for the Prevention and Treatment of Osteoporosis American Association of Clinical Endocrinologists medical guidelines for clinical practice for the diagnosis and treatment of postmenopausal osteoporosis 	Yes	No
Artal, 2016	Review article	Pregnancy women	Yes	<ul style="list-style-type: none"> American College of Obstetricians and gynaecologist guidelines Physical Activity guidelines for Americans (second edition) 	Yes	No
Aquaroni Ricci & Lopes Cunha, 2020	Review article	Older adults	Yes	<ul style="list-style-type: none"> WHO global recommendations for physical activity for health (2010) The American College of Sports Medicine—Exercise and physical activity for older adults (ACSM 2009) Physical Activity guidelines for Americans (second edition) 	Yes	No
Baena Morales et al. 2020	Special article	General population	No	N/A	Yes	Yes
Baisi Chagas et al. 2020	Communication	General population	Yes	<ul style="list-style-type: none"> WHO Stay physically active during self-quarantine (2020) 	Yes	Yes
Bianchi et al. 2017	Review article	Women with gestational diabetes	Yes	<ul style="list-style-type: none"> Italian National Health System Guidelines (2011) 	Yes	No
Bull et al. 2020	Guideline update	Adults, older adults and postpartum women and people living with chronic conditions	Yes	<ul style="list-style-type: none"> WHO Global action plan on physical activity 2018-2030 WHO global recommendations for physical activity for health (2010) 	Yes	No

(Continued)

Table 1. (Continued).

Reference	Type of study	Population	Based on PA guideline	Specify PA guideline(s)	Accessible for general public	COVID-19 specific
Castañeda-Babarro et al. 2020	Original paper	General population	Yes	<ul style="list-style-type: none"> • WHO global recommendations for physical activity for health (2010) 	Yes	Yes
Chong et al. 2020	Review article	Adults with mild cognitive impairment and subjective cognitive decline	Yes	<ul style="list-style-type: none"> • Canadian physical activity Guidelines for older Adults 	No	No
Dempsey et al. 2021	Review article	Adults with LTCs (T2DM, cancer, hypertension)	Yes	<ul style="list-style-type: none"> • WHO Global action plan on physical activity 2018-2030 • WHO global recommendations for physical activity for health (2010) • WHO guidelines on physical activity and sedentary behaviour (2021) 	Yes	No
Department of Health, Physical Activity, Health Improvement and Protection, 2011	Official document	General population	No	N/A	Yes	No
Ding et al. 2020	Editorial	Adults with LTCs	Yes	<ul style="list-style-type: none"> • WHO guidelines on physical activity and sedentary behaviour (2021) 	Yes	No
Dugan, 2016	Editorial	Adults with T2DM	Yes	<ul style="list-style-type: none"> • American College of Sports Medicine • American Diabetes Association 	Yes	No
Ekelund & Lee, 2019	Editorial	General population	Yes	<ul style="list-style-type: none"> • Physical Activity guidelines for Americans (second edition) 	No	No
Ferraro et al. 2020	Review article	Adults with cardiovascular diseases	Yes	<ul style="list-style-type: none"> • The America College of Cardiology • American Heart Association Guideline on the primary prevention of cardiovascular disease • American College of Sports Medicine • Physical Activity guidelines for Americans (second edition) 	No	No
Feldman, 2020	Recommendation article	Cancer survivors		<ul style="list-style-type: none"> • American College of Sports Medicine • 2008 physical activity guidelines for adults with chronic conditions 	No	No
Gellius et al. 2020	Original article	General population	Yes	<ul style="list-style-type: none"> • WHO global recommendations for physical activity for health (2010) 	Yes	No
Geild et al. 2018	Review article	Adults with LTCs (T2DM, COPD, arthritis, stroke, depression, back pain)	Yes	<ul style="list-style-type: none"> • WHO global recommendations for physical activity for health (2010) 	Yes	No

(Continued)

Table 1. (Continued).

Reference	Type of study	Population	Based on PA guideline	Specify PA guideline(s)	Accessible for general public	COVID-19 specific
Geild et al. 2018	Review article	Adults with multiple sclerosis	Yes	<ul style="list-style-type: none"> • Canadian Physical Activity Guidelines for Adults with Multiple Sclerosis • Multiple Sclerosis: Management of Multiple Sclerosis in Primary and Secondary Care 	No	No
Guozhu Lee et al. 2017	Review article	Older adults (65 years or older)	Yes	<ul style="list-style-type: none"> • American College of Sports Medicine • Physical Activity guidelines for Americans (second edition) 	Yes	No
Halabchi et al. 2017	Debate article	Adults with multiple sclerosis	Yes	<ul style="list-style-type: none"> • American College of Sports Medicine 	Yes	No
Hindieh et al. 2017	Review article	Adults with hypertrophic cardiomyopathy	Yes	<ul style="list-style-type: none"> • American Heart Association • American College of Cardiology • European Society of Cardiology 	No	No
Howell et al. 2017	Review article	General population	Yes	<ul style="list-style-type: none"> • National Haemophilia Foundation • Canadian Haemophilia Society • World Federation of Haemophilia 	Yes	No
Hudson et al. 2020	Review article	General population	Yes	<ul style="list-style-type: none"> • Physical Activity guidelines for Americans (second edition) • American college of sports medicine 	Yes	No
Jiménez-Pavón et al. 2020	Special commentary	General population	No	N/A	Yes	No
Jurak et al. 2020	Commentary article	General population	Yes	<ul style="list-style-type: none"> • WHO Global action plan on physical activity 2018-2030 • American College of sports medicine • Faculty of sport at the University of Ljubljana developed PA recommendations 	Yes	No
Kalb et al. 2020	Review article	Adults with multiple sclerosis	Yes	<ul style="list-style-type: none"> • The National MS Society guidelines 	Yes	No
Khoramipour et al. 2020	Discussion article	General population	No	N/A	Yes	Yes
Kim et al. 2019	Systematic search	Adults with multiple sclerosis, stroke and Parkinson's disease	Yes	<ul style="list-style-type: none"> • American College of sports medicine • American Physical Therapy Association • American Heart Association 	Yes	No
Lecube et al. 2017	Consensus document	Adults with obesity and related LTCs	No	N/A	No	No
MacKay-Lyons et al. 2020	Review article	Adults with cardiovascular diseases (stroke and transient ischemic attack)	Yes	<ul style="list-style-type: none"> • Aerobic Exercise Recommendations to Optimize Best Practices in care after stroke 	Yes	No

(Continued)

Table 1. (Continued).

Reference	Type of study	Population	Based on PA guideline	Specify PA guideline(s)	Accessible for general public	COVID-19 specific
Marcías-Rodríguez et al. 2019	Review article	Adults with cirrhosis	Yes	<ul style="list-style-type: none"> • Canadian Society for Exercise Physiology • WHO global recommendations for physical activity for health (2010) • American Heart Association 	Yes	No
Martin Ginis & West, 2020	Special report	Adults with physical disabilities	Yes	<ul style="list-style-type: none"> • The Scientific exercise guidelines for adults with spinal cord injury 	Yes	No
Martignon et al. 2020	Systematic review article	Adults with Parkinson's disease	Yes	<ul style="list-style-type: none"> • The American College of Sports Medicine Guidelines for Exercise Testing and Prescription • The European Guidelines for Physiotherapy 	Yes	No
Mendes et al. 2016	Systematic search	Adults with T2DM	No	N/A	Yes	No
Mottola et al. 2018	Review article	Pregnant women	Yes	<ul style="list-style-type: none"> • Canadian Guideline for Physical Activity throughout Pregnancy (2019) 	Yes	No
Physical Activity Guidelines Advisory Committee Scientific Report	Guideline	General population	Yes	<ul style="list-style-type: none"> • Physical Activity Guidelines Advisory Committee Scientific Report (2018) 	Yes	No
Physical Activity Guidelines for Americans. 2nd edition	Guidelines	General population	Yes	<ul style="list-style-type: none"> • Physical Activity guidelines for Americans (second edition) 	Yes	No
Piepoli et al. 2016	Official document	Adults with cardiovascular diseases	No	N/A	Yes	No
Polero et al. 2021	Review article	General population (with and without LTCs)	No	N/A	Yes	Yes
Ramirez-Velez et al. 2021	Systematic review	Women with breast cancer	No	N/A	Yes	No
Ranasinghe et al. 2020	Special report	General population	Yes	<ul style="list-style-type: none"> • WHO Guidelines (2020) • American College of Sports Medicine physical activity guidelines 	Yes	Yes
Rausch Osthoff et al. 2018	Recommendation article	Adults with inflammatory arthritis, rheumatoid arthritis, spondylarthritis, and osteoarthritis	Yes	<ul style="list-style-type: none"> • American College of Sports Medicine • American Heart Association 	Yes	No
Reid & Foster, 2017	Infographic	General population	Yes	<ul style="list-style-type: none"> • WHO Global recommendations on physical activity for health (2010) • UK Chiel Medical Officers' guidelines 2011 	Yes	No
Rivas Estany, 2016	Editorial	Adults with heart diseases	No	N/A	Yes	No

(Continued)

Table 1. (Continued).

Reference	Type of study	Population	Based on PA guideline	Specify PA guideline(s)	Accessible for general public	COVID-19 specific
Rock et al. 2020	Review article	General population	Yes	<ul style="list-style-type: none"> American Cancer Society guidelines American Heart Association Physical Activity guidelines for Americans (second edition) 	Yes	No
Ross et al. 2020	Official document	General population	Yes	<ul style="list-style-type: none"> Canadian 24-Hour Movement Guidelines for Adults aged 18–64 years 	Yes	No
Roschel et al. 2020	Editorial	General population	Yes	<ul style="list-style-type: none"> WHO Global Recommendations on Physical Activity for Health (2010) 	Yes	Yes
Savvaki et al. 2018	Review article	Pregnancy and gestational diabetes	No	N/A	Yes	No
Segal et al. 2017	Systematic review article	Adults with cancer	No	N/A	Yes	No
Sepúlveda-Loyola et al. 2020	Narrative review article	General population	Yes	<ul style="list-style-type: none"> American College of Sports Medicine American Heart Association American Physical Therapy Association International Network of Physiotherapy Regulatory Authorities International Association of Physical Therapists working with Older People World Confederation for Physical Therapy 	Yes	Yes
Singh et al. 2020	Review article	General population	Yes	<ul style="list-style-type: none"> Physical Activity guidelines for Americans (second edition) 	Yes	No
Srivastav et al. 2021	Communication article	General population	Yes	<ul style="list-style-type: none"> The American College of Sports Medicine 	Yes	Yes
Teychenne et al. 2020	Commentary article	General population with specific focus on mental health	Yes	<ul style="list-style-type: none"> WHO global recommendations for physical activity for health (2010) 	No	No
Tran et al. 2020	Review article	Adults with congenital heart disease	No	N/A	Yes	No
Trudelle-Jackson & Jackson, 2018	Original study	General population	Yes	<ul style="list-style-type: none"> Physical Activity guidelines for Americans (second edition) 	Yes	No
Verschuren et al. 2016	Review article	Adults with cerebral palsy	Yes	<ul style="list-style-type: none"> WHO global recommendations for physical activity for health (2010) American College of Sports Medicine 	Yes	No
Wagner et al. 2019	Original study	Adults with haemophilia	Yes	<ul style="list-style-type: none"> World Federation of Haemophilia guidelines (2012) 	Yes	No
Weggemans et al. 2018	Systematic review article	General population	Yes	<ul style="list-style-type: none"> WHO global recommendations for physical activity for health (2010) Dutch Physical Activity Guidelines (2017) 	Yes	No

(Continued)

Table 1. (Continued).

Reference	Type of study	Population	Based on PA guideline	Specify PA guideline(s)	Accessible for general public	COVID-19 specific
Wing & Stannard, 2016	Editorial	Adult women	Yes	<ul style="list-style-type: none"> American College of obstetrics and gynaecology US department of health and human services 	Yes	No
World Health Organization, 2020	Guideline	General population	N/A	N/A	Yes	No
World Health Organization, 2021	Official document	General population	Yes	<ul style="list-style-type: none"> WHO guidelines on physical activity and sedentary behaviour (2021) 	Yes	Yes
Yang et al. 2019	Review article	General population	Yes	<ul style="list-style-type: none"> Physical Activity guidelines for Americans (second edition) WHO global recommendations for physical activity for health (2010) 	Yes	No
Zhao et al. 2020	Original study	General population	Yes	<ul style="list-style-type: none"> Physical Activity guidelines for Americans (second edition) 	Yes	No

and presented ideas and information on how to be physically active around the home and garden, and some provided a printable, weekly exercise plan that people could follow or use as a guide (see Table 2). However, at least one organisation website contained outdated information that was applicable only to the first ‘lockdown’, making the information less applicable to later stages of the pandemic.

Several organisations (n = 10) signposted users to various external sources of information relating to PA guideline guidelines, recommendations and/or resources. Often, NHS websites were recommended, including NHS choices, NHS Fitness Studio, and NHS Better Health, as well as National projects, such as the ‘Undefeatable’ campaign and ‘Move More’ project (Bangor University), or the promotion of current ‘influencers’ (e.g. Joe Wicks and Oti Mabusi) offering PA-based engagement with the general population, including those with LTCs. However, it was noted that some of these sources of information (e.g. information linked with the influencers) had become outdated by the later stages of the pandemic.

Visual resources: A small number of organisations (n = 5) provided patient-led videos which focussed on differing aspects of fitness (e.g. aerobic, strength, and endurance) or a range of activities (e.g. yoga, Pilates, and fatigue management) which people living with LTCs could watch and follow at home. As access to gym equipment could be difficult for some users, some organisations provided practical examples of what items around the home could be used instead of resistance weights, such as tin cans or filled water bottles (e.g. MacMillan Cancer Support). Only one organisation provided dedicated safety advice for people participating in unsupervised home-based exercise (MacMillan Cancer Support).

Booklets: In addition to written information included on organisation websites, some (n = 3) offered downloadable pdf booklets that provided example activities that could be completed both indoors and outdoors, exercise plans, and information on how to break up sitting time, adding health benefits over-and-above PA participation. One organisation indicated that the audio version of their booklet could also be requested via their website (MacMillan Cancer Support).

Table 2. Main themes from LTCs organizations.

LTC organisations	Themes								
	Written text			Videos	Booklets		Podcasts		
	Generic PA guidelines	Tailored to be COVID-19 specific	Links to external sources of information	Patient-led	Written text	Audio books	Generic PA guidelines	Tailored to be COVID-19 specific	Other resources
Age UK			X						
Alzheimer's Research UK									
Alzheimer's Society	X								
Arthritis Action		X	X	X	X				
Asthma UK	X	X							
British Heart Foundation	X								
British Liver trust	X		X						
Cancer Research UK	X	X	X						
Dementia UK	X								
Diabetes UK	X	X	X						
Epilepsy society	X								
Heart Research UK									
The British Lung Foundation	X								
Kidney Care UK	X	X	X	X					
Kidney Research UK	X		X	X					
Macmillan Cancer support	X	X	X	X	X	X	X	X	
Mental Health Foundation	X	X	X						
Mind	X	X	X						
National Multiple Sclerosis Society	X			X	X				X
Parkinson's UK	X	X							
The stroke Association	X								

UK, United Kingdom.

Podcasts: One organisation (MacMillan Cancer Support) provided podcasts by 'experts' to discuss the importance of PA in a generic sense after a diagnosis of their specific LTC and how this could be managed during the current COVID-19 pandemic.

Other resources: One organisation (National MS Society) provided other resources, including 'live' online sessions (Zoom exercise classes, webinars) that people could join in with, in real-time.

Discussion

To our knowledge, this is the first review to explore the accessibility and applicability of PA guidelines, recommendations, and/or resources available to adults living with LTCs whilst shielding during the COVID-19 pandemic. Our review has shown that the accessibility and applicability of information is variable across academic databases and LTC organisations. This may have important implications for individuals who use only those resources most closely linked to their specific condition/s.

Although PA information from scientific databases was largely accessible to people living with LTCs during the COVID-19 pandemic, it is unclear how useful this source of information actually is. It is suggested that scientific databases are not the best source of information for the general public as the use of databases of this nature requires specific scientific knowledge that members of the general public may not have (Stansfield et al. 2016). Furthermore, some potentially applicable information may be inaccessible to the general public due to being hidden behind a paywall. In the current study, seven articles containing potentially useful information on PA guidelines, recommendations and/or resources were inaccessible to the general public for paywall reasons.

In total, 89% of all reviewed LTC organisations' websites provided open and free-to-access online PA resources for the general public. All identified PA guidelines, recommendations and/or resources were accessible online; none were easily or overtly accessible by way of an offline resource. Only 30% of the reviewed LTCs organizations offered the opportunity to make resources available offline, and only if specifically requested by an individual. Although online resources seem to be the most applicable way to provide PA guidelines, recommendations and/or resources, particularly while physical distancing was required, access to- and cultural acceptability of internet-based technologies could be far from universal (Sallis et al. 2020). Many people, especially those with low incomes, may not have the financial resources to have access to computers and internet, or indoor space, or may have limitations with internet coverage that makes at-home PA unrealistic. Moreover, some people living with LTCs, as per the general population, may also be precluded from accessing online information due to low digital literacy (Pan et al. 2022). Hence, routinely offering offline methods of delivery of information may be a useful means to reach a broader population, both with and without LTCs. A practical solution may be to incorporate more conventional and accessible ways of delivering exercise and/or PA guidelines, recommendations and/or resources, such as print guidelines or network television, although the cost implications of this may be a precluding factor.

In total, 43% of the organisation websites reviewed provided external links from their host site to other internet-based PA and/or exercise resources (e.g. influencer Joe Wicks or NHS Fitness Studio) (see Table 2). In some cases, one could argue that this could be useful in facilitating access to a broader network of information, but practically this is reliant on higher levels of digital literacy and a stable internet connection, and it may also result in information being accessed that is less applicable to individuals with specific LTCs. Moreover, from the organizations' perspective, they have less content control and a greater need to monitor external links, as if links become broken or content is changed then this could become difficult for people to navigate, resulting in a barrier for the person to find appropriate information relating to PA guidelines, recommendations and/or resources.

Official websites of LTC organizations are typically considered a great source of information as they are accessible to the general public, including those living with LTCs, and [often] present useful and applicable information related to PA (Goodwin et al. 2010). Generic PA guidelines, recommendations and/or resources are not suitable for everyone as differences in age, gender, physical abilities, PA preferences, and LTC severity may underpin different contraindications to exercise (Sallis et al. 2020). Therefore, five of the 21 organisations reviewed did not provide any guidelines, recommendations and/or resources; only provided general PA guidance not tailored to the LTC. Three organisations in particular provided comprehensive information that included useful resources and ideas on activities for individuals to participate in, in order to remain physically active. Moreover, some organisations

included information pertaining to the positive relationship between PA and mental health (Sallis et al. 2020) albeit in a generic sense, but which is of particular relevance when considering the evidence of the deleterious effects of pandemic restrictions, such as shielding, on people's PA, mental health, and wellbeing (Faulkner et al. 2021). Arguably, the most beneficial information was that which acknowledged the change in circumstances (e.g. shielding/being at home more than 'normal') and presented ideas and information on how to be physically active around the home and garden. Only nine of the 21 organisations reviewed provided advice or information relating to PA or exercise during the COVID-19 pandemic, specifically. This is a key aspect because information was adjusted and consequently, applicable to current circumstances regarding COVID-19 restrictions. In some cases, information provided had been tailored to acknowledge the impact of the COVID-19 pandemic and provide appropriate resources to support engagement in PA, but at the time of review, that is, following the initial 'lockdown', this information had become outdated and was therefore no longer applicable for those seeking guidance.

For individuals with LTC, it is important that unsupervised home-based exercise programmes, whether online or offline, are designed: i) according to the disease characteristic/s in order to most effectively encourage participation and to ensure the safety of the individual, and ii) acknowledging potential personal circumstances that could be a barrier to engagement. In this study, five organisations provided video resources to demonstrate appropriate home-based activities and exercise technique; some accounted for differences in functional ability (e.g. providing both standing exercises and sitting exercises). One organisation provided advice on how to use items around the home to assist in their exercises, such advice is really useful for people who may otherwise be unable to source or afford to purchase exercise equipment, either during or outside of pandemic restrictions. Only one organisation included specific safety advice for exercising at home. During pandemic circumstances when individuals with LTCs are being encouraged to stay at home, more widespread information on how to remain physically active safely, whether this is in relation to specific exercise programmes or general PA, is warranted (Kaur et al. 2020). Furthermore, as PA and/or exercise programmes designed for the general population (e.g. Joe Wicks) may not be appropriate for clinical groups from a safety perspective, simple strategies, such as 'move more and sit less' or 'breaking up sitting time' could be promoted as safe and accessible options for those living with LTCs, to counter physical inactivity and encourage PA while at home during the COVID-19 pandemic (Pinto et al. 2020).

It is important that we contextualise our findings in light of the study's strengths and limitations. Although most prevalent LTCs organisation websites were reviewed and contacted based on the Quality and Outcomes Framework (2019) it is possible that other LTCs organisations websites in the UK were not included. Also, despite identifying several LTCs organisations websites, we are unaware of how many people accessed and utilised these resources during the COVID-19 pandemic, and how this compared to the frequency of use of the same/similar resources pre-COVID-19 pandemic. In addition, data extraction was subjective, and it is plausible that some relevant information may have been inadvertently overlooked. To counter this possibility, data extraction was conducted systematically and independently by two researchers. A strength of the study was the identification of major LTC websites that correspond to the most prevalent LTCs in the UK. The relevance of this means that our findings have the greatest potential to be meaningful to a wide number of individuals. The findings may be useful for policy development and LTC organisations, in highlighting gaps and widespread differences in the guidance presented to individuals with specific LTCs, in order to promote PA engagement safely, effectively and consistently during COVID-19 restrictions, and/or future pandemics.

Conclusion

In conclusion, the rationale for this study was based upon the observation that government guidance for individuals living with LTCs was typically to stay at home and shield during the COVID-19 pandemic, without providing any specific guidance on how to become or remain

physically active. This study has shown that the accessibility and applicability of PA guidelines, recommendations and/or resources for people living with LTCs during the COVID-19 pandemic was variable across academic databases and LTC organisation websites. Although differing ways to present information have been used across differing LTC websites, it remains unclear which dissemination methods are most effective or well used by people living with LTCs who wish to become/remain physically active during periods of restriction (i.e. shielding) caused by a pandemic. This information would be beneficial for stakeholders at the micro-, meso- and macro-level to inform LTC policy development, to better support people living with LTCs to be physically active during future periods of mobility restriction and/or pandemics.

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