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Online physical activity resources for individuals with rheumatoid arthritis: An environmental scan and quality appraisal

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Article Title

Online physical activity resources for individuals with rheumatoid arthritis: An environmental scan and quality appraisal

Abstract

Objectives: To review publicly available physical activity (PA) resources for individuals with rheumatoid arthritis (RA). Aims were to find online print and audiovisual resources, review their characteristics, and critically examine their quality from medical, exercise, and behavioral science perspectives.

Design: An environmental scan was completed using the Google search engine, with combinations of terms for RA and PA. The first 5 pages of results were reviewed for RA-specific PA resources that were free, written in English, and included PA recommendations.

Outcomes: After screening, resources underwent a medical review for safety and appropriateness. After extracting data on the resource characteristics, resources were evaluated for readability, understandability, actionability, exercise recommendations, and behavior change techniques.

Results: The search yielded 23 RA-specific PA resources, 17 of which passed the medical review. All 10 print resources and 7 audiovisual resources were created in English-speaking countries. The mean reading grade was 9.0±1.5. Print resources had mean understandability of 80.0±9.8% and actionability of 60.0±27.7%.

Audiovisual materials had mean understandability of 86.0±9.2% and actionability of 86.9±22.9%. The quality of exercise recommendations was low. Only 1 resource provided comprehensive cardiovascular exercise advice, and 2 resources provided comprehensive strength exercise advice. 3-14 behavior change technique groups were featured in each resource. The most common groups were "shaping knowledge" and "natural consequences".

Conclusions: The quality of RA-specific PA resources is variable. Some high-quality resources exist that provide actionable exercise behavior change advice. Healthcare teams may refer patients to these resources.

However, more work is needed to improve the overall quality of resources. Co-development with patients,

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- providers, and exercise behavior change experts is recommended, ensuring resources are actionable, contain 25
- 2 clear exercise recommendations, and promote behavior change. **2**₃6

Strengths and limitations of this study

- The study provides a comprehensive overview and critical appraisal of publicly available physical
- activity resources for individuals with rheumatoid arthritis.
 A critical appraisal was completed by a rheumatologist, patient partners with lived experiences of
 rheumatoid arthritis, researchers, and an exercise and behavior change expert.
 All resources were evaluated using standard measures for readability, understandability, actionability, exercise recommendations, and behavior change techniques.
 Due to the inherent subjectivity of the tool used to assess understandability and actionability, triplicate
- uses ratings were completed for each resource to minimize subjective biases.
- Patient partners were individuals with high health literacy and personal engagement with their health,

which may impact certain scores and their generalizability to the broader RA population.

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Declaration of competing interests

The authors have no conflicts of interest to declare.

Abbreviations

- DMARDs = Disease-Modifying Anti-Rheumatic Drugs
- FITT = Frequency, Intensity, Time, Type
- HCP = Healthcare Provider

PA = Physical Activity

PEMAT = Patient Education Materials Assessment Tool

RA = Rheumatoid Arthritis

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49 1.0 Introduction

Rheumatoid arthritis (RA) is a chronic autoimmune inflammatory disease affecting around one percent of
Canadians [1]. Chronic inflammation of the joints and throughout the body leads to systemic problems,
compromised function, and reduced quality of life [2]. Despite significant improvements in RA treatment due
to the emergence of new classes of disease-modifying anti-rheumatic drugs (DMARDs), individuals living with
RA continue to face daily challenges [3-5]. These challenges include unpredictable disease flare ups, changes in
disease activity, debilitating chronic fatigue and pain, and significant psychological distress [5].
Effective disease self-management (or self-care, as preferred by patients) between regularly scheduled follow-

Effective disease self-management (or self-care, as preferred by patients) between regularly scheduled followup appointments is critical to quality RA care. Indeed, major international rheumatology associations such as the European League Against Rheumatology (EULAR) recommend the implementation of self-management strategies for RA care [6]. Recommended strategies include patient education, goal setting and problem solving, lifestyle advice, and connecting patients to resources [6].

Physical activity is strongly recommended as part of effective RA self-management [6-8]. Regular physical activity can positively impact many disease-related and general health outcomes among RA populations [7-13]. For example, physical activity can significantly reduce fatigue, pain, and inflammation while improving functional ability and body composition [9-11]. It is positively associated with better strength and cardiorespiratory fitness and enhanced quality of life, while reducing the risk of cardiovascular disease and all-cause mortality [9, 12, 13]. The health benefits of regular physical activity can also reduce individual- and system-level healthcare costs [14]. Unfortunately, individuals with RA report lower than average physical activity levels, and physical activity support in routine RA clinical care remains limited [9, 15].

Greater efforts are needed to help individuals with RA become and stay physically active as part of their dayto-day disease self-management. Individuals with RA lack disease-specific physical activity resources, express doubts about the safety and effectiveness of physical activity, and rarely receive physical activity advice from their care team [16]. Publicly available, RA-specific physical activity resources may be helpful for addressing

these problems. However, the quality of online health information is highly variable, and individuals with For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

chronic conditions struggle to find suitable, credible high-quality resources [17, 18]. They may also find it difficult to discern what recommendations are appropriate given their current concerns. Therefore, we completed an environmental scan of publicly available physical activity resources for individuals living with RA. Specific goals were to identify available resources, provide an overview of their characteristics, and critically examine their quality. High-quality resources identified herein can serve as a foundation for Protected by copyright, including for uses patients and providers to improve physical activity behavior change as part of RA self-management. Meanwhile, the shortcomings among existing resources can inform future research and development. 2.0 Materials and methods We completed an environmental scan and critical appraisal of publicly available online resources on physical activity for individuals living with rheumatoid arthritis. 2.1 Patient and public involvement Patient partners with lived experiences of RA were involved throughout the study. The study was conducted in q text direct response to conversations with patient partners and reports in the literature that indicate challenges and with accessing high-quality information on physical activity. Their opinions informed the study design, including the search strategy and selection of measures for critical appraisal. Furthermore, three patient <u>b</u> Al training, and similar technologies partners were involved in assessing understandability and actionability of the included resources. They will also be involved in sharing lay summaries of our findings with patient organizations. 2.2 Search Strategy An online search was carried out using the Google search engine from January-April 2024. The search strategy was developed, tested, and refined by three members of the research team (ME, SZ, CB). Searches were repeated using various combinations of search terms related to rheumatoid arthritis, physical activity, and program or resource. Search terms were obtained from existing patient materials and relevant scientific literature. Additional searches were completed after adding a term for the major countries contributing to English language patient resources (e.g. United States, United Kingdom, Canada, Australia). The complete list

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of search terms used for each concept is presented in the online Supplementary File 1. As research suggests For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

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99 1 that most online search traffic is on the first two results pages, all links on these pages were reviewed [19]. Authors also screened the results on pages 3-5 to make sure no relevant resources were missed. To be included in the environmental scan, resources had to meet the following inclusion criteria: (1) freely available, (2) written in English, (3) developed specifically for individuals living with rheumatoid arthritis, and (4) containing at least 1 recommendation for physical activity. Resources were excluded based on the following criteria: (1) payment required to access, (2) presence of predatory advertising (3) intended for healthcare by copyright professionals or researchers, (4) information not specific to rheumatoid arthritis, and (5) absence of physical activity recommendations (e.g. sign-up page for a physical activity program). During the medical safety review (described below), any resources deemed unsafe or inappropriate by a rheumatologist were also excluded (see medical safety review). 2.3 Data Extraction A data extraction spreadsheet was used to record resource characteristics including URL, title, organization, country of origin, date created or last updated, format (print, audiovisual), type (e.g. blog post, slideshow, PDF handout, video), and interactivity. A resource was deemed to be interactive if it prompted the user to complete an action or answer a question while viewing the content. If reported, additional data was recorded on the availability of translated versions of the resource, as well as the involvement of healthcare professionals or patient partners in resource development. 2.4 Critical Appraisal The included resources underwent a comprehensive critical appraisal for medical safety, readability, hnologies understandability, actionability, quality of exercise recommendations, and use of behavior change techniques. 2.4.1 Medical Safety Review The medical safety review was completed by a rheumatologist (CB) on the research team. Each resource was reviewed to ensure that the content was safe and appropriate for patients with RA in the opinion of a rheumatologist. Factors considered included (1) whether information provided in the resource about RA and its management was medically accurate, as well as, (2) whether the exercise recommendations would be safe For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml 60

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		В
124 1	from a medical perspective for patients with RA. Each resource received a yes/no rating along with additional	MJ Ope
2 1235 4	comments for consideration by the research co-lead (ME). Only resources that had no concerns across both	en: firs
126 6	factors were approved as safe for the general population of RA patients, based on clinical experience.	t publi
7 127	Resources with any concerns were deemed unsafe and excluded from further review.	shed a
9 1 28 11	2.4.2 Readability	s 10.11
123	The validated and widely used Flesch-Kincaid Reading Grade score was used to assess readability [20].	36/bmj
14 1 30 16	Document text was copied into Microsoft Word and the Flesch-Kincaid Reading Grade score was calculated	open-2
137	using the automated proofreading tools in Microsoft Word.	024-09
19 1 32	2.4.3 Understandability and Actionability	4220 or
$1\frac{23}{33}$	Understandability and actionability were assessed using the Patient Education Materials Assessment Tool	1 20 Fe
24 13/4	(PEMAT) [21]. This tool has demonstrated strong internal consistency and reliability, can be used by both	bruary Enseiç
26 1 3 5 28	researchers and patient partners, and can be used for both print (PEMAT-P, 24 items) and audio-visual	2025. E Inemer
29 136	(PEMAT-A/V, 17 items) resources. The understandability domain includes evaluation of 6 sub-domains for	ownlo
31 1 37 33	content, word choice and style, use of numbers, organization, layout and design, and use of visual aids.	aded fr rieur (A
138	Actionability measures the degree to which a resource provides specific actionable steps for patients using the	om http (BES)
36 1 39 38	provided information (e.g. feasibility, specificity, relevance). The PEMAT user guide includes specific	o://bmjc
140 40	instructions for the rating of each item as 1 (agree), 0 (disagree), or not applicable [22].	open.br
41 14 <u>1</u> 42	All assessors adhered closely to the PEMAT user guide for rating each resource [22]. To ensure consistency,	nj.com
43 14 2 45	each resource was reviewed by 3 assessors: 2 researchers (ME and KD) and 1 patient partner (AM, CG, or GL).	on Ju
46 1 43	Discrepancies for one or more items between the researcher ratings were resolved by open discussion to	ne 13, :
48 1 4 4 50	obtain a consensus researcher rating. Understandability and actionability scores, as well as overall PEMAT	2025 at
145 145	scores, were calculated for each resource according to the PEMAT scoring guidelines. To calculate scores, the	Agenc
53 1 46 55	sum for each domain was divided by the total sum of possible points in that domain and converted to a	e Bibli
1459	percentage, where 100% indicates that the resource received a rating of 1 (agree) on all applicable items in	ographi
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148 1 that domain. Mean scores were calculated using equal weights for the researcher consensus score and the patient partner score. A higher percentage indicates better understandability or actionability. Patient partners were recruited from existing relationships with patients involved in a larger project being conducted by the research team on improving physical activity support for individuals living with rheumatoid arthritis. Individuals with prior experience using the PEMAT from a previous project [23] were invited to participate by email. The email included a brief overview of the study objectives and explained the purpose of patient partner involvement with the critical appraisal of resources. All invitations included the option to decline participation. Researchers and patient partners were trained using the PEMAT user guide PDF and a virtual 1:1 session with a member of the research team (KD) as needed [22]. Those with no prior PEMAT experience (ME) completed a practice session with an experienced PEMAT rater (KD) to ensure consistency. 2.4.4 Exercise Recommendations Review The exercise review was completed by a clinical exercise specialist (ME) on the research team. Each resource was reviewed in detail to assess the presence of exercise recommendations, exercise cautions, specific and actionable exercise tips, and tailored exercise advice for rheumatoid arthritis. This information was recorded using a standard data extraction spreadsheet, with separate sections for cardiovascular, strength, balance, and stretching exercise. Exercise types that were not mentioned at all were left blank in the data extraction spreadsheet. Meanwhile, missing information was noted as "not specified". Recommendations to consult with

a healthcare professional or qualified exercise professional were recorded.

2.4.5 Behavior Change Techniques Review

The behavioral review was completed by a physical activity behavior change expert (ME) on the research team. To assess the use of behavior change techniques, each resource was reviewed using a standard data extraction spreadsheet based on the behavior change technique taxonomy [24]. This taxonomy is the gold standard for classifying behavior change techniques in physical activity behavior change research. The presence of behavior change techniques was recorded across the 16 groups from the behavior change

BMJ Open Page 9 of 35 1 technique taxonomy. Groups were either considered present, if one or more techniques from that group were identified, or absent, if none of the techniques were used. 6 3.0 Results 175 An overview of the environmental scan phases is shown in Figure 1. Our initial search yielded 33 potential resources. After screening the resources, 10 of them were excluded as they did not meet our inclusion criteria. Eight of these were landing pages for in-person or online exercise programs. One was not available in English, and another was not intended for rheumatoid arthritis. Twenty-three resources were included in the data extraction and critical appraisal phases. **70** 11



48 49 50 51 52 53	Exercise and RA	Arthritis Australia	Australia	June 2024	Brief article	No	English	Unclear	Unclear
48 49 50									
48	Print Resources								
44 45 46 47	Title	Organization	Country	Date Created or Updated	Туре	Interactive	Language	HCPs Involved	Patients Involved
41 13 43	available in Englis	h. Table 1 prese	ents the cl	naracteristic	cs for each re	esource.			
38 39 12 40	14 and 8 resource	s, respectively.	A single r	esource was	s available in	Spanish and	d English. A	ll others w	vere only
36 31	interactive compo	onent. The invo	lvement o	f healthcare	e professiona	lls and patie	nt partners	s was docu	mented ir
33 34 35	remainder were a	udiovisual reso	urces (e.g	. videos, mu	ultimedia ma	terials). Onl	y 6 resourc	es include	d an
31 89 33	resources were pr	int materials o	f various f	ormats (Blo	g post, brief	article, slide	show, PDF), whereas	the
29 88	from English-spea	king countries,	including	the USA (n=	=3), Canada (n=8) <i>,</i> UK (n=	=5), and Au	stralia (n=	1). Ten
26 2 7 28	Of these 17 resou	rces, 14 were c	reated or	updated be	tween 2020-	2024 (Table	1). All resc	ources orig	inated
24 26	3.2 Resource char	acteristics							
21 22 23	that passed the m	edical safety re	eview.						
19 240	are not represent	ative of the RA	populatio	n. The critic	al appraisal v	was complet	ted only for	the 17 re	sources
17	advertisements (e	.g. weight loss	medicatio	ns) and sto	ck images (e.	g. able-bodi	ed, younge	er white wo	omen) tha
14 1 2	activity engageme	ent despite its n	nany bene	efits. Some r	esources we	re deemed	inappropria	ate due to	predatory
11 12 11 13	85% of people wit	h RA". The stat	ement wa	as not suppo	orted by scie	ntific eviden	ce and may	y discoura	ge physica
9 10	individuals with w	ell-controlled F	RA. In cont	rast, anothe	er resource v	vrote that "	exercise is u	uncomfort	able for
7 39	statements to avo	id certain exer	cises (e.g.	high impact	t, high intens	ity), which r	nay still be	suitable fo	or
	hands and wrists)	without suffici	ent modifi	ication for R	A patients w	vith joint syn	nptoms, as	well as bla	anket
4	recommendation	of unsafe exerc	cises (e.g.	push-ups, si	it-ups, and o	ther challen	ging exercis	ses that lo	ad the
2 § 7 4									

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Challenge for Arthritis	Research Canada	Canada	January 2020	PDF workbook	Yes	English	Yes	Unclear
Exercise for RA	Health Link BC	Canada	September 2022	Brief article	No	English	Yes	Unclear
I START Toolkit (quick guide fact sheet)	University of British Columbia	Canada	2023	PDF handout	No	English	Yes	Yes
l START Toolkit (website)	University of British Columbia	Canada	2023	Brief article	No	English	Yes	Yes
Let's Move with Leon activity tracker	Versus Arthritis	UK	2024	PDF workbook	Yes	English	Yes	Unclear
Best Exercises for RA	Arthritis Foundation	USA	Unknown	Slideshow	No	English	Unclear	Unclear (
EIM Rx for Health Rheumatoid Arthritis	Exercise is Medicine	USA	2021	PDF handout	No	English, Spanish	Unclear	Unclear
Exercise can ease RA pain	Harvard Health Publishing	USA	May 2023	Blog post	No	English	Yes	Unclear
Audiovisual Resources								
How to stay active at home during COVID-19 (Arthritis at Home)	Arthritis Consumer Experts	Canada	April 2020	Video	No	English	Yes	Unclear
Indoor Exercise	Arthritis	Canada	May 2020	Video	Yes	English	Yes	Unclear
Snacks (Arthritis At Home Ep.16)	Consumer Experts	Canada		VIGCO		LIGISI		ļ
Snacks (Arthritis At Home Ep.16) Strong with Arthritis (Arthritis Research Education Series)	Consumer Experts Arthritis Research Canada	Canada	March 2023	Video	No	English	Yes	Yes
Snacks (Arthritis At Home <u>Ep.16)</u> Strong with Arthritis (Arthritis Research Education Series) Exercise Videos	Consumer Experts Arthritis Research Canada National Rheumatoid Arthritis Society	Canada	March 2023 October 2017	Video Video series	No	English	Yes	Yes Yes
Snacks (Arthritis At Home Ep.16) Strong with Arthritis (Arthritis Research Education Series) Exercise Videos Importance of physical activity and exercise (SMILE-RA)	Consumer Experts Arthritis Research Canada National Rheumatoid Arthritis Society National Rheumatoid Arthritis Society	Canada UK UK	March 2023 October 2017 September 2021	Video Video series Interactive platform	No No Yes	English	Yes Yes Yes	Yes Yes Yes

Let's Move with Ve Leon Ar	thritis UK	2024	Video series	Yes English	Yes Yes
Table 1: Characteristic	s of the 17 included	d physical a	ctivity resourc	es for individuals with r	heumatoid ar
HCP = Healthcare prov	vider.				
3.3 Readability					
The readability under	standahility, and as	tionability	scores of the i	actudad physical activit	v rocourcos is
ine readability, under					
summarized in Table 2	2. The mean reading	g grade leve	el of the 10 pri	nt resources was grade	9.0±1.5. Only
resource was written	at or below a sixth-	grade level	[33]. A second	resource fell within th	e seventh-grad
range [31]. All other p	rint resources requi	ired a readi	ing level of gra	de 9 or higher.	
Print Resources			FK Reading Grade	PEMAT	PEMAT
Article	Organization	Country	Readability	Understandability	Actionability
Exercise and RA	Arthritis Australia	Australia	10	80.1%	57.5%
At home exercise guide	Arthritis Research Canada	Canada	8.6	92.3%	50.0%
30-Day Exercise Challeng for Arthritis	e Arthritis Research Canada	Canada	8.9	84.0%	91.7%
Exercise for RA	Health Link BC	Canada	9.8	71.5%	30.0%
I START Toolkit: Quick guide fact sheet	University of British Columbia	Canada	8.9	82.6%	70.0%
I START Toolkit: Website	University of British Columbia	Canada	9.9	62.5%	73.3%
Let's Move with Leon activity tracker	Versus Arthritis	UK	7.0	91.2%	100.0%
Best Exercises for RA	Arthritis Foundation	USA	9.2	76.0%	28.3%

59 60

Rheumatoid Arthritis	Medicine	USA	6.4	89.4%	80.0%
Exercise can ease RA pain	Harvard Health Publishing	USA	11.5	70.8%	20.0%
	Mean (SD)		9.0 (1.5)	80.0 (9.8)%	60.0 (27.7)%
Audiovisual Resources			FK Reading Grade	PEMAT	PEMAT
Article	Organization	Country	Readability	Understandability	Actionability
How to stay active and exercise at home during COVID-19 (Arthritis At Home)	Arthritis Consumer Experts	Canada	N/A	84.3%	87.5%
Indoor Exercise Snacks Higher Intensity (Arthritis At Home)	Arthritis Consumer Experts	Canada	N/A	79.4%	100.0%
Strong with Arthritis Webinar (Arthritis Research Education Series)	University of British Columbia	Canada	N/A	71.5%	37.5%
Exercise Videos	National Rheumatoid Arthritis Society	UK	N/A	90.9%	83.3%
Importance of physical activity and exercise (SMILE-RA)	National Rheumatoid Arthritis Society	UK	N/A	91.3%	100.0%
Yoga Exercises (SMILE- RA)	National Rheumatoid Arthritis Society	UK	N/A	84.7%	100.0%
Let's Move with Leon	Versus Arthritis	UK	N/A	100.0%	100.0%
	Mean (SD)			86.0 (9.2)%	86.9 (22.9)%
able 2: Readability, un esch-Kincaid. PEMAT = .4 Understandability a	derstandability, an = Patient Educatior nd actionability	d actionab n Materials	ility of the inclu Assessment To	ded physical activity re ol.	esources. FK =
fter being assessed by	both researchers a	and patien	t partners, the n	hean understandability	ratings were
0.0±9.8% for print mat	terials and 86.0 ± 9.1	2% for aud	liovisual materia	iis (Table 2). Actionabil	ity ratings were

217 1	above 60% for understandability, 50.0% (5/10) of the included print resources and 14.3% (1/7) of the
2 21₃8	audiovisual resources had actionability ratings below 60%. The highest scoring print resources were the "Let's
4 2£9 6	move with Leon" PDF activity tracker workbook from Versus Arthritis, the "Rx for Health Rheumatoid Arthritis"
220 220	PDF information sheet from Exercise is Medicine, and the "30-day Exercise Challenge for Arthritis" from
9 221⊉ 11	Arthritis Research Canada [27, 31, 33]. All three scored above 80% for understandability and actionability.
221 <u>3</u>	Meanwhile, the highest scoring audiovisual resources were the "Let's move with Leon" video series from
14 2 23 16	Versus Arthritis and the "Importance of physical activity and exercise" interactive module on the National
224	Rheumatoid Arthritis Society's "SMILE-RA" online learning platform [39, 41]. These two scored above 90% for
19 2 25	understandability and actionability. Individual ratings for each resource are displayed in Table 2.
21 2 26 23	3.5 Exercise review
24 22/3	The quality of exercise recommendations provided was highly variable across the resources, as shown in Table
26 2 28	3. Specific exercise recommendations in at least one domain (e.g. cardiovascular, strength, balance, flexibility)
29 229	were included in 14/17 (82.4%) resources. Most resources recommended professional help from a doctor
31 2 30	(11/14, 78.6%) and exercise professional (14/14, 100%) for starting or resuming exercise after being diagnosed
334 23 <u>1</u>	with RA. Of the 14 resources with exercise recommendations, 13 (92.9%) provided cardiovascular exercise
36 2 32	recommendations, 13 (92.9%) provided strength exercise recommendations, 6 (42.9%) provided flexibility
38 233 40	exercise recommendations, and 5 (35.7%) provided balance exercise recommendations.
41 2342	Cardiovascular exercise was defined in lay terms in 5/14 (38.5%) of resources that recommended it. A
43 23 15 45	complete (i.e. specific details for all four variables: frequency, intensity, time, and type) prescription for
46 2346	cardiovascular exercise was included in only 1/13 (7.7%) of these resources. The remaining resources provided
48 2 397	فن either a partial (i.e. specific details missing for one or more variables) prescription (6/13, 46.2%) or none (6/13,
51 238	46.2%). Details for how to progress exercise gradually (6/13, 46.2%) and RA-specific exercise tailoring (i.e.
53 2 359	exercise adaptations and/or cautions for common RA symptoms) (8/13, 61.5%) were present in more than half
240 240	of these resources. Four (30.8%) resources did not provide any RA-specific tailoring for cardiovascular
58 2 4 59	exercise.

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too high c	RA-specific advice	e included	exercising	more wh	en RA sym	nptoms a	re lowest	, resting	g if symp	toms	are
affected a	reas of the hody	when flari	ng, jising a	nnronriat	te footwee	ar to mini	imize nair). ensur	ing a gra	ndual	•
warm-up a	and cool-down. a	nd startin	g slow befo	re progre	essing exe	rcise freq	juency. in	tensitv.	or time		
Resources	cautioned indivi	duals with	RA to avoi	d exercis	e during fl	are ups,	reduce in	tensity	or time i	fexe	rcise
leads to ur	nexpected pain, a	avoid vigoi	rous or higi	n impact	exercises a	at affecte	d joints, a	and retu	ırn slow	ly to	
cardiovasc	cular exercise aft	er flares o	r other med	dical ever	nts.						
Strength e	exercise was defi	ned in lay t	erms in 8/	13 (61.5%	6) of resou	rces that	recomm	ended i	t. These	resou	urces
provided e	either a complete	e (2/13, 15	.4%) or par	tial (4/13	8, 30.8%) s	trength e	exercise p	rescript	ion. Sev	en (5	3.8%
resources	did not provide a	any prescri	ption. Info	rmation	was provid	led on gr	adual exe	rcise pr	ogressic	on (4/	13,
30.8%) and	d RA-specific exe	rcise tailo	ring (8/13,	61.5%) fo	or strength	exercise	. Four (30).8%) re	sources	did n	ot
provide an	ny RA-specific tai	loring for s	trength ex	ercise.							
RA-specific	c strength trainir	ig recomm	endations	included	planning s	trength	training w	vhen syr	nptoms	are	
lowest, usi	ing water aerobi	cs to reduc	ce strain or	i joints, s	trengtheni	ng musc	les aroun	d affect	ed joints	s, usir	ıg
resistance	bands and wrap	ping them	around wr	ists if gri	o strength	is limited	d, using p	added g	loves ar	id sho	bes
for extra c	omfort, reducing	g weights a	ind duratio	n when s	ymptoms	are wors	e. Resour	ces cau	tioned a	gains	t
intense str	rength exercise d	uring flare	es and sugg	ested usi	ng braces	and prof	essional s	upervis	ion to m	inimi	ze
injury risk.	. Further details o	on the care	diovascular	and stre	ngth exerc	ise presc	riptions a	ind RA-s	specific a	advice	5
provided b	by each resource	can be fou	und in the S	Suppleme	entary File	2.					
	Professional Help	Cardiovasc	ular Exercise	Recomme	ndation	Strength	Exercise Re	commen	dation	Bala- nce	Flexi- bility
Title	Exercise Doctor Professional	Definition provided	FITT Rx	Progre- ssion	Tailored to RA	Definition Provided	FITT Rx	Progre- ssion	Tailored to RA		

30-Day Exercise Challenge for Arthritis		х		Partial	х			Complete	х	х		
At home exercise guide	х	х	х	Partial		х	х	None		x	x	
Exercise for RA	х	x		None			х	None				,
I START Toolkit (quick guide fact sheet)	x	x		None			х	None		x		
l START Toolkit (website)		х		None				None				
Strong with Arthritis (Arthritis Research Webinar)	х	х					х	Partial	х	х		
Exercise Videos	х	x		None		Х	х	Partial		х		
Importance of physical activity and exercise (SMILE-RA)	x	x		Partial	x	X						
Let's Move with Leon (Activity Tracker)	x	х	х	Partial	х	х		Partial	х	х	x	>
Let's Move with Leon (Videos)	х	x	x	Partial	х	x		Partial	х	х	x	,
Best Exercises for RA	х	х		None				None				>
Rx for Health Rheumatoid Arthritis	х	х	x	Complete	x	х	x	Complete		x	x	>

ease RA pain	>	<		х	N	one			х		х	N	one				x x
Table 3: Summa	ry of e	exerci	se rec	comm	nenda	tions	provi	ided k	by the	e inclu	ded p	hysic	al act	ivity ı	esou	rces. F	ITT =
frequency, inter	isity, t	ime, t	type.														
3.6																	
Behavior Chang	e Tech	nique	es rev	iew													
Table 4 presents	the g	roups	s of b	ehavi	or ch	ange	techn	iques	sused	l in ea	ch re	sourc	e. Ou	t of 1	6 pos	sible g	roups,
the mean numb	er of b	ehav	ior ch	nange	grou	ps us	ed wa	as 9.0	±4.4 1	for PD	F res	ource	s, 5.7:	±2.1 1	for we	ebsite	s, and
6.3±4.5 for audi	ovisua	l reso	ource	s. Five	e (29.	4%) r	esour	ces u	sed 8	or m	ore (i.	e. ove	er 50%	6) of †	the be	ehavio	or
change groups.	The re	sourc	es wi	ith th	e higi	nest n	umbe	er of b	behav	ior ch	ange	grou	os use	d we	re the	e "Let'	s move
with Leon" PDF	workb	ook a	and vi	deo s	eries	from	Versi	ıs Art	hritis	(14 b	ehavi	or ch	ange	prour		d in b	oth
resources) and t	ho"In	nort	ance	of nh	vsical	activ	vity an		arciso	" moc		vithin	tho N	ation	al Rha		oid
			·	or pri	ysicai		ity an			moc							
Arthritis Society	's SMI	LE-RA	inte	ractiv	e leai	rning	platfo	orm (1	l1 be	havio	r char	ige gr	oups	used)	[31,	39]. A	II 16
behavior change	e grou	ps we	ere us	ed in	at lea	ast on	ie res	ource	. The	least	comn	non b	ehavi	or ch	ange (group	s used
were "identity"	(Grouj	p 13),	"sch	edule	ed cor	isequ	ences	5" (Gr	oup 1	.4), ar	id "co	vert l	earnii	ng" (C	Group	16) <i>,</i> e	each
appearing in onl	y 2 res	sourc	es. In	cont	rast, '	ʻshap	ing kr	nowle	edge"	(Grou	ıp 4) a	and "r	natura	al con	seque	ences	' (Grou
5) were the mos	t com	mon,	appe	earing	in 17	/17 (100%) and	13/1	7 (76.	5%) re	esour	ces, r	espec	tively	•	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Tota /16
Print (PDF)						1									Mean	(SD)	9.0 (4.
I START Toolkit: Quick guide fact sheet	x	x	x	x	x						x						6
Let's Move with Leon Activity Tracker	x	x	x	x	x	x	x	x	x	x		x	x	x	x		14
Rx for Health Rheumatoid Arthritis	x		x	x	x			x	x		x						7
			1	1													

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At home exercise			x	x	x			x	x		x	x				x	8
Arthritis At home exercise																	
guide																	
Exercise for RA				x	x				x								3
I START Toolkit: Website	x		x	x	x	x						x					6
Best Exercises for RA			x	x	x			x	x								5
Exercise can ease RA pain			x	x	x				x								4
Audiovisual					I	I	I	I							Mea	n (SD)	6.3 (4.5)
How to stay active																	
home during COVID-19	x	x		x			x										4
Indoor Exercise Snacks Higher Intensity				x		x		x									3
I START Toolkit: strength training for RA		x		x	x			x	x		x						6
SMILE-RA:																	
physical activity and exercise	x	x	X	x	x	x		X	x	x					x	x	11
Exercise Videos				x	x	x			x								4
SMILE-RA: Yoga exercises				x		x											2
Let's Move with Leon Exercise Program	x	x	x	x	x	x	x	x	x	x		x	x	x	x		14
Total (N)	8	7	10	17	13	8	3	10	12	3	5	5	2	2	4	2	
			•			1	1	1	1		1	1	1	1			

Table 4: Overview of behavior change techniques identified in the included resources. 1 = Goals and planning.
2 = Feedback and monitoring. 3 = Social support. 4 = Shaping knowledge. 5 = Natural consequences. 6 =
Comparison of behavior. 7 = Associations. 8 = Repetition and substitution. 9 = Comparison of outcomes. 10 =
Reward and threat. 11 = Regulation. 12 = Antecedents. 13 = Identity. 14 = Scheduled consequences. 15 = Selfbelief. 16 = Covert learning.

4.0 Discussion

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4.1 Principal findings

283 Physical activity is internationally recommended as a key component of RA care, contributing to improved 19 overall health and quality of life [7-15]. Patient-facing online resources may help individuals with RA become 2& 21 285 23 and stay physically active. Through our environmental scan of online RA-specific physical activity resources, weg 24 identified 23 resources, 6 of which were excluded due to predatory advertising or medical safety concerns [25 28/9 26 287 41]. A comprehensive critical appraisal of the 17 remaining resources, 10 print and 7 audiovisual, highlighted 28 29 288 high overall understandability. Several resources stood out for having high actionability that was supported by 31 289 detailed exercise recommendations and strong use of behavior change techniques. Audiovisual resources had 33 233 higher average actionability than print resources. However, many resources left room for improvement with 36 regards to readability and actionability. These concerns were often compounded by incomplete exercise 291 38 292 40 recommendations and behavior change support, reducing the potential impact of these resources on physical 41 2943 activity behavior change.

294 4.2 Study meaning in relation to related research

46 295 Medical safety concerns continue to be a weakness among online patient resources. Alongside the present 48 298 study, where 26% of the resources were excluded due to concerns, a recent environmental scan of flare self-50 29<u>7</u> management resources excluded 32% of resources for inappropriate advertisements or medical concerns [23]. 53 298 Weight loss medications and programs were commonly advertised and often included stigmatizing language, 55 299 which could be harmful to patients. In prior work, patients expressed concerns about the poor quality of 58 patient materials, causing them to distrust online information [18]. Physical activity resources should always 30:0

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riais, causing them to distrust online information [18]. Physical activity resources should alwa For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

301 1	be reviewed by rheumatologists, exercise professionals, and patients to ensure safety prior to publication.
2 30 <u>3</u> 2	Furthermore, caution must be taken to ensure that advertisements, if present, are appropriate for the target
4 30 5 3 6	population. This can be challenging for YouTube and other social media platforms where additional
7 3024	recommendations and advertisements are automated. Some resources were flagged during expert review for
9 3 09 11	their negative tone and advanced exercise examples. To ensure that future resources empower, rather than
зdg	discourage, physical activity behavior change, emphasis on positive messaging and gradual progression is
14 30 3 16	preferable.
3018	Certain resources stood out during the critical appraisal. These resources had high understandability and
19 30 <u>0</u> 9 21	actionability scores, as well as detailed exercise and behavior change content [27, 31, 38, 39, 41]. Notable
310 23	differences between these and other resources were the presence of interactive components (e.g. follow-
24 31 <u>5</u> 15	along exercises, goal-setting prompts, self-monitoring tools) and the involvement of healthcare teams,
26 3 2 28	exercise professionals, and patients in resource development. In line with evidence-based best practices for
29 3133	creating patient materials, these findings further emphasize the importance of co-development with relevant
31 3 1 84 33	partners [42, 43]. For physical activity resources, this may include members of the target population (e.g.
3 ³⁴ 3 ¹ ₃ 5	individuals with RA), healthcare providers, exercise professionals, and behavior change experts.
36 31367 38	Whereas understandability was generally acceptable across the physical activity resources, more work is
317 40	needed to improve their readability and actionability. The average reading level in both the present work and
41 3 14<u>8</u> 43	prior studies is often above 8 th grade, with little or no patient materials meeting the recommended level of
31 9 45	grade 6 or lower [44, 45]. Adding to this challenge is the limited translation of patient materials, despite the
46 3 249	high prevalence of non-native English speakers in Canada and other English-speaking countries [46]. A
40 3249 50	common shortcoming among patient materials, noted above and across the literature, is a lack of actionability
32 <u>52</u>	[23]. Specific actionable steps are key to eliciting physical activity behavior change among RA populations [47-
53 3 23 55	49]. Close collaboration with patient partners is required to ensure that written and audiovisual content is
324	actionable. The PEMAT emphasizes the importance of including clear actions, manageable steps, tools to
58 3 259 60	support action, and visual aids to enhance actionability [21]. We noted that audiovisual content across the For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

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reviewed resources featured either stock images of healthy, younger adults or white women with RA without apparent physical limitations. More representative content is warranted to encourage physical activity behavior change across the range of ages, ethnicities, and physical abilities of RA patients. Comprehensive exercise recommendations are essential to physical activity promotion as part of RA management. First, individuals with RA need specific information on the frequency, intensity, time, and type (or FITT) of physical activity to address lack of knowledge, a common physical activity barrier in this population management. First, individuals with RA need specific information on the frequency, intensity, time, and type Š copyright [47-49]. The reviewed RA-specific physical activity resources rarely provided complete FITT recommendations or covered all 4 key domains of physical fitness: cardiovascular, strength, balance, and flexibility. Future resources should aim to address this shortcoming. Second, individuals with RA may be unsure how to continue ing being physically active after an RA diagnosis, with fears about exacerbating RA symptoms [16]. While many ₫ resources provided some RA-specific suggestions for tailoring and progressing exercise, physical activity promotion efforts in this population could benefit from standardized physical activity guidelines. Relevant tex tailoring factors may include RA history and medications, joint damage and active inflammation, joint replacement precautions, and other health concerns impacting physical activity tolerance. Such guidelines are (ABES) ata mini common for chronic conditions such as cancer and cardiovascular disease [50, 51]. Due to the breadth of ≥ important information related to the 4 physical fitness domains and RA-specific tailoring, resource developers may purposefully select content that aligns with specific aims for a patient resource. However, physical activity information alone does not necessarily lead to behavior change. Only some of the l simi included patient resources placed a strong emphasis on behavior change. These resources leveraged ihno evidence-based behavior change techniques such as goal-setting and self-monitoring, which have been shown ğ to support physical activity behavior change [52]. Many of the resources, however, focused on educating individuals with RA about the importance of physical activity but did not provide sufficient tools for helping them become and stay active. A lack of actionable behavior change advice is likely to limit the potential positive impact of these resources in RA care. Consultation with a behavior change specialist is recommended for future physical activity resources. Importantly, online resources alone may not be sufficient to promote

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353 4.3 Clinical implications

7 35z4 For rheumatology care providers, our findings have important clinical implications. The list of RA-specific 9 359 physical activity resources reviewed can serve as a useful starting point for supporting patients to set, meet, 11 35g and adjust their physical activity goals. Providers are encouraged to keep a list of available resources to refer 14 358 patients to, including information on the characteristics of the resources as well as the quality of content 16 3518 within them. Notably, the resources varied widely with respect to their purpose, content, format, complexity, 19 and actionability. For example, resources covered one or more of the following domains: education on why to 35209 21 360 23 exercise, demonstration of how to exercise, guidance on talking about exercise with a care provider, tips for 24 adopting and maintaining exercise habits, and more. This variety should be seen as a strength. Different 3**6**£ 26 3**6**2 content and delivery modes may work better for different patients. Optimal physical activity behavior change 28 29 363 support should begin with a patient-led discussion around needs, preferences, available time and resources, 31 3644 motivation, and other relevant factors [53]. The provider can then use this information to provide tailored 33 3635 recommendations to available resources or additional support as part of a "personalized medicine" approach 36 to physical activity. 366 38

4.4 Study strengths and limitations

41 3642 The strengths of our work include the involvement of patient partners to assess understandability and 43 369 45 actionability, the use of a search strategy that mimicked a real-world scenario of patients searching for 46 37ġ resources, and the in-depth critical appraisal from patient, medical, exercise, and behavioral science 48 374₽ perspectives. A limitation to the use of the PEMAT is its inherent subjectivity. To counteract this, we 50 37<u>5</u>1 3752 completed triplicate ratings for all resources. The search strategy may have led to some resources being 53 373 missed. However, resources not identified in the first 5 pages of Google search results are unlikely to be found 55 3754 by patients themselves [19]. The lack of a validated measure for assessing exercise and behavior change 58 3759 components of patient materials is also a limitation. Work is needed to develop such measures that can guide

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development and evaluation. Lastly, our patient partner team featured individuals with high health literacy
 and personal engagement in their health. This may have impacted the resultant PEMAT scores, limiting
 generalizability to all RA populations.

5.0 Conclusion

Our environmental scan of publicly available physical activity resources for individuals with RA identified 17 Protected appropriate resources. Several resources, usually developed in collaboration with healthcare teams and patient partners, stood out as highly actionable, with clear exercise recommendations and behavior change tips. Others had significant gaps with regards to actionability and lacked clear physical activity behavior change advice. Overall, there is a need for more high-quality physical activity resources for RA populations. Wherever <u>b</u> possible, resources should be developed with patient partners and content experts to optimize actionability. ₫ More work is needed to create resources that provide complete FITT recommendations for exercise and go beyond providing knowledge to truly empowering behavior change. To address health inequities, efforts must text be made to create accessible resources for underserved populations. The use of more diverse audiovisual content and translation into other languages represent two steps in the right direction. A bigger library of excellent physical activity resources will better support the different needs, capabilities, and considerations of ,≥ individuals with RA. Further research is also needed to develop and implement more intensive physical activity training interventions for patients where resources alone are insufficient to promote behavior change.

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Author contributions

ME: Conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project

administration, resources, supervision, visualization, writing – original draft, writing – reviewing and editing. For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml technologies

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24 4 <u>1</u> 2 <u>3</u> 26	physical activity resources for individuals with rheumatoid arthritis.	ruary 2 Enseig ses rel:
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5 69 50	Adults: Motivational Interviewing. Journal of Gerontological Nursing. 2014 Nov 1;40(11):26-3
51 566 53	Tables and Figures
5 67 55	Figure 1: Flow diagram of environmental scan and critical appraisal of physical activity resources for
568 58	with rheumatoid arthritis.
59 60	For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

BMJ Open: first published as 10.1136/bmjopen-2024-094220 on 20 February 2025. Downloaded from http://bmjopen.bmj.com/ on June 13, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies. 1 Table 1: Characteristics of the 17 included physical activity resources for individuals with rheumatoid arthritis. 57₃0 HCP = Healthcare provider. 57⁄1 6 Table 2: Readability, understandability, and actionability of the included physical activity resources. SD =

Standard deviation. FK = Flesch-Kincaid. PEMAT = Patient Education Materials Assessment Tool.

Table 3: Summary of exercise recommendations provided by the included physical activity resources. FITT =

frequency, intensity, time, type.

Table 4: Overview of behavior change techniques identified in the included resources. SD = Standard

deviation. 1 = Goals and planning. 2 = Feedback and monitoring. 3 = Social support. 4 = Shaping knowledge. 5

Natural consequences. 6 = Comparison of behavior. 7 = Associations. 8 = Repetition and substitution. 9 =

Comparison of outcomes. 10 = Reward and threat. 11 = Regulation. 12 = Antecedents. 13 = Identity. 14 =

Scheduled consequences. 15 = Self-belief. 16 = Covert learning.

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Figure 1: Flow diagram of environmental scan and critical appraisal of physical activity resources for individuals with rheumatoid arthritis.

265x279mm (144 x 144 DPI)

Supplementary File 1

Complete list of search terms for the environmental scan of publicly available online physical activity resources for individuals with rheumatoid arthritis.

Rheumatoid Arthritis	Physical Activity	Additional Descriptors	
Rheumatoid arthritis	Physical activity	Resource	
Rheumatology	Exercise	Handout	
Arthritis	Sports	Program	
Inflammatory arthritis	Movement	Group	
	Fitness	Manual	
	Exercising	Canada	
	Strength exercise	US	
		UK	
	Exercise training		
Page	35	of	35
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Supplementary File 2	
Detailed exercise recommendations provi	ided by each included resource.
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		Professio	onal Help		Cardiovas	cular/Aerobi	c Exercise Re	commendat	ions			Strength/R	esistance I		mindation	15			Other re	commend
Title	Organization	Doctor	Exercise Professional	Personal Trainer	Definition provided	Frequency (weekly)	Intensity	Time (minutes)	Types	Progression	Tailored to RA	Definition Provided	Frequency (weekly)	Intensity	Tige (ses/reps)	Types	Progression	Tailored to RA	Balance	Stretchin
Exercising with Rheumatoid Arthritis	Exercise is Medicine	Y	Y	N	N	3-4	M-V	75-150 /week	Water; Activities you enjoy; variety	Y	Y	N	2-3	nclųdi	203 sets 10-15 reps	All major muscle groups; water; machines; free weights; body weight	N	Y	N	Y
Best Exercises for RA	Arthritis Foundation	Y	Y	N	N	N/S	N/S	N/S	Walking; Water; Biking	N	Ν	N	N/S	nguf	1 2N/S	Water; Weight training	Ν	N	N	Y
30-Day Exercise Challenge for Arthritis	Arthritis Research Canada	N	Y	N	N	3-5	N/S	30/day	Walking; Biking; Water; Zumba; Golf; Gardening; Dancing; Exercise Games; Outdoor; Cardio Machines	Y	N	N	2-3	6-7/10 6-7/10 95 6-7/10	P-3 sets D 12 reps	Resistance bands; free weights;	Y	Y	N	N
9 Best Excercises for RA pain	Medical News Today	Y	Y	N	N	N/S	N/S	N/S	Walking; Water; Biking	Y	Y	N	N/S	N/8	ZN/S	Resistance bands; grip strength (hands, wrists)	N	N	N	Y
Exercise can ease RA pain	Harvard Health Publishing	N	Y	N	Y	N/S	N/S	N/S	Walking; Water; Biking	N	Y	Y	N/S	ated ≥	025	lsometrics; free weights; weight machines	N	N	Y	Y
Make an Exercise Plan for RA	WebMD	Y	Y	Y	Y	5	N/S	30/day	Walking; biking; water; dance;	Y	Y	N	N/S	N/D		Free weights; resistance bands	Ν	N	N	Y
Exercise for RA	Health Link BC	Y	Y	N	N	N/S	N/S	N/S	Walking	N	N	Y	N/S	ext a	wnlo	N/S	Ν	N	N	Y
Exercise helps ease arthritis pain and stiffness	MayoClinic	Y	Y	Ν	Y	Most days	Somewhat hard	150/week	Walking; water; biking	Y	Y	Y	2+	nd dat	aded f	All major muscle groups; resistance bands; free weights; weight machines	N	N	N	Y
Exercise and RA	Arthritis Australia	Y	Y	N	N	N/S	N/S	N/S	Water;	Y	Y	Y	N/S	a maini ≥∕ini		Free weights; weight machines; resistance bands; bodyweight	Ν	N	N	N
RA Exercises that are easy on your joints	WebMD	Y	Y	Y	N	Most days	м	30-60 /day	Stair climbing; walking; dancing; cardio machines; water	Y	Y	N	2-3	ing _≥ A	ttp://b	Free weights; weight machines; resistance bands; isometrics	Ν	Y	N	Y
7 Essential Everyday Exercises to Manage RA Pain	Healthline	Y	N	Y	N	N/S	N/S	N/S	Water; Biking; walking; cardio machines;	N	Y	N	2-3	N/S	N/S	Free weights; resistance bands	N	Y	N	Y
I START Toolkit (quick guide fact sheet)	University of British Columbia	Y	Y	N	N	N/S	N/S	N/S	N/S	Ν	N	Y	N/S	ning ≥	N/S	Resistance bands; free weights; body weight	Ν	Y	N	Ν
I START Toolkit (website)	University of British Columbia	N	Y	N	N	N/S	N/S	N/S	N/S	N	Ν	N	N/S	N/Sa	N/S	N/S	Ν	N	N	Ν
Rx for Health Rheumatoid Arthritis	Exercise is Medicine	Y	Y	N	Y	3-5	M-V; Somewhat hard	75-150 /week	Walking; biking; elliptical; rowing; water	Y	Y	Y	2-3	M-VS (start Imnt)	2-3 sets	Free weights; resistance bands; weight machines; body weight; all major muscle groups	N	Y	Y	Y
At home exercise guide	Arthritis Research Canada	Y	Y	N	Y	N/S	M; Talk but not sing	N/S	Dance; stair climbing; walking; boxing/martial arts; intervals	N	Y	Y	N/S	ilar, te	on Ju	Body weight; resistance bands; free weights; weight machines; household items	N	Y	Y	N
Let's Move with Leon (Activity Tracker)	Versus Arthritis	Y	Y	N	Y	N/S	M-V	75-150 /week	M: brisk walk, swim, cycle; V: climb stairs, run, sports	Y	Y	N	2	chnolo ≥	ne 13, 2	Gym (specific upper, lower, and core exercises); yoga; heavy carrying	Y	Y	Y	Y
Let's Move with Leon (Videos)	Versus Arthritis	Y	Y	N	Y	N/S	M-V	75-150 /week	M: brisk walk, swim, cycle; V: climb stairs, run, sports	Y	Y	N	2	gies, ⊳∕,	2025 at	Gym (specific upper, lower, and core exercises); yoga; heavy carrying	Y	Y	Y	Y
Exercise Videos	National Rheumatoid Arthritis Society	Y	Y	N	N	N/S	N/S	N/S	N/5	N	Y	Y	N/S	N/S	Agence	Arm raises; sit to stand; wrist alphabet; seated leg and feet exercises; grip strength; supported lunge; chair push up	N	Y	N	N
Strong with Arthritis Webinar (Arthritis Research Education Series Ep.9)	University of British Columbia	Y	Y	N								Y	N/S	6-8/10 RPE	Biblig sets 1015 reps	Body weight; resistance bands; weight training machines; push, pull, squat/lunge, hinge, lateral, rotation	Y	Y	N	N
Importance of physical activity and exercise (SMILE-RA)	National Rheumatoid Arthritis Society	Y	Y	N	N	N/S	N/S	N/S	Low impact; swimming; walking; cycling; return to regular activities;	Y	Y				phique				N	N

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Online physical activity resources for individuals with rheumatoid arthritis: An environmental scan and quality appraisal

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Keywords:	Exercise, RHEUMATOLOGY, Self-Management, Person-Centered Care, Physical Fitness

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Article Title

Online physical activity resources for individuals with rheumatoid arthritis: An environmental scan and quality appraisal

Abstract

Objectives: To review publicly available physical activity (PA) resources for individuals with rheumatoid arthritis (RA). Aims were to find online print and audiovisual resources, review their characteristics, and critically examine their quality from medical, exercise, and behavioral science perspectives. Design: An environmental scan was completed using the Google search engine, following a pragmatic

approach to reviewing patient-facing self-care resources.

Protected by copyright, including Data sources: We used combinations of common search terms for RA and PA. The first 5 pages of results were ð uses reviewed for patient-facing resources.

Eligibility criteria: Resources were included if they were (1) included RA-specific content, (2) provided specific PA recommendations, (3) written in English, and (4) freely available.

Data extraction and synthesis: Two independent experts completed a medical review of resources to ensure appropriateness for RA. Data was then extracted by two reviewers using a standardized template to record resource characteristics. Two research team members and two patient partners independently evaluated resources for readability, understandability, and actionability. Lastly, the quality of exercise recommendations and behavior change technique use was evaluated by an expert reviewer.

Results: The search yielded 23 RA-specific PA resources, 17 of which passed the medical review. All 10 print resources and 7 audiovisual resources were created in English-speaking countries. The mean reading grade was 9.0±1.5. Print resources had mean understandability of 80.0±9.8% and actionability of 60.0±27.7%.

Audiovisual materials had mean understandability of 86.0±9.2% and actionability of 86.9±22.9%. The quality of

exercise recommendations was low. Only 1 resource provided comprehensive cardiovascular exercise advice,

and 2 resources provided comprehensive strength exercise advice. 3-14 behavior change technique groups

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were featured in each resource. The most common groups were "shaping knowledge" and "natural 25 2 26 consequences". 4

Conclusions: The quality of RA-specific PA resources is variable. Some high-quality resources exist that provide actionable PA behavior change advice. Healthcare teams may refer patients to these resources. However, more work is needed to improve the overall guality of resources. Co-development with patients, providers, and exercise behavior change experts is recommended, ensuring resources are actionable, contain clear exercise recommendations, and promote behavior change.

Strengths and limitations of this study

- The study provides a comprehensive overview and critical appraisal of publicly available physical activity resources for individuals with rheumatoid arthritis.
- A critical appraisal was completed by a rheumatologist, patient partners with lived experiences of rheumatoid arthritis, researchers, and an exercise and behavior change expert.
- All resources were evaluated using standard measures for readability, understandability, actionability, exercise recommendations, and behavior change techniques.
- ita mining, Due to the inherent subjectivity of the tool used to assess understandability and actionability, triplicate Al training, ratings were completed for each resource to minimize subjective biases.
- Patient partners were individuals with high health literacy and personal engagement with their health,

which may impact certain scores and their generalizability to the broader RA population.

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Declaration of competing interests

The authors have no conflicts of interest to declare.

Abbreviations

DMARDs = Disease-Modifying Anti-Rheumatic Drugs

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(ABES

49 1 FITT = Frequency, Intensity, Time, Type HCP = Healthcare Provider PA = Physical Activity PEMAT = Patient Education Materials Assessment Tool RA = Rheumatoid Arthritis

1.0 Introduction

Protected by copyright, Rheumatoid arthritis (RA) is a chronic autoimmune inflammatory disease affecting around one percent of Canadians [1]. Chronic inflammation of the joints and throughout the body leads to systemic problems, including compromised function, and reduced quality of life [2]. Despite significant improvements in RA treatment due to the emergence of new classes of disease-modifying anti-rheumatic drugs (DMARDs), individuals living with ₫ RA continue to face daily challenges [3-5]. These challenges include unpredictable disease flare ups, changes in disease activity, debilitating chronic fatigue and pain, and significant psychological distress [5]. Effective disease self-management (or self-care, as preferred by patients) between regularly scheduled followup appointments is critical to quality RA care. Indeed, major international rheumatology associations such as ita mining the European League Against Rheumatology (EULAR) recommend the implementation of self-management Al training, and similar technologies strategies for RA care [6]. Recommended strategies include patient education, goal setting and problem solving, lifestyle advice, and connecting patients to resources [6]. Physical activity is strongly recommended as part of effective RA self-management [6-8]. Regular physical activity can positively impact many disease-related and general health outcomes among RA populations [7-13]. For example, physical activity can significantly reduce fatigue, pain, and inflammation while improving

functional ability and body composition [9-11]. It is positively associated with better strength and

cause mortality [9, 12, 13]. The health benefits of regular physical activity can also reduce individual- and

cardiorespiratory fitness and enhanced quality of life, while reducing the risk of cardiovascular disease and all-

system-level healthcare costs [14]. Unfortunately, individuals with RA report lower than average physical

activity levels, and physical activity support in routine RA clinical care remains limited [9, 15]. For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Greater efforts are needed to help individuals with RA become and stay physically active as part of their dayto-day disease self-management. Individuals with RA lack disease-specific physical activity resources, express doubts about the safety and effectiveness of physical activity, and rarely receive physical activity advice from their care team [16]. Publicly available, RA-specific physical activity resources may be helpful for addressing these problems. However, the quality of online health information is highly variable, and individuals with chronic conditions struggle to find suitable, credible high-quality resources [17, 18]. They may also find it difficult to discern what recommendations are appropriate given their current concerns.

living with RA. Specific goals were to identify available resources, provide an overview of their characteristics, and critically examine their quality. High-quality resources identified herein can serve as a foundation for patients and providers to improve physical activity behavior change as part of RA self-management. Meanwhile, the shortcomings among existing resources can inform future research and development.

2.0 Materials and methods

We completed an environmental scan and critical appraisal of publicly available online resources on physical activity for individuals living with rheumatoid arthritis [19]. Environmental scans are a form of pragmatic content review that has been used extensively in healthcare to understand the quantity and quality of available health resources such as patient education materials [19].

2.1 Patient and public involvement

Patient partners with lived experiences of RA were involved throughout the study. The study was conducted in direct response to conversations with patient partners and reports in the literature that indicate challenges with accessing high-quality information on physical activity. Their opinions informed the study design, including the search strategy and selection of measures for critical appraisal. Furthermore, three patient partners were involved in assessing understandability and actionability of the included resources. Patient partners were recruited from existing relationships with patients involved in a larger project being conducted by the research team on improving physical activity support for individuals living with RA. Individuals with For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

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123 1	A data extraction spreadsheet was used to record resource characteristics including URL, title, organization,	
2 12₃4	country of origin, date created or last updated, format (print, audiovisual), type (e.g. blog post, slideshow, PDF	
125 6	handout, video), and interactivity. A resource was deemed to be interactive if it prompted the user to	
7 126	complete an action or answer a question while viewing the content. If reported, additional data was recorded	
9 1 219 11	on the availability of translated versions of the resource, as well as the involvement of healthcare	Prot
	professionals or patient partners in resource development.	ected b
14 1 29 16	2.4 Critical Appraisal	DV CODY
130	The included resources underwent a comprehensive critical appraisal for medical appropriateness, readability,	riaht, i
19 1 31) 21	understandability, actionability, quality of exercise recommendations, and use of behavior change techniques.	ncludin
$1\frac{22}{23}$	While physical activity is any body movement that expends energy, exercise is a subset of structured, planned	la for u
24 13)3 26	physical activity that aims to improve physical fitness [22]. The focus of the critical appraisal was specifically on	ses rel
20 1 3 4 28	exercise.	ated to
29 135	2.4.1 Medical Review	text ar
136 33	The medical review was completed by a rheumatologist (CB) on the research team, in collaboration with	id data
137	research co-lead (ME), an exercise specialist with a PhD in Kinesiology focusing on exercise psychology among	mining
36 1 38 38	individuals with chronic conditions. Each resource was reviewed to ensure that the content was safe and	i. Al tra
139 40	appropriate for patients with RA in the opinion of a rheumatologist. Factors considered included (1) whether	ining, a
41 1 4<u>10</u> 43	information provided in the resource about RA and its management was medically accurate, as well as, (2)	and sim
141 45	whether the exercise recommendations would be safe from a medical perspective for patients with RA. Each	nilar tec
46 1 42 48	resource received a yes/no rating along with additional comments for consideration by the research co-lead	hnolog
48 1 43 50	(ME). Both team members met to discuss resources and achieve consensus on final decisions to include or	lies.
144 52	exclude the resource. Only resources that had no concerns across both factors were approved as medically	
55 1 49 55	suitable for the general population of RA patients, based on clinical experience. Resources with any concerns	
1456	were deemed unsuitable and excluded from further review.	
58 1 4 9	2.4.2 Readability	

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148 1 The validated and widely used Flesch-Kincaid Reading Grade score was used to assess readability [23]. It has 2 149 demonstrated both content- and criterion-related validity across various written materials. Document text 4 150 was copied into Microsoft Word and the Flesch-Kincaid Reading Grade score was calculated using the 6 7 1531 automated proofreading tools in Microsoft Word. The formula used is 0.39*mean words per sentence + 9 152 11.8*mean syllables per word – 15.59. Numbers range from 1-18, corresponding to the United States school Protected by copyright, including 11 15 13 grade reading level required to understand the resource. Grade 1-5 is a primary school, grades 6-8 middle 14 school, and grades 9-12 correspond to secondary/high school in this system. Scores of 13-15 are considered 154 16 1515 18 college reading level and 15-18 is considered post-graduate level. 19 2.4.3 Understandability and Actionability 156 21 157 23 Understandability and actionability were assessed using the Patient Education Materials Assessment Tool ð uses related 24 (PEMAT) [24]. This tool has demonstrated strong internal consistency and reliability, can be used by both 158 26 139 researchers and patient partners, and can be used for both print (PEMAT-P, 24 items) and audio-visual 28 29 160 text (PEMAT-A/V, 17 items) resources. The understandability domain includes evaluation of 6 sub-domains for 31 162 content, word choice and style, use of numbers, organization, layout and design, and use of visual aids. 33 1<u>6</u>34 Actionability measures the degree to which a resource provides specific actionable steps for patients using the Вu 36 ≥ provided information (e.g. feasibility, specificity, relevance). The PEMAT user guide includes specific 163 38 164 40 instructions for the rating of each item as 1 (agree), 0 (disagree), or not applicable [25]. All assessors adhered 41 1645 closely to the PEMAT user guide for rating each resource [25]. Researchers and patient partners were trained S 43 lar technologies 160 using the PEMAT user guide PDF and a virtual 1:1 session with a member of the research team (KD) as needed 46 1647 [25]. Those with no prior PEMAT experience (ME) completed a practice session with an experienced PEMAT 48 168 rater (KD) to ensure consistency. 50 51 169 To ensure consistency, each resource was reviewed by 3 assessors: 2 researchers (ME and KD) and 1 patient 53 1769 partner (Either AM, CG, or GL). Discrepancies between researcher ratings were resolved by open discussion to 55 175 achieve a consensus researcher score. Understandability and actionability scores, as well as overall PEMAT 58

132 scores, were calculated according to PEMAT scoring guidelines [24]. The percentage of possible points 60 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

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179 2.4.4 Exercise Recommendations Review

178 The exercise review was completed by a clinical exercise specialist (ME) on the research team. Each resource 14 179 was reviewed in detail to assess the presence of exercise recommendations, exercise cautions, specific and 16 180 actionable exercise tips, and tailored exercise advice for rheumatoid arthritis. This information was recorded using a standard data extraction spreadsheet, with separate sections for cardiovascular, strength, balance, and 19 181 21 182 23 stretching exercise. Exercise types that were not mentioned at all were left blank in the data extraction spreadsheet. Meanwhile, missing information was noted as "not specified". Recommendations to consult with 24 183 26 184 a healthcare professional or qualified exercise professional were recorded. 28

185 2.4.5 Behavior Change Techniques Review

186 The behavioral review was completed by a physical activity behavior change expert (ME) on the research 33 18<u>3</u>4 team. To assess the use of behavior change techniques for physical activity behavior, each resource was 36 reviewed using a standard data extraction spreadsheet based on the behavior change technique taxonomy 188 38 189 40 [26]. This taxonomy is the gold standard for classifying behavior change techniques in physical activity 41 1940 behavior change research. The presence of behavior change techniques was recorded across the 16 groups 43 1**91** 45 from the behavior change technique taxonomy. Groups were either considered present, if one or more 46 197 techniques from that group were identified, or absent, if none of the techniques were used.

3.0 Results

An overview of the environmental scan phases is shown in Figure 1. Our initial search yielded 33 potential resources. After screening the resources, 10 of them were excluded as they did not meet our inclusion criteria. Eight of these were landing pages for in-person or online exercise programs. One was not available in English,

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3.1 Medical review

After completing the medical review, 17 resources were approved as safe and appropriate for individuals with RA [27-43]. Six resources were excluded due to concerns about appropriateness for individuals with RA (1/23), Provide the (2/23) Notable concerns among the excluded resources were the l by copyright, recommendation of potentially unsuitable weight-bearing exercises (e.g. push-ups and other exercises that load the hands and wrists) without sufficient modification for RA patients with joint symptoms, as well as blanket statements to avoid certain exercises (e.g. high impact, high intensity), which may still be suitable for individuals with well-controlled RA. In contrast, another resource wrote that "exercise is uncomfortable for 85% of people with RA". The statement was not supported by scientific evidence and may discourage physical activity engagement despite its many benefits. Some resources were deemed inappropriate due to predatory advertisements (e.g. weight loss medications) and stock images (e.g. able-bodied, younger white women) that are not representative of the RA population. The critical appraisal was completed only for the 17 resources that passed the medical review.

advertisements (e.g. weight loss medications) and stock images (e.g. able-bodied, younger white women) that are not representative of the RA population. The critical appraisal was completed only for the 17 resources hat passed the medical review. <i>B.2 Resource characteristics</i> Of these 17 resources, 14 were created or updated between 2020-2024 (Table 1). All resources originated rom English-speaking countries, including the USA (n=3), Canada (n=8), UK (n=5), and Australia (n=1). Ten esources were print materials of various formats (Blog post, brief article, slideshow, PDF), whereas the emainder were audiovisual resources (e.g. videos, multimedia materials). Only 6 resources included an interactive component. The involvement of healthcare professionals and patient partners was documented in .4 and 8 resources, respectively. A single resource was available in Spanish and English. All others were only available in English. Table 1 presents the characteristics for each resource.				Data				HCDs	.
advertisements (e.g. weight loss medications) and stock images (e.g. able-bodied, younger white women) that are not representative of the RA population. The critical appraisal was completed only for the 17 resources hat passed the medical review. B.2 Resource characteristics Of these 17 resources, 14 were created or updated between 2020-2024 (Table 1). All resources originated rom English-speaking countries, including the USA (n=3), Canada (n=8), UK (n=5), and Australia (n=1). Ten esources were print materials of various formats (Blog post, brief article, slideshow, PDF), whereas the emainder were audiovisual resources (e.g. videos, multimedia materials). Only 6 resources included an interactive component. The involvement of healthcare professionals and patient partners was documented in .4 and 8 resources, respectively. A single resource was available in Spanish and English. All others were only	vailable in E	English. Table 1 prese	ents the cl	naracterist	tics for each	resource.			
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advertisements (e.g. weight loss medications) and stock images (e.g. able-bodied, younger white women) that are not representative of the RA population. The critical appraisal was completed only for the 17 resources hat passed the medical review. <i>R.2 Resource characteristics</i> Of these 17 resources, 14 were created or updated between 2020-2024 (Table 1). All resources originated rom English-speaking countries, including the USA (n=3), Canada (n=8), UK (n=5), and Australia (n=1). Ten esources were print materials of various formats (Blog post, brief article, slideshow, PDF), whereas the	emainder w	vere audiovisual reso	ources (e.g	. videos, n	nultimedia	materials). Onl	y 6 resourc	es include	d an
advertisements (e.g. weight loss medications) and stock images (e.g. able-bodied, younger white women) that are not representative of the RA population. The critical appraisal was completed only for the 17 resources hat passed the medical review. <i>R.2 Resource characteristics</i> Of these 17 resources, 14 were created or updated between 2020-2024 (Table 1). All resources originated rom English-speaking countries, including the USA (n=3), Canada (n=8), UK (n=5), and Australia (n=1). Ten	esources we	ere print materials o	f various f	ormats (Bl	og post, br	ef article, slide	show, PDF), whereas	the
advertisements (e.g. weight loss medications) and stock images (e.g. able-bodied, younger white women) that are not representative of the RA population. The critical appraisal was completed only for the 17 resources hat passed the medical review. <i>B.2 Resource characteristics</i> Of these 17 resources, 14 were created or updated between 2020-2024 (Table 1). All resources originated	rom English-	-speaking countries,	including	the USA (ı	n=3), Canac	a (n=8), UK (n=	=5), and Au	stralia (n=	1). Ten
advertisements (e.g. weight loss medications) and stock images (e.g. able-bodied, younger white women) that are not representative of the RA population. The critical appraisal was completed only for the 17 resources hat passed the medical review. 2.2 Resource characteristics)f these 17 r	resources, 14 were c	created or	updated b	etween 20	20-2024 (Table	1). All resc	ources orig	ginated
advertisements (e.g. weight loss medications) and stock images (e.g. able-bodied, younger white women) that are not representative of the RA population. The critical appraisal was completed only for the 17 resources hat passed the medical review.	2.2 Resource	characteristics							
ndvertisements (e.g. weight loss medications) and stock images (e.g. able-bodied, younger white women) that are not representative of the RA population. The critical appraisal was completed only for the 17 resources	hat passed t	the medical review.							
idvertisements (e.g. weight loss medications) and stock images (e.g. able-bodied, younger white women) that	re not repre	esentative of the RA	populatio	n. The crit	ical apprais	al was comple	ted only for	the 17 re	sources
		nts (e.g. weight loss	medicatio	ns) and st	ock images	(e.g. able-bod	ed, younge	er white wo	omen) that

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			or Updated					
Print Resources								
Exercise and RA	Arthritis Australia	Australia	June 2024	Brief article	No	English	Unclear	Unclea
At home exercise guide	Arthritis Research Canada	Canada	July 2022	Brief article	No	English	Yes	Yes
30-Day Exercise Challenge for Arthritis	Arthritis Research Canada	Canada	January 2020	PDF workbook	Yes	English	Yes	Unclea
Exercise for RA	Health Link BC	Canada	September 2022	Brief article	No	English	Yes	Unclea
I START Toolkit (quick guide fact sheet)	University of British Columbia	Canada	2023	PDF handout	No	English	Yes	Yes
l START Toolkit (website)	University of British Columbia	Canada	2023	Brief article	No	English	Yes	Yes
Let's Move with Leon activity tracker	Versus Arthritis	UK	2024	PDF workbook	Yes	English	Yes	Unclea
Best Exercises for RA	Arthritis Foundation	USA	Unknown	Slideshow	No	English	Unclear	Unclea
EIM Rx for Health Rheumatoid Arthritis	Exercise is Medicine	USA	2021	PDF handout	No	English, Spanish	Unclear	Unclea
Exercise can ease RA pain	Harvard Health Publishing	USA	May 2023	Blog post	No	English	Yes	Unclea
Audiovisual Resources								
How to stay active at home during COVID-19 (Arthritis at Home)	Arthritis Consumer Experts	Canada	April 2020	Video	No	English	Yes	Unclea
Indoor Exercise Snacks (Arthritis At Home Ep.16)	Arthritis Consumer Experts	Canada	May 2020	Video	Yes	English	Yes	Unclea
Strong with Arthritis (Arthritis Research Education Series)	Arthritis Research Canada	Canada	March 2023	Video	No	English	Yes	Yes

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Exercise Videos	National Rheumatoid Arthritis Society	UK	October 2017	Video series	No	English	Yes	Yes
Importance of physical activity and exercise (SMILE-RA)	National Rheumatoid Arthritis Society	UK	Septembe 2021	r Interactive platform	Yes	English	Yes	Yes
Yoga Exercises (SMILE-RA)	National Rheumatoid Arthritis Society	UK	Septembe 2021	r Video	Yes	English	Yes	Yes
Let's Move with Leon	Versus Arthritis	UK	2024	Video series	Yes	English	Yes	Yes
							rocour	
The readability, un summarized in Tab resource was writt range [33]. All othe	derstandabilit le 2. The mea en at or belov er print resour	ry, and ac n reading v a sixth-g rces requi	tionability s grade leve grade level red a readin	cores of the i l of the 10 pri [35]. A second ng level of gra	ncluded p nt resourc d resource ide 9 or hij	hysical activit ces was grade fell within the gher.	9.0±1.5 e sevent	rces is 5. Only one th-grade
The readability, un summarized in Tab resource was writt range [33]. All othe Print Resources	derstandabilit le 2. The mea en at or belov er print resour	ry, and ac n reading v a sixth-g rces requi	tionability s grade leve grade level red a readin	icores of the i l of the 10 pri [35]. A second ng level of gra FK Reading Grade	ncluded p nt resource d resource ide 9 or hig PEN	hysical activit ces was grade fell within the gher. IAT	9.0±1.5 e sevent	rces is 5. Only one th-grade
The readability, un summarized in Tab resource was writt range [33]. All othe Print Resources Article	derstandabilit le 2. The mea en at or belov er print resour Organiz	ry, and ac n reading v a sixth-g ces requi	tionability s grade leve grade level red a readin Country	cores of the i l of the 10 pri [35]. A second ng level of gra FK Reading Grade Readability	ncluded p nt resource ide 9 or hij PEN Und	hysical activit es was grade fell within the gher. IAT erstandability	9.0±1.5 e sevent PEMA Action	rces is 5. Only one th-grade AT aability
The readability, un summarized in Tab resource was writte range [33]. All othe Print Resources Article Exercise and RA	derstandabilit le 2. The mea en at or belov er print resour Organiz Arthritis	ry, and ac n reading v a sixth-g rces requi zation	tionability s grade leve grade level red a readin Country Australia	icores of the i l of the 10 pri [35]. A second ng level of gra FK Reading Grade Readability 10	ncluded p nt resource ide 9 or hi PEN Und	hysical activity ces was grade fell within the gher. IAT erstandability	9.0±1.5 e sevent PEMA Action	rces is 5. Only one th-grade AT
The readability, un summarized in Tab resource was writte range [33]. All othe Print Resources Article Exercise and RA At home exercise guid	derstandabilit le 2. The mea en at or belov er print resour Organiz Arthritis de Arthritis Canada	zy, and ac n reading v a sixth-g ces requi zation Australia Research	tionability s grade leve grade level red a readin Country Australia Canada	icores of the i l of the 10 pri [35]. A second ng level of gra FK Reading Grade Readability 10 8.6	ncluded p nt resource ide 9 or hig PEN Und 80.19	hysical activity ces was grade fell within the gher. IAT erstandability %	9.0±1.5 e sevent PEMA Action 57.5%	rces is 5. Only one th-grade AT aability
The readability, un summarized in Tab resource was writte range [33]. All othe Print Resources Article Exercise and RA At home exercise guid 30-Day Exercise Chall for Arthritis	derstandabilit le 2. The mea en at or belov er print resour Organiz Arthritis de Arthritis Canada enge Arthritis Canada	ry, and ac n reading v a sixth-g ces requi zation Australia Research Research	tionability s grade leve grade level l red a readin Country Australia Canada	icores of the i l of the 10 pri [35]. A second ng level of gra FK Reading Grade Readability 10 8.6	ncluded p nt resource ide 9 or hig PEN Und 80.19 92.39	hysical activity ces was grade fell within the gher. IAT erstandability %	9.0±1.5 e sevent PEMA Action 57.5% 50.0% 91.7%	rces is 5. Only one th-grade AT hability
The readability, un summarized in Tab resource was writte range [33]. All othe Print Resources Article Exercise and RA At home exercise guid 30-Day Exercise Chall for Arthritis Exercise for RA	derstandabilit le 2. The mea en at or belov er print resour Organiz Arthritis de Arthritis Canada enge Arthritis Canada Health Li	ry, and ac n reading v a sixth-g rces requi zation Australia Research Research	tionability s grade leve grade level l red a readin Country Australia Canada Canada	icores of the i I of the 10 pri [35]. A second Ing level of gra FK Reading Grade Readability 10 8.6 8.9 9.8	ncluded p nt resource ide 9 or hig PEN Und 80.19 92.39 84.09 71.59	hysical activity ces was grade fell within the gher. IAT erstandability %	9.0±1.5 e sevent PEMA Action 57.5% 50.0% 91.7% 30.0%	rces is 5. Only one th-grade AT hability

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I STAKT TOOIKIT: WEDSITE	British Columbia	Canada	9.9	02.3%	/3.3%
Let's Move with Leon activity tracker	Versus Arthritis	UK	7.0	91.2%	100.0%
Best Exercises for RA	Arthritis Foundation	USA	9.2	76.0%	28.3%
EIM Rx for Health Rheumatoid Arthritis	Exercise is Medicine	USA	6.4	89.4%	80.0%
Exercise can ease RA pain	Harvard Health Publishing	USA	11.5	70.8%	20.0%
	Mean (SD)		9.0 (1.5)	80.0 (9.8)%	60.0 (27.7)%
Audiovisual Resources			FK Reading Grade	PEMAT	PEMAT
Article	Organization	Country	Readability	Understandability	Actionability
How to stay active and exercise at home during COVID-19 (Arthritis At Home)	Arthritis Consumer Experts	Canada	N/A	84.3%	87.5%
Indoor Exercise Snacks Higher Intensity (Arthritis At Home)	Arthritis Consumer Experts	Canada	N/A	79.4%	100.0%
Strong with Arthritis Webinar (Arthritis Research Education Series)	University of British Columbia	Canada	N/A	71.5%	37.5%
Exercise Videos	National Rheumatoid Arthritis Society	UK	N/A	90.9%	83.3%
Importance of physical activity and exercise (SMILE-RA)	National Rheumatoid Arthritis Society	UK	N/A	91.3%	100.0%
Yoga Exercises (SMILE- RA)	National Rheumatoid Arthritis Society	UK	N/A	84.7%	100.0%
Let's Move with Leon	Versus Arthritis	UK	N/A	100.0%	100.0%
	Maan (SD)			86.0 (9.2)%	86 9 (22 9)%

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229 3.4 Understandability and actionability

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7 23g0 After being assessed by both researchers and patient partners, the mean understandability ratings were 9 23Ŷ 80.0±9.8% for print materials and 86.0±9.2% for audiovisual materials (Table 2). Actionability ratings were 11 12 23 lower for print materials (60.0±27.7%) than audiovisual materials (86.9±22.9%). Whereas all resources scored 14 23₿ above 60% for understandability, 50.0% (5/10) of the included print resources and 14.3% (1/7) of the 16 234 2348 audiovisual resources had actionability ratings below 60%. The highest scoring print resources were the "Let's 19 230 move with Leon" PDF activity tracker workbook from Versus Arthritis, the "Rx for Health Rheumatoid Arthritis 21 2<u>36</u> PDF information sheet from Exercise is Medicine, and the "30-day Exercise Challenge for Arthritis" from 24 2337 Arthritis Research Canada [29, 33, 35]. All three scored above 80% for understandability and actionability. 26 238 28 Meanwhile, the highest scoring audiovisual resources were the "Let's move with Leon" video series from 29 Versus Arthritis and the "Importance of physical activity and exercise" interactive module on the National 239 31 240 Rheumatoid Arthritis Society's "SMILE-RA" online learning platform [41, 43]. These two scored above 90% for 33 34 2435 understandability and actionability. Individual ratings for each resource are displayed in Table 2.

3.5 Exercise review

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243 The quality of exercise recommendations provided was highly variable across the resources, as shown in Table 41 24442 3. Specific exercise recommendations in at least one domain (e.g. cardiovascular, strength, balance, flexibility) 43 245 45 were included in 14/17 (82.4%) resources. Most resources recommended professional help from a doctor 46 (11/14, 78.6%) and exercise professional (14/14, 100%) for starting or resuming exercise after being diagnosed 24467 48 2**47** 50 with RA. Of the 14 resources with exercise recommendations, 13 (92.9%) provided cardiovascular exercise 51 2438 recommendations, 13 (92.9%) provided strength exercise recommendations, 6 (42.9%) provided flexibility 53 249 exercise recommendations, and 5 (35.7%) provided balance exercise recommendations. 55

259 Cardiovascular exercise was defined in lay terms in 5/14 (38.5%) of resources that recommended it. A

252 complete (i.e. specific details for all four variables: frequency, intensity, time, and type) prescription for For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

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252 1	cardiovascula	r exercise was included in only 1/13 (7.7%) of these resources. The remaining resources provided
2 2533 4	either a partia	al (i.e. specific details missing for one or more variables) prescription (6/13, 46.2%) or none (6/13,
2 5 4 6	46.2%). Detail	ls for how to progress exercise gradually (6/13, 46.2%) and RA-specific exercise tailoring (i.e.
7 255 0	exercise adap	tations and/or cautions for common RA symptoms) (8/13, 61.5%) were present in more than half
9 2 50 11	of these resou	urces. Four (30.8%) resources did not provide any RA-specific tailoring for cardiovascular
253 14	exercise.	
14 2 58 16	Common RA-s	specific advice included exercising more when RA symptoms are lowest, resting if symptoms are
2519 18	too high, choo	osing lower impact exercise types (e.g. swimming) to reduce stress on joints, focusing on less-
19 2 60 21	affected areas	s of the body when flaring, using appropriate footwear to minimize pain, ensuring a gradual
2 61 23	warm-up and	cool-down, and starting slow before progressing exercise frequency, intensity, or time.
24 2 62 26	Resources cau	utioned individuals with RA to avoid exercise during flare ups, reduce intensity or time if exercise
263 263 28	leads to unex	pected pain, avoid vigorous or high impact exercises at affected joints, and return slowly to
29 264 21	cardiovascula	r exercise after flares or other medical events.
2 6 5 33	Strength exer	cise was defined in lay terms in 8/13 (61.5%) of resources that recommended it. These resources
2636	provided eith	er a complete (2/13, 15.4%) or partial (4/13, 30.8%) strength exercise prescription. Seven (53.8%)
30 2 67 38	resources did	not provide any prescription. Information was provided on gradual exercise progression (4/13,
268	30.8%) and RA	A-specific exercise tailoring (8/13, 61.5%) for strength exercise. Four (30.8%) resources did not
41 264 <u>9</u> 43	provide any R	A-specific tailoring for strength exercise.
2 70 45	RA-specific st	rength training recommendations included planning strength training when symptoms are
46 274 3 48	lowest, using	water-based exercises to reduce strain on joints, strengthening muscles around affected joints,
2 7/2 50	using resistan	ce bands and wrapping them around wrists if grip strength is limited, using padded gloves and
273 2753	shoes for extr	a comfort, reducing weights and duration when symptoms are worse. Resources cautioned
275 4 55	against intens	se strength exercise during flares and suggested using braces and professional supervision to
275	minimize inju	ry risk. Further details on the cardiovascular and strength exercise prescriptions and RA-specific
2756	advice provide	ed by each resource can be found in the Supplementary File 2.

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	Profes	sional Help	Cardiovaso	cular Exercise	Recomme	endation	Strength	Exercise Rec	ommen	dation	nce	bility
Title	Doctor	Exercise Professional	Definition provided	FITT Rx	Progre- ssion	Tailored to RA	Definition Provided	FITT Rx	Progre- ssion	Tailored to RA		
Exercise and RA	x	x		Partial	х	Х	x	None				
30-Day Exercise Challenge for Arthritis		x		Partial	x			Complete	Х	x		
At home exercise guide	x	х	x	Partial		Х	x	None		Х	x	
Exercise for RA	x	х		None			x	None				x
I START Toolkit (quick guide fact sheet)	x	х		None			x	None		х		
l START Toolkit (website)		х		None				None				
Strong with Arthritis (Arthritis Research Webinar)	x	х					x	Partial	х	x		
Exercise Videos	x	х		None		х	x	Partial		х		
Importance of physical activity and exercise (SMILE-RA)	x	x		Partial	x	х						
Let's Move with Leon (Activity Tracker)	x	X	x	Partial	x	X		Partial	х	X	x	x
Let's Move with Leon (Videos)	x	x	x	Partial	x	X		Partial	x	x	x	x

59 60

Best Exercises for RA	х	х		None			None			x
Rx for Health Rheumatoid Arthritis	x	x	x	Complete	х	Х	X Complete	Х	x	x
Exercise can ease RA pain		x	x	None		х	X None		x	x
Table 3: Su	able 3: Summary of exercise recommendations provided by the included physical activity resources. FITT =									
frequency,	requency, intensity, time, type.									
3.6										
5.0	.b Cludii or									
Behavior Cl	nange	Technique	es review							
Supplemen	upplementary File 3 presents the groups of behavior change techniques used in each resource. Out of 16									
possible gro	معنية المعنية المع معنية المعنية المعن معنية المعنية المع معنية المعنية المعني المعنية المعنية المعنية المعنية المعنية المعنية المعني									
wobsitos	websites and 6.3+4.5 for audiovisual resources. Five (29.4%) resources used 8 or more (i.e. over 50%) of the first of the									
websites, a										
behavior ch	ehavior change groups. The resources with the highest number of behavior change groups used were the solution of the second sec									
"Let's move	Let's move with Leon" PDF workbook and video series from Versus Arthritis (14 behavior change groups used									
n both resources) and the "Importance of physical activity and exercise" module within the National										
Rheumatoi	heumatoid Arthritis Society's SMILE-RA interactive learning platform (11 behavior change groups used) [33,									
41]. All 16 k	pehavio	or change	groups w	vere used in at	least o	ne resoui	ce. The least common b	ehavior d	chang	е
groups used were "identity" (Group 13), "scheduled consequences" (Group 14), and "covert learning" (Group										
16), each appearing in only 2 resources. In contrast, "shaping knowledge" (Group 4) and "natural										
consequen	ېږې consequences" (Group 5) were the most common, appearing in 17/17 (100%) and 13/17 (76.5%) resources, وېږې کېږې									
respectivel	/.									
4.0 Discuss	ion									
	ıl findiı	nas								
4.1 Principo	,	190								

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Physical activity is internationally recommended as a key component of RA care, contributing to improved overall health and quality of life [7-15]. Patient-facing online resources may help individuals with RA become and stay physically active. Through our environmental scan of online RA-specific physical activity resources, we identified 23 resources, 6 of which were excluded due to predatory advertising or medical concerns [27-43]. A comprehensive critical appraisal of the 17 remaining resources, 10 print and 7 audiovisual, highlighted high overall understandability. Several resources stood out for having high actionability that was supported by detailed exercise recommendations and strong use of behavior change techniques. Audiovisual resources had higher average actionability than print resources. However, many resources left room for improvement with regards to readability and actionability. These concerns were often compounded by incomplete exercise recommendations and behavior change support, reducing the potential impact of these resources on physical activity behavior change.

4.2 Study meaning in relation to related research

Medical appropriateness concerns for individuals with RA continue to be a weakness among online patient resources. Alongside the present study, where 26% of the resources were excluded due to concerns, a recent environmental scan of flare self-management resources excluded 32% of resources for inappropriate advertisements or medical concerns [20]. Weight loss medications and programs were commonly advertised and often included stigmatizing language, which could be harmful to patients. In prior work, patients expressed concerns about the poor quality of patient materials, causing them to distrust online information [18]. Physical activity resources should always be reviewed by rheumatologists, exercise professionals, and patients to ensure safety prior to publication. Furthermore, caution must be taken to ensure that advertisements, if present, are appropriate for the target population. This can be challenging for YouTube and 🖗 other social media platforms where additional recommendations and advertisements are automated. Some resources were flagged during expert review for their negative tone and advanced exercise examples. To ensure that future resources empower, rather than discourage, physical activity behavior change, emphasis on positive messaging and gradual progression is preferable.

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320 1	Certain resources stood out during the critical appraisal. These resources had high understandability and	
2 3231	actionability scores, as well as detailed exercise and behavior change content [29, 33, 40, 41, 43]. Four of	
4 3222 6	these resources were developed by organizations in the United Kingdom (Versus Arthritis [33, 43], National	
3283	Rheumatoid Arthritis Society [40, 41]) and one was created in Canada (Arthritis Research Canada [29]).	
9 3 214 11	Notable differences between these and other resources were the presence of interactive components (e.g.	Pro
12 325	follow-along exercises, goal-setting prompts, self-monitoring tools) and the involvement of healthcare teams,	tected
14 3 26 16	exercise professionals, and patients in resource development. In line with evidence-based best practices for	by copy
327 18	creating patient materials, these findings further emphasize the importance of co-development with relevant	yright,
19 3 28	partners [44, 45]. For physical activity resources, this may include members of the target population (e.g.	includi
21 3 29 23	individuals with RA), healthcare providers, exercise professionals, and behavior change experts.	ng for I
24 3 3 09	Whereas understandability was generally acceptable across the physical activity resources, more work is	uses re
26 3 3 1 28	needed to improve their readability and actionability. The average reading level in both the present work and	lated to
29 333	prior studies is often above 8 th grade, with little or no patient materials meeting the recommended level of	o text a
31 3 33 33	grade 6 or lower [46, 47]. Adding to this challenge is the limited translation of patient materials, despite the	nd data
334 33 <u>4</u>	high prevalence of non-native English speakers in Canada and other English-speaking countries [48]. Rapid	minin
36 3 35 38	improvements in automated translation through Google Translate and other artificial intelligence-based tools	g, Al tra
336 40	may help address this gap. A common shortcoming among patient materials, noted above and across the	aining,
41 334 <u>7</u> 42	literature, is a lack of actionability [20]. Specific actionable steps are key to eliciting physical activity behavior	and sir
43 3 38 45	change among RA populations [49-51]. Close collaboration with patient partners is required to ensure that	nilar te
46 3349	written and audiovisual content is actionable. The PEMAT emphasizes the importance of including clear	chnolo
48 3 49 50	actions, manageable steps, tools to support action, and visual aids to enhance actionability [24]. We noted	gies.
51 34 <u>1</u>	that audiovisual content across the reviewed resources featured either stock images of healthy, younger	
53 3 42 55	adults or white women with RA without apparent physical limitations. More representative content is	
3 <u>4</u> 3	warranted to encourage physical activity behavior change across the range of ages, ethnicities, and physical	
58 3 454	abilities of RA patients.	

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Comprehensive exercise recommendations are essential to physical activity promotion as part of RA management. First, individuals with RA need specific information on the frequency, intensity, time, and type (or FITT) of physical activity to address lack of knowledge, a common physical activity barrier in this population [49-51]. The reviewed RA-specific physical activity resources rarely provided complete FITT recommendations or covered all 4 key domains of physical fitness: cardiovascular, strength, balance, and flexibility. Future resources should aim to address this shortcoming. Second, individuals with RA may be unsure how to continue or covered all 4 key domains of physical fitness: cardiovascular, strength, balance, and flexibility. Future by copyright, being physically active after an RA diagnosis, with fears about exacerbating RA symptoms [16]. While many resources provided some RA-specific suggestions for tailoring and progressing exercise, physical activity including promotion efforts in this population could benefit from standardized physical activity guidelines. Relevant tailoring factors may include RA history and medications, joint damage and active inflammation, joint ₫ replacement precautions, and other health concerns impacting physical activity tolerance. Such guidelines are common for chronic conditions such as cancer and cardiovascular disease [52, 53]. Due to the breadth of important information related to the 4 physical fitness domains and RA-specific tailoring, resource developers may purposefully select content that aligns with specific aims for a patient resource. However, physical activity information alone does not necessarily lead to behavior change. Only some of the ŋg` ≥ included patient resources placed a strong emphasis on behavior change. These resources leveraged evidence-based behavior change techniques such as goal-setting and self-monitoring, which have been shown and similar technolog to support physical activity behavior change [54]. Many of the resources, however, focused on educating individuals with RA about the importance of physical activity but did not provide sufficient tools for helping them become and stay active. A lack of actionable behavior change advice is likely to limit the potential positive impact of these resources in RA care. Consultation with a behavior change specialist is recommended for future physical activity resources. Importantly, online resources alone may not be sufficient to promote lasting physical activity behavior change among many individuals with RA. Work is needed to integrate further physical activity behavior change support into RA care pathways.

4.3 Clinical implications

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370 1 For rheumatology care providers, our findings have important clinical implications. The list of RA-specific 2 3731 physical activity resources reviewed can serve as a useful starting point for supporting patients to set, meet, 4 37⁄2 and adjust their physical activity goals. Providers are encouraged to keep a list of available resources to refer 6 373 373 patients to, including information on the characteristics of the resources as well as the quality of content 9 374 within them. Notably, the resources varied widely with respect to their purpose, content, format, complexity, 11 375 and actionability. For example, resources covered one or more of the following domains: education on why to 14 376 exercise, demonstration of how to exercise, guidance on talking about exercise with a care provider, tips for 16 377 18 adopting and maintaining exercise habits, and more. This variety should be seen as a strength. Different 19 content and delivery modes may work better for different patients. Optimal physical activity behavior change 37288 21 379 23 support should begin with a patient-led discussion around needs, preferences, available time and resources, 24 motivation, and other relevant factors [55]. The provider can then use this information to provide tailored 38g 26 381 recommendations to available resources or additional support as part of a "personalized medicine" approach 28 29 383 to physical activity. In addition to patient-provider discussions and recommendation of high-quality physical 31 3**83** activity resources, rheumatology care teams may want to leverage mobile health technologies or tailored 33 3834 3835 group-based programs (online or in-person, where available). These approaches have shown promise for 36 helping individuals with RA increase their physical activity [56, 57]. 385 38

4.4 Study strengths and limitations

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41 38472 The strengths of our work include the involvement of patient partners to assess understandability and 43 388 45 actionability, the use of a search strategy that mimicked a real-world scenario of patients searching for 46 389 resources, and the in-depth critical appraisal from patient, medical, exercise, and behavioral science 48 390 perspectives. While this pragmatic single search engine strategy may have led to some resources being 50 51 3<u>91</u> missed, resources not identified in the first 5 pages of Google search results are unlikely to be found by 53 3**92** patients themselves [21]. A limitation to the use of the PEMAT is its inherent subjectivity. To counteract this, 55 3<u>5</u>5 we completed triplicate ratings for all resources. The lack of a validated measure for assessing exercise and 58 3954 behavior change components of patient materials is also a limitation. In addition, the exercise and behavioral

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appraisal was completed by a single author, which may have led to some coding biases despite significant expertise in the topic areas. Work is needed to develop such measures that can guide development and evaluation. Lastly, our patient partner team featured individuals with high health literacy and personal engagement in their health. This may have impacted the resultant PEMAT scores, limiting generalizability to all RA populations.

5.0 Conclusion

Our environmental scan identified a need for more high-quality physical activity resources for RA populations which should be developed with patient partners and content experts. More work is needed to create resources that provide complete FITT recommendations for exercise and go beyond providing knowledge to truly empowering behavior change. To address health inequities, efforts must be made to create accessible resources for underserved populations. The use of more diverse audiovisual content and translation into other languages represent two steps in the right direction. A bigger library of excellent physical activity resources will better support the different needs, capabilities, and considerations of individuals with RA. Further research is also needed to develop and implement more intensive physical activity interventions for patients where resources alone are insufficient to promote behavior change.

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Author contributions

ME: Conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, supervision, visualization, writing – original draft, writing – reviewing and editing, guarantor. SZ: Data curation, formal analysis, methodology, writing – reviewing and editing. KD: Data curation, formal analysis, investigation, project administration, resources, writing – reviewing and editing. AMH: For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

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420 1	Conceptualization, methodology, resources, writing – reviewing and editing. CG: Data curation, formal
2 4231	analysis, investigation, writing – reviewing and editing. AM: Data curation, formal analysis, investigation,
4 4222 6	writing – reviewing and editing. CB: Conceptualization, data curation, formal analysis, funding acquisition,
7 4283	investigation, methodology, resources, supervision, writing – original draft, writing – reviewing and editing.
9 4 214 11	Data availability
12 423	The data is available from the corresponding author upon reasonable request.
14 4 26	Supplementary material
427 18	Supplementary File 1: Complete list of search terms for the environmental scan of publicly available online
19 4 28	physical activity resources for individuals with rheumatoid arthritis.
21 4 29 23	Supplementary File 2: Detailed exercise recommendations provided by each included resource.
24 43209	Supplementary File 3: Overview of behavior change techniques identified in the included resources.
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596	Tables and Figures	20 on 2
22 5 97 24	Figure 1: Flow diagram of environmental scan and critical appraisal of physical activity resources for individuals	20 Febru Er
598 26	with rheumatoid arthritis.	lary 20 Iseigne
27 5 9 9 29	Table 1: Characteristics of the 17 included physical activity resources for individuals with rheumatoid arthritis.	25. Dovement Service
600 31	HCP = Healthcare provider.	wnload Superie
32 6033	Table 2: Readability, understandability, and actionability of the included physical activity resources. SD =	ed fror eur (AB
54 6 92 36	Standard deviation. FK = Flesch-Kincaid. PEMAT = Patient Education Materials Assessment Tool.	n <mark>http:/</mark> ES) . ining
37 693	Table 3: Summary of exercise recommendations provided by the included physical activity resources. FITT =	//bmjop Al trair
39 6 04 41	frequency, intensity, time, type.	en.bm
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individuals with rheumatoid arthritis.

262x275mm (144 x 144 DPI)

Supplementary File 1

Complete list of search terms for the environmental scan of publicly available online physical activity resources for individuals with rheumatoid arthritis.

Rheumatoid Arthritis	Physical Activity	Additional Descriptors
Rheumatoid arthritis	Physical activity	Resource
Rheumatology	Exercise	Handout
Arthritis	Sports	Program
Inflammatory arthritis	Movement	Group
	Fitness	Manual
	Exercising	
	Strength exercise	US
		UK
	Exercise training	
		Australia

Page	33	of	36
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		Professional Help			Cardiovascular/Aerobic Exercise Recommendations							Strength/Resistance Exercise			mindation	IS			Other recommer		
Title	Organization	Doctor	Exercise Professional	Personal Trainer	Definition provided	Frequency (weekly)	Intensity	Time (minutes)	Types	Progression	Tailored to RA	Definition Provided	Frequency (weekly)	Intensity	Time (ses/reps)	Types	Progression	Tailored to RA	Balance	Stretchi	
Exercising with Rheumatoid Arthritis	Exercise is Medicine	Y	Y	N	N	3-4	M-V	75-150 /week	Water; Activities you enjoy; variety	Y	Y	N	2-3	nclųdi	203 sets 10-15 reps	All major muscle groups; water; machines; free weights; body weight	N	Y	N	Y	
Best Exercises for RA	Arthritis Foundation	Y	Y	N	N	N/S	N/S	N/S	Walking; Water; Biking	Ν	N	N	N/S	nguf	- n 20N/S	Water; Weight training	Ν	N	N	Y	
30-Day Exercise Challenge for Arthritis	Arthritis Research Canada	N	Y	Ν	N	3-5	N/S	30/day	Walking; Biking; Water; Zumba; Golf; Gardening; Dancing; Exercise Games; Outdoor; Cardio Machines	Y	N	N	2-3	6-7/10 6-7/10 8 9	P-3 sets	Resistance bands; free weights;	Y	Y	N	N	
9 Best Excercises for RA pain	Medical News Today	Y	Y	N	N	N/S	N/S	N/S	Walking; Water; Biking	Y	Y	N	N/S	N\® Sel	N/S	Resistance bands; grip strength (hands, wrists)	N	N	N	Y	
Exercise can ease RA pain	Harvard Health Publishing	N	Y	Ν	Y	N/S	N/S	N/S	Walking; Water; Biking	Ν	Y	Y	N/S	ated ⊳/ed	2025	Isometrics; free weights; weight machines	Ν	N	Y	Y	
Make an Exercise Plan for RA	WebMD	Y	Y	Y	Y	5	N/S	30/day	Walking; biking; water; dance;	Y	Y	N	N/S	N/O t		Free weights; resistance bands	Ν	N	N	Y	
Exercise for RA	Health Link BC	Y	Y	N	N	N/S	N/S	N/S	Walking	N	N	Y	N/S	ext al ≥∕	N/S	N/S	N	N	N	Y	
Exercise helps ease arthritis pain and stiffness	MayoClinic	Y	Y	N	Y	Most days	Somewhat hard	150/week	Walking; water; biking	Y	Y	Y	2+	nd dat ≥≊	aded f	All major muscle groups; resistance bands; free weights; weight machines	N	N	N	Y	
Exercise and RA	Arthritis Australia	Y	Y	N	N	N/S	N/S	N/S	Water;	Y	Y	Y	N/S	a maini ≥		Free weights; weight machines; resistance bands; bodyweight	N	N	N	N	
RA Exercises that are easy on your joints	WebMD	Y	Y	Y	N	Most days	м	30-60 /day	Stair climbing; walking; dancing; cardio machines; water	Y	Y	N	2-3	ng _⊳ A	ttp://b	Free weights; weight machines; resistance bands; isometrics	N	Y	N	Y	
7 Essential Everyday Exercises to Manage RA Pain	Healthline	Y	N	Y	N	N/S	N/S	N/S	Water; Biking; walking; cardio machines;	N	Y	N	2-3	N/S	N/S	Free weights; resistance bands	N	Y	N	Y	
I START Toolkit (quick guide fact sheet)	University of British Columbia	Y	Y	Ν	N	N/S	N/S	N/S	N/S	Ν	N	Y	N/S	ining	N/S	Resistance bands; free weights; body weight	Ν	Y	N	N	
I START Toolkit (website)	University of British Columbia	N	Y	Ν	N	N/S	N/S	N/S	N/S	Ν	N	N	N/S	യ്. ∾/മ	N/S	N/S	N	N	N	N	
Rx for Health Rheumatoid Arthritis	Exercise is Medicine	Y	Y	Ν	Y	3-5	M-V; Somewhat hard	75-150 /week	Walking; biking; elliptical; rowing; water	Y	Y	Y	2-3	M-S (start light)	-3 sets	Free weights; resistance bands; weight machines; body weight; all major muscle groups	N	Y	Y	Y	
At home exercise guide	Arthritis Research Canada	Y	Y	N	Y	N/S	M; Talk but not sing	N/S	Dance; stair climbing; walking; boxing/martial arts; intervals	N	Y	Y	N/S	ilar, te ∾	on Ju	Body weight; resistance bands; free weights; weight machines; household items	N	Y	Y	N	
Let's Move with Leon (Activity Tracker)	Versus Arthritis	Y	Y	N	Y	N/S	M-V	75-150 /week	M: brisk walk, swim, cycle; V: climb stairs, run, sports	Y	Y	N	2	chnolo ≥	ne 13, 1	Gym (specific upper, lower, and core exercises); yoga; heavy carrying	Y	Y	Y	Y	
Let's Move with Leon (Videos)	Versus Arthritis	Y	Y	N	Y	N/S	M-V	75-150 /week	M: brisk walk, swim, cycle; V: climb stairs, run, sports	Y	Y	N	2	gies, _{N/} ,	2025 at	Gym (specific upper, lower, and core exercises); yoga; heavy carrying	Y	Y	Y	Y	
Exercise Videos	National Rheumatoid Arthritis Society	Y	Y	N	N	N/S	N/S	N/S	N/S	N	Y	Y	N/S	N/S	Agence	Arm raises; sit to stand; wrist alphabet; seated leg and feet exercises; grip strength; supported lunge; chair push up	N	Y	N	N	
Strong with Arthritis Webinar (Arthritis Research Education Series Ep.9)	University of British Columbia	Y	Y	N								Y	N/S	6-8/10 RPE	Biblig sets	Body weight; resistance bands; weight training machines; push, pull, squat/lunge, hinge, lateral, rotation	Y	Y	N	N	
Importance of physical activity and exercise (SMILE-RA)	National Rheumatoid Arthritis Society	Y	Y	N	N	N/S	N/S	N/S	Low impact; swimming; walking; cycling; return to regular activities;	Y	Y				phiqu				N	N	

BMJ Open Supplementary File 3 Overview of behavior change techniques identified in the included resources. One (1) = Goals and planning. Two (2) = Feedback and monitoring. Three (3) = Social support. Four (4) = Shaping knowledge. Five (5) = Natural .iltorin.c. .i(7) = Associc .) = Regulation. Twelv. .ef. Sixteen (16) = Covert lear. consequences. Six (6) = Comparison of behavior. Seven (7) = Associations. Eight (8) = Repetition and stitution. Nine (9) = Comparison of outcomes. Ten (10) = Reward and threat. Eleven (11) = Regulation. Twelve (12) = Antecedents. Thirter 13) = Identity. Fourteen (14) = ruary 2025. Downloaded from http://bmjopen.bmj.com/ on June 13, 2025 at Agence Bibliographique Enseignement Superieur (ABES) . ses related to text and data mining, Al training, and similar technologies. Scheduled consequences. Fifteen (15) = Self-belief. Sixteen (16) = Covert learning.

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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 Print (PDF) Mean (SD) I START Toolkit: Quick guide fact Х Х Х Х Х Х sheet Let's Move with Leon Activity Х Х Х Х Х Х Х Х Х Х Х Х Х Х Tracker Rx for Health Rheumatoid Х Х Х Х Х Х Х Arthritis Mean (SD) Print (Website) Exercise and RA Х Х Х Х Х 30-Day Exercise Challenge for Х Х Х Х Х Х Х Х Х Arthritis At home exercise Х Х Х Х Х Х Х Х guide Exercise for RA Х Х Х I START Toolkit: Х Х Х Х Х Х Website Best Exercises for Х Х Х Х Х RA For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

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Exercise can ease RA pain			x	x	x				x								4
Audiovisual															Mea	n (SD)	6.3 (4
How to stay active																	
and exercise at	х	x		x			x										4
home during COVID-19																	
Indoor Exercise																	
Snacks Higher				х		х		х									3
Intensity																	
I START Toolkit:																	
strength training		x		x	x			х	x		х						6
for RA																	
SMILE-RA:																	
Importance of																	
physical activity	х	X	X	X	X	X		X	X	X					X	X	11
and exercise																	
Exercise Videos				x	x	x			x								4
SMILE-RA: Yoga																	
exercises				X		X											2
Let's Move with																	
Leon Exercise	х	x	x	x	x	x	x	x	x	x		x	x	x	x		14
Program																	
Total (N)	8	7	10	17	13	8	3	10	12	3	5	5	2	2	4	2	
Total (%)	47.1	41 2	58.8	100	76 5	47 1	17.6	58.8	70.6	17.6	29.4	29.4	11.8	11.8	235	11 8	

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