

Review

Effects of Using Websites on Physical Activity and Diet Quality for Adults Living With Chronic Health Conditions: Systematic Review and Meta-Analysis

Dina Pogrebnoy^{1,2}, BA; Amy M Dennett^{3,4}, PhD; Dawn B Simpson^{1,5}, PhD; Lesley MacDonald-Wicks^{1,6}, PhD; Amanda J Patterson^{1,6}, PhD; Coralie English^{1,5}, PhD

¹School of Health Sciences, University of Newcastle, Newcastle, Australia

²Department of Physiotherapy, Western Health, St Albans, Australia

³Allied Health Clinical Research Office, Eastern Health, Melbourne, Australia

⁴School of Allied Health, Human Services and Sport, Latrobe University, Melbourne, Australia

⁵Heart and Stroke Program, Hunter Medical Research Institute, Newcastle, Australia

⁶Food and Nutrition Program, Hunter Medical Institute, Newcastle, Australia

Corresponding Author:

Dina Pogrebnoy, BA

School of Health Sciences, University of Newcastle

University Dr

Callaghan

Newcastle, 2308

Australia

Phone: 61 403432415

Email: dina.pogrebnoy@uon.edu.au

Abstract

Background: Adults with chronic health conditions need support to manage modifiable risk factors such as physical inactivity and poor diet. Disease-specific websites with health information on physical activity and diet quality may be effective in supporting adults in managing their chronic illnesses.

Objective: The primary aim of this review was to determine whether using websites with health information can lead to improvements in physical activity levels or diet quality in adults with chronic health conditions.

Methods: Randomized controlled trials evaluating the effectiveness of website use on levels of physical activity or diet quality in adults with chronic health conditions were included. MEDLINE, Embase, CINAHL, and the Physiotherapy Evidence Database were searched from the earliest available record until February 2023. Data for outcomes measuring physical activity levels; diet quality; and, where reported, self-efficacy and quality of life were independently extracted by 2 reviewers. The risk of bias was assessed using the Physiotherapy Evidence Database scale, and the overall certainty of evidence was assessed using the Grading of Recommendations Assessment, Development, and Evaluation approach. Where values were presented as the same unit of measure, postintervention scores were pooled for meta-analysis to yield an overall mean difference (MD). A standardized MD (SMD) was calculated for the pooled data in which different units for the same outcome were used. Individual trial data were described in cases where the data of trials could not be pooled.

Results: A total of 29 trials (N=6418 participants) across 8 different disease groups with intervention periods ranging from 4 weeks to 12 months were included in the analysis. There was moderate-certainty evidence that using websites with health information increased levels of moderate to vigorous physical activity (MD=39 min/wk, 95% CI 18.60-58.47), quality of life (SMD=0.36, 95% CI 0.12-0.59), and self-efficacy (SMD=0.26, 95% CI 0.05-0.48) and high-certainty evidence for reduction in processed meat consumption (MD=1.1 portions/wk, 95% CI 0.70-1.58) when compared with usual care. No differences were detected in other measures of diet quality. There was no increased benefit for website users who were offered additional support.

Conclusions: The use of websites for risk factor management has the potential to improve physical activity levels, quality of life, and self-efficacy as well as reduce processed meat consumption for adults living with chronic health conditions when compared with usual care. However, it remains unclear whether using websites leads to meaningful and long-lasting behavior change.

Trial Registration: PROSPERO CRD42021283168; https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=283168

(*J Med Internet Res* 2023;25:e49357) doi: [10.2196/49357](https://doi.org/10.2196/49357)

KEYWORDS

modifiable risk factors; secondary prevention; physical activity; diet quality; websites; chronic health; chronic illness

Introduction

Background

Chronic illness is the leading cause of poor health [1] and disability [2] worldwide. Advances in the medical management of chronic health conditions such as cancer, cardiovascular disease, and stroke have enhanced life expectancy [3,4] but have inadvertently contributed to an increase in the prevalence of chronic health conditions in our community. With people living longer, it is unsurprising that the demand for programs to better manage the effects of chronic illnesses is increasing [5]. One way to reduce the burden of chronic health conditions [6,7] on health care systems is to develop services [5] that assist patients in managing their own modifiable risk factors and improving their quality of life. Common modifiable risk factors [8,9] for chronic health conditions are physical inactivity [10-12] and poor diet [13,14]. Being physically active and eating well when living with a chronic health condition have the potential to improve blood pressure [13], lipid profiles [14], and glucose metabolism [10]. Increasing activity levels may result in lower rates of morbidity and mortality in adults living with chronic health conditions [9]. Given the protective benefits of being physically active and eating well when living with a chronic health condition, it is essential for clinicians and policy makers to consider evidence-based interventions [8] that help prevent and manage chronic illnesses.

Adults living with chronic health conditions experience many challenges in accessing health support services [7,15]. Barriers to accessing in-person chronic health management programs can include long waiting lists, programs not being suitable, difficulty with transportation, and challenges with meeting program costs [15]. Living with a chronic health condition can also result in fatigue [16], impaired function, diminished exercise capacity, and issues with mood and motivation [16]. Furthermore, adults who are disadvantaged or live in a rural setting [16] can be more vulnerable to health-related complications as access to chronic disease management programs is limited. For effective long-term management of chronic health conditions, patients, carers, and health care providers need accessible resources that can support the self-management of modifiable risk factors.

Websites that focus on modifiable risk factor management could potentially address barriers that currently exist in the effective management of chronic health conditions. Data from reviews of individual chronic disease groups such as cancer, cardiovascular disease, and diabetes suggest that self-directed websites could be effective in supporting risk factor management [17-20]. However, a lack of consistency in study design [21], type of interventions, and collected outcomes [21] has made it difficult to pool data into a meta-analysis [18]. No previous reviews have quantified the effect of using websites to help

improve physical activity levels or diet quality in adults across a range of chronic health conditions. Given that the challenges in accessing secondary prevention programs [7,22] and the universal goals of treatment across chronic disease groups are similar for adults irrespective of their chronic health condition [22], we chose to undertake this broad review.

Objectives

The specific research questions for this review were as follows:

1. Is the use of websites containing health information by adults with chronic health conditions effective in improving physical activity or diet quality relative to passive control conditions (no intervention or care as usual) or active control conditions (websites with additional support)?
2. Is the use of websites aimed at improving physical activity or diet quality by adults with chronic health conditions effective in improving self-efficacy or quality of life relative to passive control conditions (no intervention or care as usual) or active control conditions (websites with additional support)?

Methods

This review is reported according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Multimedia Appendix 1 [23]) and was prospectively registered with PROSPERO (CRD42021283168). There were no deviations from the registered protocol for this review.

Eligibility Criteria

We included randomized controlled trials that tested the effectiveness of using websites designed to provide health information compared with care as usual (eg, waitlist control or no intervention) or with using websites with additional support (eg, supervised by a health professional) on levels of physical activity or diet quality in adults with a chronic health condition [24].

Participants

Trials were included if the enrolled participants were adults and had a chronic health condition. We defined *chronic health conditions* as medically diagnosed physical conditions that are long-lasting with persistent effects [8]. Studies with a mix of healthy participants and participants with chronic health conditions were deemed eligible if at least 50% of participants had a chronic health condition as defined by our criteria. We excluded studies testing the effectiveness of interventions on obesity and hypertension as we deemed these to be primary disease markers of a chronic health condition as opposed to a chronic health condition per se. We excluded studies evaluating the effectiveness of interventions for adults with eating disorders, intellectual disabilities, mental health conditions, and

complications related to pregnancy, as well as of general lifestyle interventions such as intervention for weight loss.

Intervention

For inclusion, trials needed to evaluate the effectiveness of using a website with health information that was not individually tailored to a participant, did not include supervision by or direct contact with a health professional, and could be accessed on any device (eg, desktop computer, laptop, or mobile phone browser). The website needed to promote chronic disease management and had to focus on improving either physical activity levels or diet quality (or both). We included studies in which a generic email or SMS text message was sent to participants as a reminder as long as it was not individualized based on engagement with website content during the intervention period. Contact for technical support from a therapist was acceptable if the therapist did not provide any guidance based on the intervention.

The comparison intervention could be usual care (eg, waitlist control, written pamphlets, or generic website links) or websites with additional behavior change elements (eg, websites with personal tailoring or supervision from a therapist on more than one occasion). Trials were excluded if the intervention was not via a website (eg, SMS text messaging, fitness tracker, console, or phone app), was therapist led (eg, teleconference, face-to-face, or artificial intelligence supported), was not focused on promoting improvements in either diet quality or levels of physical activity (eg, measures of BMI or weight loss), and did not promote chronic disease management (eg, reporting and monitoring symptoms).

Outcome Measures

Trials were included if they used standardized self-reported questionnaires for either physical activity or diet quality (eg, International Physical Activity Questionnaire and Diet Quality Index), individual recall methods (eg, exercise tracking sheets or food recall diaries), or device-based data collection (eg, via accelerometers) for physical activity or diet quality. If trials with a primary outcome measure of physical activity or diet quality reported on self-efficacy and quality of life, these data were also extracted.

Search Strategy

A comprehensive search strategy with the support of an academic librarian was conducted in the following databases—MEDLINE, Embase, CINAHL, and Physiotherapy Evidence Database (PEDro)—from the earliest available record until October 2021. The search was rerun in February 2023 to capture the most recent publications. The search strategy included keywords, Medical Subject Heading terms, and subject headings describing participants (eg, adults with a chronic health condition), the intervention (eg, websites and self-directed), and the outcome of interest (changes to physical activity or diet quality). The search was restricted to studies published in English as restricting it to English-language publications had little impact on the effect estimates and conclusions of this systematic review [25]. The study design was not restricted in the search strategy. The full search strategies are available in [Multimedia Appendix 2](#). To ensure that all possible trials were considered for inclusion, citation tracking was conducted, and the reference lists of all the included trials were also checked. Gray literature was not searched for this review.

Selection Process

The EndNote X9 (Clarivate Analytics) software was used to manage the titles and abstracts from the individual databases. Once duplicates were removed, all remaining titles and abstracts were exported into Covidence (Veritas Health Innovation) to manage study selection for this review. In total, 2 reviewers (DP and AMD) independently agreed on the selection of eligible studies and achieved consensus on which studies to include by applying the inclusion criteria for the initial search. When the search was rerun in February 2023, a total of 2 reviewers (DP and CE) selected a sample of eligible studies and achieved good agreement with the remainder selected by 1 reviewer (DP). In total, 2 reviewers (DP and AMD) independently reviewed the full texts of all potential titles against the inclusion criteria ([Textbox 1](#)). Disagreements or ambiguities were resolved through consensus after discussion with a third reviewer (DBS). Agreement between reviewers was assessed using the κ statistic [26].

Textbox 1. Inclusion criteria.

<p>Design</p> <ul style="list-style-type: none">• Randomized controlled trials published in a peer-reviewed journal in English <p>Participants</p> <ul style="list-style-type: none">• Adults with a chronic health condition <p>Intervention</p> <ul style="list-style-type: none">• Self-directed website• Aim to promote chronic disease management or survivorship• Focus on <i>either</i> diet and healthy eating habits or physical activity levels <p>Outcome measures</p> <ul style="list-style-type: none">• Physical activity<ul style="list-style-type: none">• Self-efficacy• Quality of life• Diet changes<ul style="list-style-type: none">• Self-efficacy• Quality of life <p>Comparisons</p> <ul style="list-style-type: none">• Usual care• No intervention• A more supported web program (eg, supervised)

Risk-of-Bias Assessment

The methodological quality of the included trials was assessed by 2 reviewers (DP and AMD) independently by applying the PEDro scale [27,28]. This is an 11-item scale comprising 1 item evaluating external validity and 10 items evaluating internal validity. A score of 8 on the PEDro scale is considered the highest possible score as participants and therapists in exercise trials cannot be blinded. The PEDro score demonstrates convergent and construct validity [29] and has moderate levels of interrater reliability (intraclass correlation coefficient=0.68, 95% CI 0.57-0.76) [28]. Disagreements were resolved through consensus. Agreement between reviewers was assessed using the κ statistic [26].

Data Extraction

At least 2 reviewers achieved a consensus on which data to extract from the included studies. One reviewer (DP) extracted the data, and a second reviewer (DBS) checked them, with final consensus achieved through discussion. Data extracted included participant characteristics (age, gender, and time since diagnosis), type of chronic health condition, type and duration of the intervention, description of comparison group, type of outcomes measured, and results as reported in each individual trial. Where information was not available in the published paper, details were requested from the corresponding authors. In cases in which more than one paper reported data from the

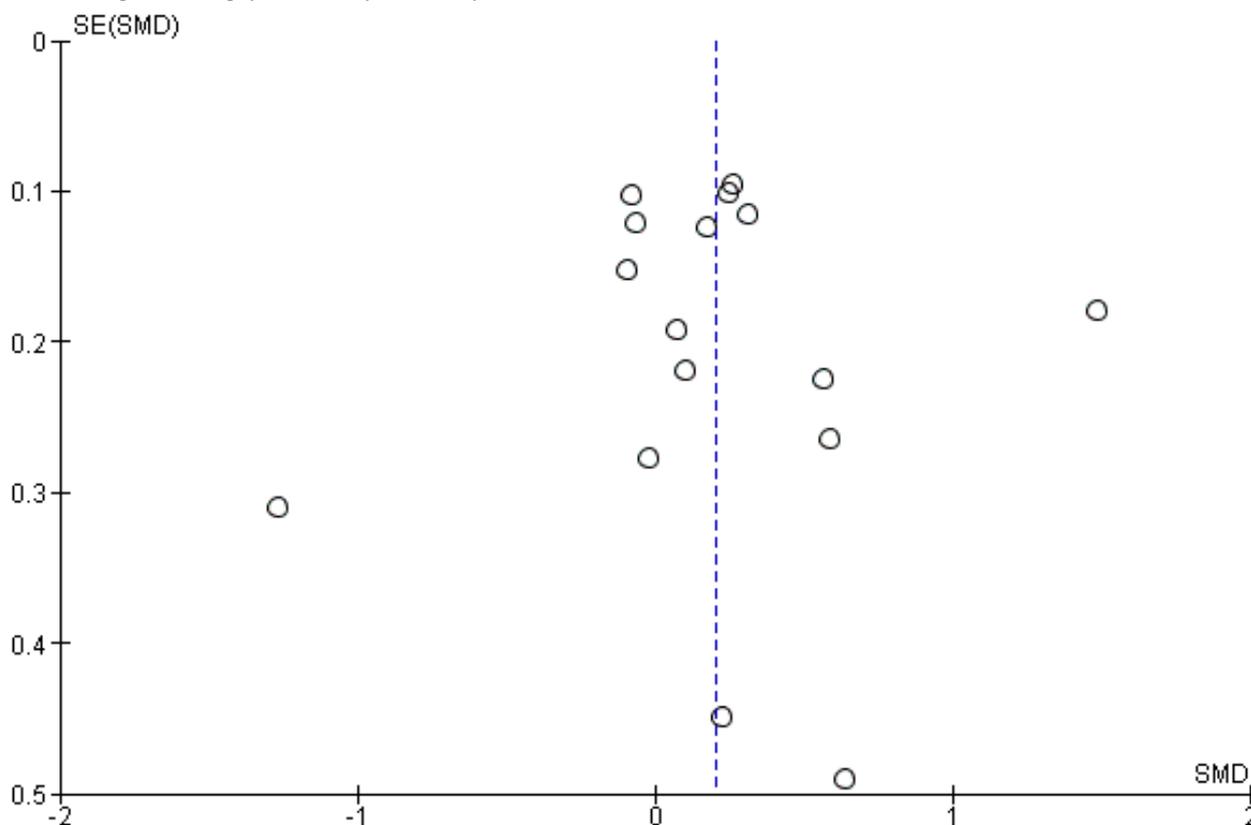
same cohort of participants, data from the main trial were included in the analyses.

Synthesis of Results

Postintervention means and SDs [30] with the corresponding number of participants for outcomes of interest were pooled via meta-analyses using random-effects models. We calculated the weighted mean difference (MD) for meta-analyses that included the same outcome measure and the standardized MD (SMD) where different outcome measures were used to measure the same construct. If data were presented as medians and IQRs, they were converted to means and SDs [31]. If data could not be included in a pooled meta-analysis, the individual trial results were summarized descriptively [32]. Sensitivity and subgroup analyses were performed to assess the robustness of the synthesized results and explore possible causes of heterogeneity [32]. The analyses were performed using Review Manager (version 5.4; The Nordic Cochrane Centre) [33]. For all outcome measures, the critical value for rejecting H_0 was set at a level of .05 (2-tailed).

Publication Bias

Publication bias was assessed using funnel plots for a meta-analysis with >10 included trials. Funnel plots were interpreted through visual inspection of asymmetry. An example of a funnel plot can be found in Figure 1.

Figure 1. Funnel plot for the physical activity meta-analysis. SMD: standardized mean difference.

Certainty Assessment

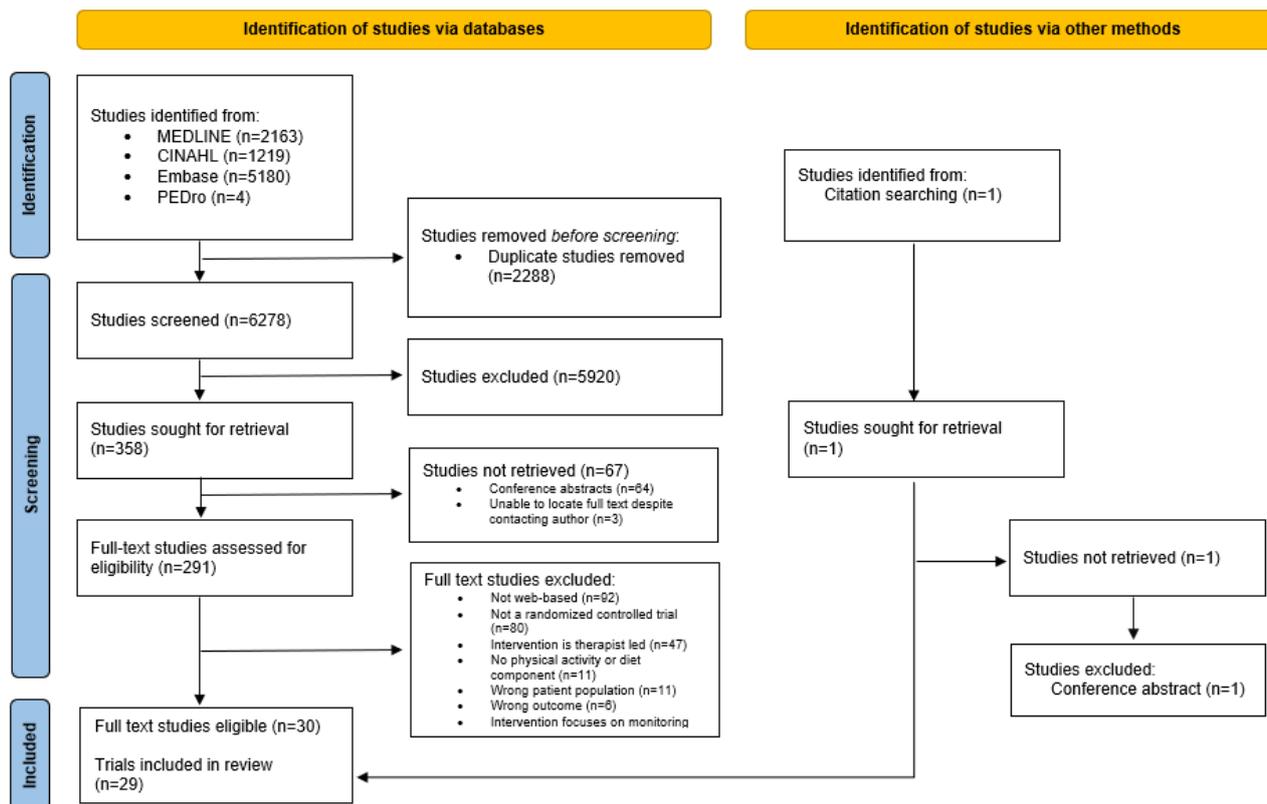
The GRADE (Grading of Recommendations Assessment, Development, and Evaluation) approach was used to summarize the overall certainty of evidence for each outcome [33,34]. The GRADE system specifies 4 levels of certainty for a body of evidence for any given outcome: high, moderate, low, and very low. We downgraded the certainty of evidence by 1 point [35] if one of the following prespecified criteria were present: low methodological quality (defined as >50% of the trials having a PEDro score of <6), inconsistency of estimates among pooled studies ($I^2 > 50\%$) [34] or effect estimate with wide CIs (ie, CI range of >0.8 SMD), and publication bias suspected when looking at symmetry of funnel plots for a meta-analysis of >10 studies.

Results

Study Selection

The electronic database search initially identified 8566 studies, which was reduced to 6278 (73.29%) once duplicate studies were removed. After screening titles, abstracts, and reference lists, 358 full-text studies were retrieved. Substantial agreement ($\kappa=0.73$) was achieved between reviewers when screening the titles and abstracts. There were 91.6% (328/358) of studies that failed to meet the inclusion criteria, leaving 30 studies to be included. Moderate agreement ($\kappa=0.51$) was achieved between reviewers who screened the full-text papers. The list of excluded studies with reasons for exclusion after full-text screening is available in [Multimedia Appendix 3](#). A total of 7% (2/30) of the studies [36,37] reported data from the same trial; therefore, this systematic review included 30 studies that reported outcomes from 29 trials [36,38-65] ([Figure 2](#)).

Figure 2. Study selection flowchart. PA: physical activity; PEDro: Physiotherapy Evidence Database.



Study Characteristics

The 29 trials included 6418 participants across 8 different chronic disease groups (cancer: n=12, 41%; chronic obstructive pulmonary disease: n=1, 3%; cardiovascular disease: n=4, 14%; lower back pain: n=1, 3%; metabolic syndrome: n=1, 3%; type 2 diabetes mellitus: n=7, 24%; stroke: n=2, 7%; and rheumatoid

arthritis: n=1, 3%). Most of the included participants were female, with a mean age across all trials of 55 (SD 9) years. A total of 38% (11/29) of the included trials were published in the last 3 years. Additional information was requested from the corresponding authors of 34% (10/29) of the trials and received from those of 7% (2/29) of included trials [38,39]. The study characteristics are described in Table 1.

Table 1. Summary of study characteristics and individual results.

Study, year	Country	Condition	Participants	PA ^a or diet	Program duration	Intervention	Comparison	Outcome measures	Favors the use of websites with health information alone
Chan et al [40], 2020	United States	Cancer	N=202; mean age: 70 (SD 2.9) y; time since diagnosis: mean 5 (SD 2.3) y; female sex: 0%	PA and diet	3 mo	General web-based information (n=49)	Tailored website with feedback (n=51); tailored website+Fitbit+SMS text messaging (n=50); tailored website+Fitbit+SMS text messaging+2 face-to-face sessions (n=52)	MVPA ^b (min/wk); FFQ ^c ; vegetable, processed meat, and fish consumption (serves/wk); self-reported	XXXXX ^d
Finlay et al [41], 2020	Australia	Cancer	N=71; mean age: 67 (SD 10) y; time since diagnosis: mean 5.1 (SD 4.4) y; female sex: not reported	PA	4 wk	Nonspecific web links (n=17)	Tunneled modules+ask an expert (n=27); self-paced modules+ask an expert (n=27)	MVPA (min/wk); self-reported GSLTPAQ ^e	X
Forbes et al [42], 2015	Canada	Cancer	N=95; mean age: 65 (SD 9) y; time since diagnosis: mean 6.6 (SD 2.6) y; female sex: 56%	PA	9 wk	Sequential web modules (n=48)	Usual care (n=47)	MVPA (min/wk); self-reported LSI ^f from GSLTPAQ; QOL ^g : FACT-G ^h questionnaire	XX
Holt Dirk et al [43], 2021	Germany	Cancer	N=363; mean age: 50 (SD 8.2) y; time since diagnosis: not reported; female sex: 100%	PA and diet	3 mo	Website offering cognitive behavioral therapy (n=181)	Waitlist control (n=182)	PA: aerobic METs ⁱ (min/wk); diet: food quality questionnaire; QOL: WHOQOL ^j (brief) total score	✓✓✓
Kanera et al [36,37], 2016 and 2017	The Netherlands	Cancer	N=518; mean age: 56 (SD 11) y; time since diagnosis: mean 24.3 (SD 13.2) wk; female sex: 80%	PA and diet	6-mo and 12-mo follow-up	Self-paced web-based program (n=265)	Waitlist control—with access after 12 mo (n=253)	Moderate PA (min/wk); SQUASH ^k ; vegetable consumption (g/d); self-reported	X✓
Kenfield et al [44], 2019	United States	Cancer	N=76; mean age: 64.8 (SD 1.5) y; time since diagnosis: not reported; female sex: 0%	PA and diet	12 wk	Web program with 4 topics (n=37)	Usual care (n=39)	MVPA (min/wk) and steps (per d) via accelerometer; vegetable, processed meat, and fish consumption (serves/wk); self-reported	X✓✓✓

Study, year	Country	Condition	Participants	PA ^a or diet	Program duration	Intervention	Comparison	Outcome measures	Favors the use of web-sites with health information alone
Lee et al [45], 2014	South Korea	Cancer	N=59; mean age: 42.4 (SD 5.7) y; time since diagnosis: mean 22.7 (SD 15) wk; female sex: not reported	PA and diet	12 wk	Structured self-paced web program (n=30)	Educational booklet (n=29)	Self-report PA: reported as >150 min/wk (number and percentage); fruit and vegetable 3-d recall: reported as >5 serves/d (number and percentage); DQI ¹ : total score; QOL: EORTC QLQ-C30 ^m ; self-efficacy to increase exercise and fruit and vegetable intake	✓✓✓✓✓
Rabin et al [46], 2011	United States	Cancer	N=18; mean age: 32.2 (SD 5.6) y; time since diagnosis: mean 4.0 (SD 2.5) y; female sex: 56%	PA	12 wk	Website access (n=8)	Web links only (n=10)	MVPA (min/wk): 7-d PAR ⁿ	✓
Rees-Punia et al [47], 2021	United States	Cancer	N=85; mean age: 60.9 (SD 7.4) y; time since diagnosis: mean 7.0 (SD 1.9) y; female sex: 94%	PA	12 wk	Website access (n=45)	Waitlist control (n=40)	MVPA (min/wk) measured via accelerometer	✗
van Blarigan et al [48], 2020	United States	Cancer	N=50; median age: 55 (IQR 50-62) y; time since diagnosis: median 1.8 (IQR 1-3.3) y; female sex: 66%	Diet	12 wk	Website access (n=25)	Waitlist control (n=25)	Consumption of vegetables, fish, and processed meat (serves/d): 4-d diet records using ASA24 ^o	✗✗✗
van de Wiel et al [56], 2021	Switzerland	Cancer	N=137; mean age: 59.8 (SD 11.7) y; time since diagnosis: not reported; female sex: 49%	PA	6 mo	Website access (n=45)	Website+telephone support (n=46); usual care (n=46)	MVPA measured via accelerometer	✗
Yun et al [57], 2020	South Korea	Cancer	N=394; mean age: 53.8 (SD 10.9) y; time since diagnosis: not reported; female sex: 61%	PA	6 mo	Website access (n=125)	Website+health coaching (n=135); usual care (n=134)	MVPA: GSLT-PAQ self-reported questionnaire, reported as >150 min/wk (number and percentage)	✗
Wan et al [49], 2017	United States	COPD ^p	N=109; mean age: 53.8 (SD 10.9) y; time since diagnosis: not reported; female sex: 2%	PA	3 mo	Self-paced web program+pedometer (n=57)	Pedometer only (n=52)	PA: step count (pedometer); self-efficacy: Exercise Self-Regulatory Efficacy Scale	✓✗

Study, year	Country	Condition	Participants	PA ^a or diet	Program duration	Intervention	Comparison	Outcome measures	Favors the use of web-sites with health information alone
Antypas and Wang-berg [50], 2017	Norway	CVD ^q	N=69; mean age: 59.2 (SD 9.1) y; time since diagnosis: not reported; female sex: 23%	PA	12 wk	Self-directed web-based program (n=28)	Personalized web-based program (n=29)	Moderate PA (min/wk) via IPAQ ^t ; self-efficacy: PC-EX ^s scale	XX
Duan et al [38], 2018	China	CVD	N=114; mean age: 48.53 (SD 13.55) y; time since diagnosis: newly diagnosed; female sex: 53%	PA and diet	8 wk (4 wk PA and 4 wk diet)	Weekly web-site modules (n=60)	Waitlist control (n=54)	Moderate PA (min/wk) via IPAQ; fruit and vegetable consumption, 7-d recall: portions/d (80 g)	✓✓
Engelen et al [58], 2020	The Netherlands	CVD	N=208; mean age: 63.5 (SD 9.9) y; time since diagnosis: mean 4.6 (SD 8.0) y; female sex: 31%	PA and diet	12 mo	Self-paced web program (n=103)	Usual care (n=105)	Moderate PA (min/wk) via IPAQ; Dutch Healthy Diet Index SE Physical Activity and SE Diet; RAND health change questionnaire	XXXX
Wong et al [59], 2020	China	CVD	N=438; mean age: 52.3 (SD 4.9) y; time since diagnosis: not reported; female sex: 34%	PA	6 mo	Self-paced web-based program (n=219)	Usual care (n=219)	GSLTPAQ; SEE-C ^t scale	XX
Geraghty et al [51], 2018	United Kingdom	LBP ^u	N=87; mean age: 58 (SD 13.5) y; time since diagnosis: not reported; female sex: 61%	PA	6-wk program, follow-up data at 3 mo	Web-based program with 6 modules (n=25)	Web-based program+physiotherapist telephone support (n=22); usual care only (n=26)	Moderate PA (min/wk): self-report IPAQ-SF ^v	X
Jahangiry et al [60], 2017	Iran	Metabolic syndrome	N=160; mean age: 44.2 (SD 10) y; time since diagnosis: not reported; female sex: 37%	PA and diet	6 mo	Self-paced structured web program (n=80)	General information about risk factors (n=80)	Moderate PA (min/wk): self-reported IPAQ; vegetable intake: self-reported and FFQ; QOL: SF-36 ^w and physical function	✓✓X
Booth et al [52], 2016	Australia	T2DM ^x	N=84; mean age: 59 (SD 9.9) y; time since diagnosis: not reported; female sex: 42%	PA and diet	12 wk	Self-paced web program (n=41)	List of websites only (n=43)	4-d food diary recording percentage of total energy; moderate PA (min/wk): self-reported IPAQ; QOL: SF-36 and physical function	XXX
Connelly et al [61], 2017	United Kingdom	T2DM	N=31; mean age: 66.7 (SD 8.7) y; time since diagnosis: mean 7.3 (SD 3.7) y; female sex: 42%	PA	6 mo	Information web group (n=10)	Interactive web group (n=11); written T2DM advice (n=10)	MVPA (min/wk) measured via accelerometer; step count (steps/wk)	XXXX

Study, year	Country	Condition	Participants	PA ^a or diet	Program duration	Intervention	Comparison	Outcome measures	Favors the use of web-sites with health information alone
Glasgow et al [62], 2010	United States	T2DM	N=463; mean age: 58.4 (SD 9.2) y; time since diagnosis: not reported; female sex: 50%	PA and diet	4 mo	Self-paced web-based program (n=169)	Web-based program+social support (n=162); enhanced usual care (n=132)	Fat intake (percentage): Starting The Conversation scale; PA (calories/wk); CHAMPS ^y questionnaire	XXX
Hansel et al [63], 2017	France	T2DM	N=120; mean age: 56.5 (SD 9.2) y; time since diagnosis: not reported; female sex: 67%	Diet and PA	16 wk	Self-paced web-based program (n=60)	General nutrition advice (n=60)	DQI-I ^z ; moderate PA (min/wk); self-report via IPAQ-SF	✓X
Jennings et al [53], 2014	Australia	T2DM	N=397; mean age: 58.2 (SD 10.3) y; time since diagnosis: mean 8.35 (SD 6.72) y; female sex: 48%	PA	12 wk	Self-paced web-based program with pedometer (n=118)	Pedometer and questionnaire only (n=145)	Moderate PA (min/wk); self-reported IPAQ	X
Muller et al [54], 2017	United Kingdom, Austria, Germany, Ireland, and Taiwan	T2DM	N=1045; mean age: 62 (SD 9.2) y; time since diagnosis: 9.2 y; female sex: 46%	PA	Immediate pretest-posttest design	Text-only web-based intervention (n=497)	Interactive (tailored) web-based intervention (n=548)	Engagement: self-reported measures of engagement (number of completed sections)	✓
Vluggen et al [64], 2021	The Netherlands	T2DM	N=478; mean age: 60 (SD 6.7) y; time since diagnosis: not reported; female sex: 32%	PA and diet	6 mo	Access to a web-based program (n=234)	Waitlist control (n=244)	Moderate PA (min/wk); SQUASH; self-administered FFQ; snack intake (calories/wk)	X✓
Guillaumier et al [39], 2022	Australia	Stroke	N=399; mean age: 66 (SD 12) y; time since diagnosis: not reported; female sex: 35%	PA and diet	12 wk	Web-based program (n=199)	Links to generic websites (n=200)	ARFS ^{aa} ; GSLT-PAQ	X✓
Kim et al [55], 2013	South Korea	Stroke	N=36; mean age: 65.6 (SD 7.4) y; time since diagnosis: 3.5 y; female sex: 36%	PA and diet	9 wk	Structured web-based program (n=18)	Standard care (n=18)	Self-reported health behaviors (regular exercise; yes or no); self-efficacy; Mastery Scale; diet: self-reported fruit and vegetable intake (percentage)	✓✓✓

Study, year	Country	Condition	Participants	PA ^a or diet	Program duration	Intervention	Comparison	Outcome measures	Favors the use of web-sites with health information alone
van den Berg et al [65], 2006	The Netherlands	RA ^{ab}	N=160; median age: 49.6 (IQR 13.4) y; time since diagnosis: 6.6 (10.1) y; female sex: 76%	PA	12 mo	Self-paced web-based program (n=78)	Individually tailored+therapist-guided web-based program (n=82)	PA: moderate or vigorous activity self-reported as number of d/wk physically active; QOL: SF-36 and RAQoL ^{ac} score	XX

^aPA: physical activity.

^bMVPA: moderate to vigorous physical activity.

^cFFQ: food frequency questionnaire.

^dA “✓” symbol corresponds to a significant finding as reported by authors of each trial specific to each outcome measure of interest for which data was extracted for this review. An “X” corresponds to a nonsignificant finding as reported by authors of each trial specific to each outcome measure of interest for which data was extracted for this review and 5 X symbols correspond to 5 such outcomes.

^eGSLTPAQ: Godin-Shephard Leisure-Time Physical Activity Questionnaire.

^fLSI: Leisure Score Index.

^gQOL: quality of life.

^hFACT-G: Functional Assessment of Cancer Therapy.

ⁱMET: metabolic equivalent of task.

^jWHOQOL: World Health Organization Quality of Life assessment.

^kSQUASH: Short Questionnaire to Assess Health-Enhancing Physical Activity.

^lDQI: Diet Quality Index.

^mEORTC QLQ-C30: European Organization for the Research and Treatment of Cancer Quality of Life Questionnaire.

ⁿPAR: Physical Activity Recall.

^oASA24: Automatic Self-Administered 24-hour Dietary Assessment Tool.

^pCOPD: chronic obstructive pulmonary disease.

^qCVD: cardiovascular disease.

^rIPAQ: International Physical Activity Questionnaire.

^sPC-EX: Perceived Competence for Regular Physical Exercise.

^tSEE-C: Chinese version of the Self-Efficacy for Exercise Scale.

^uLBP: low back pain.

^vIPAQ-SF: International Physical Activity Questionnaire-Short Form.

^wSF-36: 36-item Short Form Health Survey.

^xT2DM: type 2 diabetes mellitus.

^yCHAMPS: Community Health Activities Model Program for Seniors.

^zDQI-I: Diet Quality Index-International.

^{aa}ARFS: Australian Recommended Food Score.

^{ab}RA: rheumatoid arthritis.

^{ac}RAQoL: Rheumatoid Arthritis Quality of Life.

The intervention periods ranged from 4 weeks to 12 months. In total, 62% (18/29) of the trials [38-55] included short web interventions (≤3 mo), and 38% (11/29) of the trials [36,56-65] included longer web interventions (>3 mo). A total of 79% (23/29) of the trials [36,38,39,42-49,51-53,55,56,58-64] had a comparator group that was either usual care or a waitlist control (eg, no intervention). In the remaining 21% (6/29) of the trials [40,41,50,54,57,65], the control group was offered use of the same website and additional support (eg, tailored content or supervision from an allied health professional). In total, 14% (4/29) of the trials [51,56,57,61] were multiarm trials with 2 comparator interventions where the use of a website containing

health information was compared with usual care as well as with a website with additional support.

Methodological Quality

The mean PEDro score of the included trials was 5.8 (SD 1.3; Table 2). The agreement of methodological quality ratings between the reviewers was almost perfect (κ=0.901). Most studies reported similar characteristics of the participants across groups at baseline (20/30, 67%) and performed an intention-to-treat analysis (20/30, 67%). Less than half (11/30, 37%) of the included studies had blinded assessors. In 17% (5/30) of the studies, the participants were blinded to the intervention.

Table 2. Physiotherapy Evidence Database scores of the included trials (N=29).

Study, year	Random allocation	Concealed allocation	Groups similar at baseline	Participant blinding	Therapist blinding	Assessor blinding	<15% dropout	Intention-to-treat analysis	Between-group difference reported	Point estimate and variability reported	Total (0-10)
Chan et al [40], 2020 ^a	1	1	1	1	0	0	0	0	1	1	6
Finlay et al [41], 2020 ^b	1	1	0	1	0	0	0	0	1	1	5
Forbes et al [42], 2015 ^c	1	0	1	0	0	0	1	1	1	1	6
Holt Dirk et al [43], 2021 ^d	1	0	1	0	0	0	0	1	1	1	5
Kanera et al [36], 2017 ^e	1	1	0	0	0	0	0	1	1	1	5
Kenfield et al [44], 2019 ^f	1	1	1	0	0	1	0	0	1	1	6
Lee et al [45], 2014 ^g	1	1	1	1	0	0	1	0	1	1	7
Rabin et al [46], 2011 ^h	1	0	0	0	0	0	1	1	0	1	4
Rees-Punia et al [47], 2021 ⁱ	1	0	1	0	0	1	1	0	0	1	5
van Blarigan et al [48], 2020 ^j	1	1	0	0	0	0	1	0	1	1	5
van de Wiel et al [56], 2021 ^k	1	1	1	0	0	0	0	1	1	1	6
Yun et al [57], 2020 ^l	1	0	1	0	0	1	0	1	1	1	6
Wan et al [49], 2017 ^m	1	1	1	0	0	1	1	1	1	1	8
Antypas and Wangberg [50], 2017 ⁿ	1	0	0	1	0	1	0	0	1	1	5
Duan et al [38], 2018 ^o	1	0	1	0	0	0	0	0	1	1	4
Engelen et al [58], 2020 ^p	1	0	1	0	0	0	1	1	1	1	6
Wong et al [59], 2020 ^q	1	1	1	0	0	1	1	1	1	1	8
Geraghty et al [51], 2018 ^r	1	1	1	0	0	1	0	1	1	1	7
Jahangiry et al [60], 2017 ^s	1	0	1	0	0	0	1	1	1	1	6

Study, year	Random allocation	Concealed allocation	Groups similar at baseline	Participant blinding	Therapist blinding	Assessor blinding	<15% dropout	Intention-to-treat analysis	Between-group difference reported	Point estimate and variability reported	Total (0-10)
Booth et al [52], 2016 ^t	1	0	1	0	0	0	0	0	1	1	4
Connelly et al [61], 2017 ^u	1	1	0	0	0	0	1	0	0	1	4
Glasgow et al [62], 2010 ^v	1	0	1	0	0	0	0	1	1	1	5
Hansel et al [63], 2017 ^w	1	0	1	0	0	1	1	1	1	1	7
Jennings et al [53], 2014 ^x	1	1	0	0	0	0	0	1	1	1	5
Muller et al [54], 2017 ^y	1	1	0	1	0	1	0	1	1	1	7
Vluggen et al [64], 2021 ^z	1	0	0	0	0	0	0	1	1	1	4
Guillaumier et al [39], 2022 ^{aa}	1	1	1	0	0	1	1	1	1	1	8
Kim et al [55], 2013 ^{ab}	1	0	1	0	0	0	1	1	1	1	6

Study, year	Random allocation	Concealed allocation	Groups similar at baseline	Participant blinding	Therapist blinding	Assessor blinding	<15% dropout	Intention-to-treat analysis	Between-group difference reported	Point estimate and variability reported	Total (0-10)
van den Berg et al [65], 2006 ^{ac}	1	1	1	0	0	1	1	1	1	1	8

^aProject supported by the National Center for Advancing Translational Sciences, National Institutes of Health (NIH), grants UL1 TR001872 and UL1TR002369, and other NIH grants (P30DK098722, P30 CA069533-21, and National Cancer Institute K07CA197077).

^bAmy Finlay was supported by a PhD scholarship provided by the University of Adelaide as well as a scholarship top-up by the Freemasons Centre for Male Health. Project costs were covered by a start-up package provided to Camile E Short when commencing at the Freemasons Centre for Male Health. Camile E Short was also supported by a National Health and Medical Research Council Early Career Research fellowship.

^cThis work was supported by the Canada Research Chairs Program held by Kerry Courneya.

^dThis study was funded by Gaia, Germany, a research-focused small to medium enterprise that specializes in eHealth interventions and regularly participates in publicly funded research. There was no external funding.

^eResearch project funded by the Dutch Cancer Society (grant NOU2011-5151).

^fThis work was supported by grants from the Prostate Cancer Foundation; the American Cancer Society; and the Department of Urology, University of California, San Francisco.

^gAuthors declared no funding source.

^hThis research was funded by an award from the National Cancer Institute (R03 CA134197).

ⁱThe American Cancer Society funds the creation, maintenance, and updating of the Cancer Prevention Study-3.

^jThe research reported in this publication was supported by the National Cancer Institute of the NIH under award K07CA197077 to EVB.

^kThis project (NKI 2015-7904) is funded by the Dutch Cancer Society (*KWF Kankerbestrijding*). The funding body had no role in the design of the study; collection, analysis, and interpretation of the data; or writing of the manuscript.

^lThis study was supported by grants from the National R&D Program for Cancer Control, Ministry of Health and Welfare, Republic of Korea (1320330), and partially by a grant from the Korea Health Technology R&D Project through the Korea Health Industry Development Institute, funded by the Ministry of Health and Welfare, Republic of Korea (grant HC15C1391).

^mDepartment of Veterans Affairs Office of Rehabilitation Research and Development Service (Career Development Award 2, F6847W [MM]; Career Development Award 2, IK2RX002165 [EW]; Merit O1150-R [MM]).

ⁿFully funded by a PhD grant from the Northern Norway Regional Health Authority (ID 3342/HST986-10).

^oResearch supported by a junior research group grant from the *Wilhelm-Stiftung für Rehabilitationsforschung* in Germany and a faculty research grant from Hong Kong Baptist University in Hong Kong (FRG1/12-13/064).

^pThis study was funded by ZonMw, the Netherlands Organization for Health Research and Development (520001001).

^qThis research was supported by the Health and Medical Research Fund (10110301), the Food and Health Bureau, and the Hong Kong Special Administrative Regions.

^rThis paper presents independent research funded by the National Institute for Health and Care Research (NIHR) for Patient Benefit program (PB-PG-1111-26080). Nadine E Foster and Jonathan C Hill are funded by an NIHR Research Professorship awarded to Nadine E Foster (NIHR-RP-011-015), and Lisa C Roberts is funded by a Higher Education Funding Council for England and National Institute of Health and Care Research Senior Clinical Lectureship (round 3). Nadine E Foster, Elaine M Hay, and Paul Little are National Institute of Health and care Research senior investigators.

^sThis manuscript originated from a PhD thesis (240/2425) by LJ.

^tSource of funding not reported by the study authors.

^uSource of funding not reported by the study authors.

^vSupported by grant DK35524 from the National Institute of Diabetes and Digestive and Kidney Diseases.

^wThe Medical Expert Systems-MXS company kindly provided the MXS-CARE e-coaching program for use in this study. The company did not take part in the data analyses.

^xCorneel Vandelanotte was supported by the National Health and Medical Research Council of Australia (519778) and a National Heart Foundation of Australia (PH 07B 3303) postdoctoral research fellowship.

^yThis research was part of the Diabetes Literacy project supported by grant FP7-Health-2012-Innovation-1/306186 of the European Commission.

^zThis study was supported by the Maastricht University Medical Center+ Strategy Horizon 2020. The funding source had no involvement in conducting the research or preparing the research paper.

^{aa}This study was funded by a grant from the National Health and Medical Research Council (NHMRC; APP1125429) awarded to Billie Bonevski, Neil J Spratt, Michael Pollack, Amanda Baker, Parker Magin, Alyna Turner, Christopher Oldmeadow, Clare Collins, and Robin Callister. Ashleigh Guillaumier was supported by a postdoctoral fellowship from the National Heart Foundation (award 101303). Neil J Spratt was supported by a cofunded Australian NHMRC and National Heart Foundation Career Development/Future Leader Fellowship (GNT1110629/100827). Amanda Baker was supported by an NHMRC Research Fellowship (G1200044). The funders had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript.

^{ab}This work was supported by the Basic Science Research Program through the National Research Foundation of Korea funded by the Ministry of Education, Science, and Technology (20110003345).

^{ac}Supported by ZonMw (Netherlands Organization for Health Research and Development; grant 4010.0004) and the *Reumafonds* (Dutch Arthritis Foundation).

Effect of Using Websites Containing Health Information Compared With Usual Care on Physical Activity Levels

Overview

A total of 79% (23/29) of the trials compared the effect of the use of websites containing health information with that of usual care on physical activity levels. A meta-analysis of 55% (16/29) of the trials (Figure 3 [37-39,42-44,46,49,51,53,56,58-61,64]) including 2884 participants found no between-group differences in physical activity levels when comparing the use of websites that contain health information with usual care (SMD=0.20, 95% CI -0.01 to 0.41). A sensitivity analysis was performed to remove 6% (1/16) of these trials [51] with implausibly high baseline levels of physical activity. A meta-analysis of the remaining 94% (15/16) of the trials including 2833 participants found moderate-certainty evidence with a small effect size that the use of websites containing health information increased physical activity levels in adults living with chronic health conditions (SMD=0.27, 95% CI 0.08-0.46) when compared with usual care (Table 3).

When a meta-analysis of 52% (15/29) of the trials (Figure 4 [37-39,42-44,46,49,51,53,56,58-61,64]) including 2775 participants was performed on reported physical activity levels as minutes of moderate to vigorous physical activity (self-reported and device based) per week, there was moderate-certainty evidence that using websites containing health information increased time spent in moderate to vigorous physical activity when compared with usual care (MD=39 min/wk, 95% CI 18.60-58.47; Table 3).

Data from 7% (2/29) of the trials [45,55] on the proportion of participants who met the recommended 150 minutes per week of moderate physical activity could not be pooled for meta-analysis. In one trial [45] (N=59), the authors found that 66% of participants in the intervention group compared with 36% in the usual care group ($P<.001$) achieved the recommended physical activity levels. In the other trial [55] (N=394), there were no between-group differences for participants who met physical activity recommendations ($P=.08$).

Figure 3. Standardized mean difference (95% CI) of the effect of using websites containing health information compared with usual care on physical activity levels by pooling data from 16 trials.

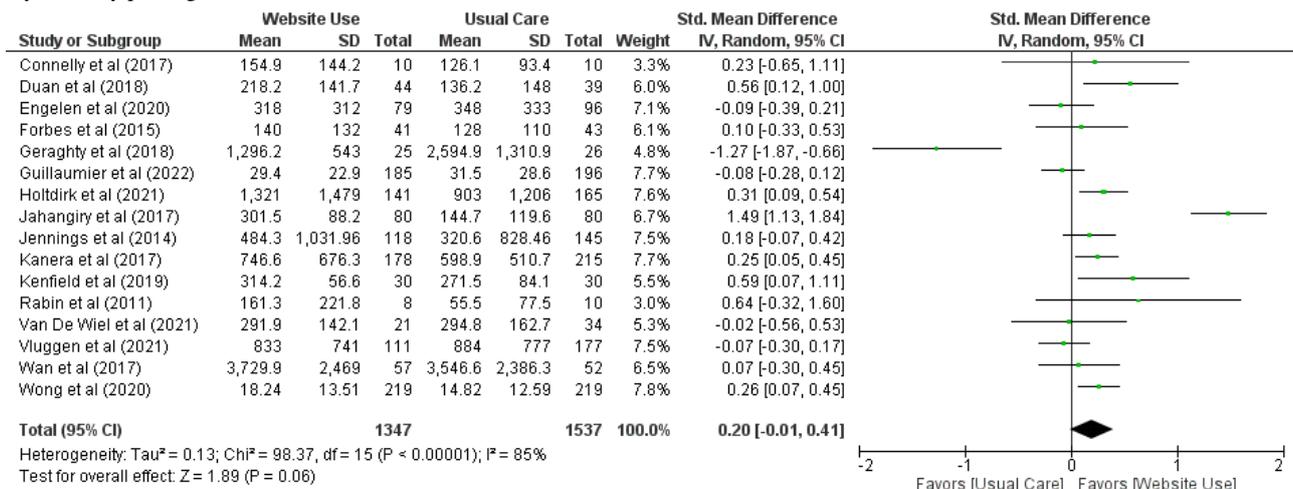


Table 3. Overall meta-analyses of the effects of using websites containing health information on physical activity levels, quality of life, self-efficacy, and diet changes.

Outcome and comparison group	Trials (n=29), n (%)	Participants	MD ^a (95% CI)	SMD ^b (95% CI)	Quality of evidence (GRADE ^c)
Physical activity^d					
Usual care	16 (55)	2884	N/A ^e	0.20 (–0.01 to 0.41)	Moderate ^f
Usual care ^g	15 (52)	2833	N/A	0.27 (0.08 to 0.46)	Moderate ^f
Website+additional support	7 (24)	572	N/A	0.14 (–0.26 to 0.54)	Low ^h
MVPAⁱ (min/wk)					
Website+additional support ^j	2 (7)	67	46.97 (–21.16 to 115.10)	N/A	Moderate ^k
Processed meat consumption (serves/wk)					
Usual care	2 (7)	109	1.14 (0.70 to 1.58)	N/A	High
Healthy diet^l					
Usual care	4 (14)	958	N/A	0.13 (–0.11 to 0.37)	Moderate ^k
Vegetable intake (serves/wk)					
Usual care	5 (17)	755	N/A	0.47 (–0.01 to 0.94)	Very low ^m
Fish consumption (serves/wk)					
Usual care	2 (7)	109	0.86 (–0.86 to 2.57)	N/A	Low ⁿ
Quality of life^o					
Usual care	6 (21)	877	N/A	0.36 (0.12 to 0.59)	Moderate ^f
Self-efficacy^p					
Usual care	4 (14)	1693	N/A	0.26 (0.05 to 0.48)	Moderate ^f

^aMD: mean difference.

^bSMD: standardized mean difference.

^cGRADE: Grading of Recommendations Assessment, Development, and Evaluation. *Working group grades of evidence*: high quality (further research is very unlikely to change our confidence in the estimate of the effect), moderate quality (further research is likely to have an important impact on our confidence in the estimate of the effect and may change the estimate), low quality (further research is very likely to have an important impact on our confidence in the estimate of the effect and is likely to change the estimate), and very low quality (we are very uncertain about the estimate).

^dPhysical activity (PA): questionnaires reporting on moderate to vigorous PA levels in minutes per week (eg, International Physical Activity Questionnaire, Community Health Activities Model Program for Seniors, Godin-Shephard Leisure-Time Physical Activity Questionnaire, and Short Questionnaire to Assess Health-Enhancing Physical Activity), self-reported active minutes per week, and device-measured PA levels (eg, accelerometer), as well as steps per day.

^eN/A: not applicable.

^fReason for downgrade: I^2 score of >50%.

^gSensitivity analysis to remove trials with high median metabolic equivalent of task minutes of PA at baseline, and the authors declared that trial participants likely substantially overestimated their activity using the International Physical Activity Questionnaire–Short Form tool.

^hReason for downgrade: I^2 score of >50% and >50% of trials with a Physiotherapy Evidence Database (PEDro) score of <6.

ⁱMVPA: moderate to vigorous physical activity.

^jObjectively measured moderate to vigorous physical activity.

^kReason for downgrade: 95% CI range of >0.8 standardized mean difference or >2 times the mean difference.

^lDiet quality: questionnaires reporting on diet quality (eg, Dutch Healthy Diet Index, Diet Quality Index, food frequency questionnaire, or self-reported consumption of fruit or vegetables or processed meat or fish or legumes in either serves per d or per wk or either yes or no response to meeting guidelines).

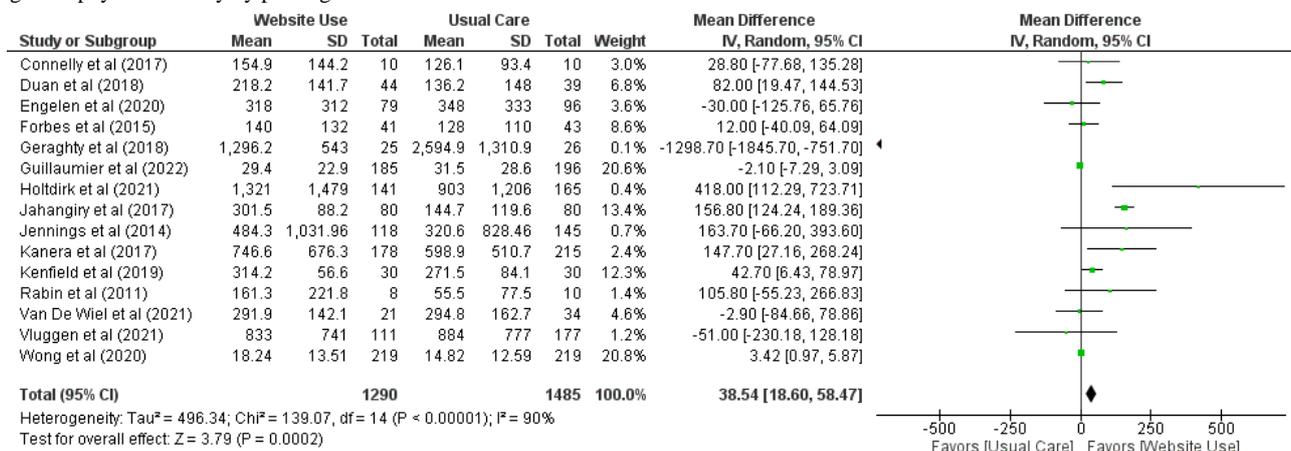
^mReason for downgrade: I^2 score of >50% and >50% of trials with a PEDro score of <6 and 95% CI range of >0.8 standardized mean difference or >2 times the mean difference.

ⁿReason for downgrade: I^2 score of >50% and 95% CI range of >0.8 standardized mean difference or >2 times the mean difference.

^oQuality of life: a variety of questionnaires were used (eg, health change questionnaire, quality of life Functional Assessment of Cancer Therapy, World Health Organization Quality of Life–Brief, and RAND-SF36).

^pSelf-efficacy: a variety of methods were used to report on self-efficacy (eg, Self-Management Ability–Patient Activation Measure, Chinese version of the Self-Efficacy for Exercise Scale, self-reported satisfaction, and the Mastery Scale).

Figure 4. Mean difference (95% CI) of the effect of using websites containing health information compared with usual care on time spent in moderate to vigorous physical activity by pooling data from 15 trials.



Subgroup Analysis: Effect of Using Websites Containing Health Information by Disease Type

Subgroup analyses were performed for specific disease groups. For adults living with cancer, a meta-analysis of 21% (6/29) of the trials [36,42-44,46,56] including 916 participants found high-certainty evidence in favor of using a website containing

health information for improving physical activity levels (MD=55 min/wk, 95% CI 1.60-107.40) compared with usual care. For adults with type 2 diabetes [53,61,64] or cardiovascular disease [38,58,59], no between-group differences were found for increasing physical activity levels when comparing the use of websites containing health information with usual care (Table 4).

Table 4. Subgroup meta-analyses of the effect of using websites containing health information on physical activity levels by outcome measurement, program duration, and chronic health condition.

Outcome	Comparison group	Trials (n=29), n (%)	Participants	MD ^a (95% CI)	SMD ^b (95% CI)	Quality of evidence (GRADE ^c)
Physical activity: MVPA ^d only ^e	Usual care	15 (52)	2775	38.54 (18.60 to 58.47)	N/A ^f	Moderate ^g
Physical activity: device based only ^e	Usual care	3 (10)	135	34.63 (2.98 to 66.29)	N/A	High
Physical activity: program duration (<3 mo)	Usual care	9 (31)	1355	N/A	0.12 (-0.13 to 0.37)	Moderate ^g
Physical activity: program duration (>3 mo) ^e	Usual care	7 (24)	1529	41.38 (-33.80 to 116.56)	N/A	Low ^h
Physical activity: cancer ^e	Usual care	6 (21)	916	54.50 (1.60 to 107.40)	N/A	High
Physical activity: T2DM ^{e,i}	Usual care	3 (10)	571	29.57 (-58.6 to 117.8)	N/A	Low ^j
Physical activity: CVD ^{e,k}	Usual care	3 (10)	696	20.64 (-34.88 to 76.16)	N/A	Low ^l

^aMD: mean difference.

^bSMD: standardized mean difference.

^cGRADE: Grading of Recommendations Assessment, Development, and Evaluation.

^dMVPA: moderate to vigorous physical activity.

^eAll mean differences are measured in minutes per week.

^fN/A: not applicable.

^gReason for downgrade: I^2 score of >50%.

^hReason for downgrade: I^2 score of >50% and 95% CI range of >0.8 standardized mean difference or >2 times the mean difference.

ⁱT2DM: type 2 diabetes mellitus.

^jReason for downgrade: 95% CI range of >0.8 standardized mean difference or >2 times the mean difference and >50% of trials with a PEDro score of <6.

^kCVD: cardiovascular disease.

^lReason for downgrade: I^2 score of >50% and >50% of trials with a PEDro score of <6 and 95% CI range of >0.8 standardized mean difference or >2 times the mean difference.

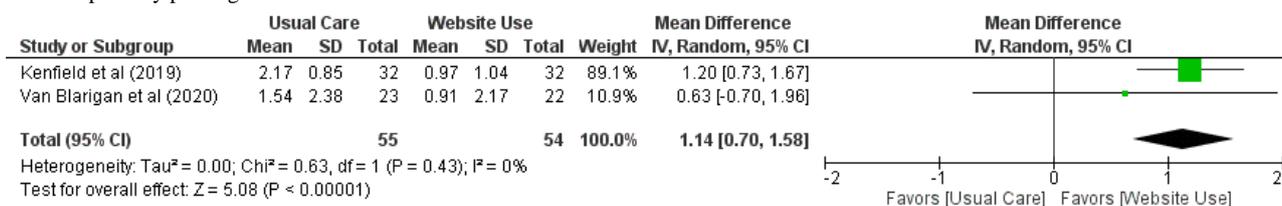
Subgroup Analysis: Effect of Using Websites Containing Health Information by Intervention Duration

When the trials were grouped into short (<3 mo) and long (≥3 mo) interventions and compared with usual care, no between-group differences were found (Table 4).

Subgroup Analysis: Effect of Using Websites Containing Health Information Compared With Usual Care on Processed Meat Consumption

A meta-analysis of 7% (2/29) of the trials including 109 participants found high-certainty evidence that using websites containing health information reduced processed meat consumption for adults living with chronic health conditions (MD=1.14 serves/wk, 95% CI 0.70-1.58; Figure 5 [44,48]) when compared with usual care.

Figure 5. Mean difference (95% CI) of the effect of using websites containing health information compared with usual care on reducing processed meat consumption by pooling data from 2 trials.



Subgroup Analysis: Effect of Using Websites Containing Health Information Compared With Usual Care on Other Diet Measures

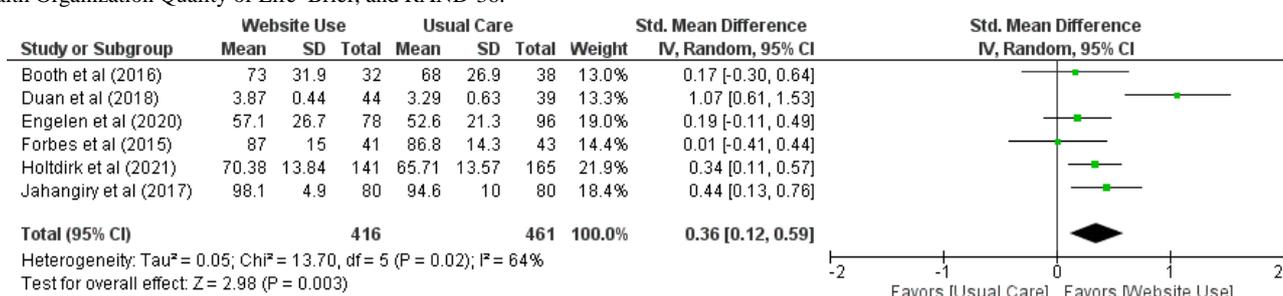
Data from 7% (2/29) of the included trials [52,64] could not be combined for meta-analysis because of heterogeneity in outcomes. One trial [64] found reduced snack intake in calories per week when accessing self-directed websites compared with usual care ($P=.002$). The second trial [52] did not find any between-group differences in consumption of protein ($P=.54$), carbohydrates ($P=.06$), sugars ($P=.71$), sodium ($P=.38$), or fiber ($P=.29$) when comparing the use of websites containing health information with usual care.

There were no between-group differences in healthy diet questionnaire scores or vegetable and fish consumption when comparing groups that used websites containing health information with usual care (Table 3).

Subgroup Analysis: Effect of Using Websites Containing Health Information Compared With Usual Care on Quality of Life

A meta-analysis of 21% (6/29) of the trials including 877 participants found moderate-certainty evidence with a small to moderate effect size that using websites containing health information improved quality of life in adults with chronic health conditions (SMD=0.36, 95% CI 0.12-0.59; Figure 6 [38,42,43,52,58,60]) when compared with usual care.

Figure 6. Standardized mean difference (95% CI) of the effect of using websites containing health information compared with usual care on quality of life by pooling data from 6 trials. Questionnaires used: health change questionnaire, quality of life Functional Assessment of Cancer Therapy, World Health Organization Quality of Life–Brief, and RAND-36.

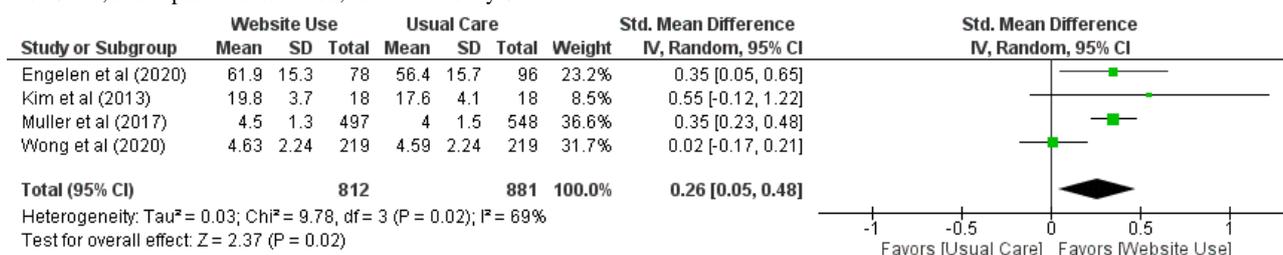


Subgroup Analysis: Effect of Using Websites Containing Health Information Compared With Usual Care on Self-Efficacy

A meta-analysis of 14% (4/29) of the trials including 1693 participants found moderate-certainty evidence with a small

effect size that using websites containing health information improved self-efficacy in adults living with chronic health conditions (SMD=0.26, 95% CI 0.05-0.48; Figure 7 [54,55,58,59]) when compared with usual care.

Figure 7. Standardized mean difference (95% CI) of the effect of using websites containing health information compared with usual care on self-efficacy by pooling data from 4 trials. Questionnaires used: Self-Management Ability–Patient Activation Measure, Chinese version of the Self-Efficacy for Exercise Scale, self-reported satisfaction, and the Mastery Scale.



Subgroup Analysis: Effect of Using Websites Containing Health Information Compared With Using the Same Websites With Additional Support on Physical Activity Levels

A total of 34% (10/29) of the trials compared the effect of using websites containing health information with that of using the same websites offering additional support on physical activity levels. A meta-analysis of 70% (7/10) of these trials including 572 participants found no between-group differences in physical activity minutes (SMD=0.14, 95% CI -0.26 to 0.54) when comparing the effect of the use of websites containing health

information with that of the use of the same websites offering additional support on improving physical activity minutes.

Subgroup Analysis: Effect of Using Websites Containing Health Information Compared With Using the Same Websites With Additional Support on Other Outcomes of Interest

No between-group differences were found for outcomes related to diet quality, self-efficacy, and quality of life when comparing the use of websites containing health information with the use of websites with additional support.

Discussion

Principal Findings

In this systematic review and meta-analysis, we found moderate-to high-certainty evidence with small to moderate effect sizes that using websites that contain health information improved physical activity levels, quality of life, and self-efficacy in adults living with chronic health conditions. There was also high-certainty evidence that using websites containing health information may lead to reduced processed meat consumption. No substantial effects were found for other dietary outcomes in favor of using websites over usual care. Furthermore, our results demonstrate no added benefit of personalized support when using websites that contain health information and promote self-management in adults living with chronic health conditions. This review adds to the literature as the first to evaluate the effect of using websites that contain health information on behavior change in terms of physical activity levels and diet quality for risk factor management in a broad range of adults living with a variety of chronic health conditions.

Using websites that contain health information may result in clinically meaningful improvements in physical activity levels for adults living with chronic health conditions. Our findings are consistent with those of previous reviews suggesting that websites that contain health information have the potential to effectively support adults with cancer, diabetes, and cardiovascular disease [17-20,66] in improving their levels of activity. The estimated mean increase of 39 active minutes per week observed after using websites aimed at increasing physical activity equates to >25% of the recommended weekly physical activity as per current guidelines [67]. An estimated mean increase of 35 active minutes per week was observed when physical activity was measured using a device, further strengthening our main findings by removing the potential for self-reporting bias. The findings of our review confirm, with moderate to high certainty, that the use of websites that contain health information can lead to significant and clinically meaningful improvements in levels of physical activity for adults living with chronic health conditions.

Using websites that contain health information may lead to a reduction in processed meat consumption but not to increases in fruit, vegetable, or fish intake. Diet patterns that are high in processed meat [68,69] are associated with an increased risk of developing type 2 diabetes, cancer, and cardiovascular disease [70], so a demonstrated reduction in intake with the use of websites that contain health information is an important finding. Diet patterns that are high in vegetables, fruits, fish, and legumes have a protective effect against chronic disease [69,70], yet we were unable to demonstrate an increase in the consumption of these with the use of websites that contain health information. It is possible that the use of these types of websites is better able to induce a reduction in the consumption of *risk type* foods (eg, processed meats) as opposed to an increase in the consumption of *protective* foods (eg, vegetables). It is also possible that any beneficial effects are diluted by trying to induce simultaneous changes in multiple dietary factors (eg, increases in the consumption of fruits, vegetables, fish, and

legumes simultaneously) [71]. However, we acknowledge that our inability to demonstrate the effectiveness of using websites that contain health information in increasing “protective” food consumption was likely affected by the heterogeneity associated with how the consumption of these foods was measured. Trials variously measured foods in grams, serves (defined in multiple ways), and frequencies, and this made it difficult to draw any strong conclusions from pooled data on the effectiveness of websites with health information to improve these aspects of diet [72]. Nevertheless, using such websites appears likely to have a positive influence on decreasing processed meat intake, and it may be that, if websites targeted increased intakes of only 1 or 2 “positive” foods, significant changes could be achieved. Consistency in how the consumption of these foods is measured, defined, and reported in the literature will help researchers understand the true impacts of websites with health information on behavior change that results in diet changes for adults living with chronic health conditions.

Web-based interventions may be effective in enhancing quality of life and improving self-efficacy in adults living with chronic health conditions [73,74]. Building self-efficacy early in the chronic disease process empowers adults living with chronic illnesses to take greater control of their health [74]. Key elements to successful risk factor management programs include having access to disease-specific knowledge and suitable tools for self-management [75]. Therefore, changes in physical activity and dietary behavior through the use of websites with health information may be mediated by improvements in self-efficacy through information provision. Our findings suggest that carefully designed websites that contain health information are well placed to provide users with disease-specific information and motivation to build their capacity for behavior change in relation to physical activity and diet quality [76].

Challenges accessing suitable in-person risk factor management programs continue to exist for adults living with chronic health conditions, especially in rural and regional settings [77]. The COVID-19 pandemic has led to the rapid and widespread uptake of digital technology with improvements in infrastructure and greater user confidence worldwide [78]. Therefore, the provision of health information via websites as described in this study may help overcome issues related to lack of in-person care to support positive changes in the lifestyle behaviors of adults living with chronic health conditions. It appears that web-based interventions could be a solution to the access gap that currently exists between adults with chronic health conditions living in rural and metropolitan areas [79], but it should be acknowledged that differences in health literacy [80] as well as differences in access to appropriate broadband and technology may affect the ability of adults living rurally to benefit from this type of intervention [81]. Despite the potential for some issues that could arise from upscaling the use of websites with health information, it seems appropriate to consider whether such an intervention could be a low-resource way to reach and support more adults in managing their chronic health conditions irrespective of where they live and what support they have around them [81].

Strengths and Limitations

This review has several strengths. Our review of 29 trials included participants living with a variety of chronic health conditions across many countries worldwide, increasing the generalizability of our results. Our review was prospectively registered and synthesized very recent evidence (11/29, 38% of the included trials were published in the last 3 y), making the findings relevant to current issues faced in health care settings. The methodology used in this review was robust and with careful appraisal of quality of evidence via the GRADE approach, with most meta-analysis (7/10, 70%) rated as “moderate” or “high” in certainty of evidence, increasing the confidence in the estimate of the effect as seen in our results.

It is important to note that this review has some limitations. One limitation was heterogeneity and inconsistency in the reporting of diet data, which made it difficult to draw meaningful conclusions on the effectiveness of using websites with health information on behavior change in relation to diet quality. However, in the absence of more objective data, an evaluation of the best available evidence can still inform practice. For measures we could pool, we used SMD to account for the variability in how diet quality was measured or reported. Although there did not appear to be any added benefit of providing additional support when using websites that contain health information, these findings should be interpreted with caution because of the small number of included trials with these comparisons in this review. The same can be said for findings such as a reduction in processed meat consumption, which were obtained from a small sample. Similarly, our findings in relation to quality of life and self-efficacy are specific to trials that also looked at physical activity or diet quality and, therefore, may have missed other trials specifically looking at these outcomes. It should also be acknowledged that we could

not isolate which specific website components contributed to effectiveness (eg, content and interface design), and therefore, we are unable to make any recommendations on what individual elements in websites that contain health information have the greatest effect. We are also unable to draw any conclusions about whether using websites that contain health information results in sustained behavior change as this was not the purpose of this review. Finally, participants who agreed to take part in the research were likely to be motivated and ready for change compared with those who chose not to take part in the research. This may affect the generalizability of our findings to patient cohorts who experience challenges with engagement and may not yet be ready for change [82].

Conclusions

The use of websites that contain health information can lead to some healthy lifestyle changes in adults living with chronic health conditions, improve levels of physical activity, reduce processed meat consumption, and improve self-efficacy and quality of life. Providing access to disease-specific websites for chronic disease management may offer a realistic alternative to no intervention for patients who have challenges adopting positive lifestyle behaviors, particularly if they are unable to access health care providers for more intensive therapies. Further research is warranted to explore which specific features of websites have the greatest effect and whether using websites with health information can lead to long-lasting behavior change. To further our understanding of the type of person who stands to benefit most from using websites to promote behavior change in relation to physical activity or diet quality, we recommend that future trials focus on accounting for variables such as age, gender, severity of chronic health condition, and digital competence.

Acknowledgments

The authors would like to thank Debbie Booth for her assistance with developing the search strategy for this review in her role as the academic librarian at the University of Newcastle.

Data Availability

The data sets analyzed during this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

None declared.

Multimedia Appendix 1

PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 checklist.
[\[PDF File \(Adobe PDF File\), 95 KB-Multimedia Appendix 1\]](#)

Multimedia Appendix 2

Full search strategies.
[\[DOCX File , 28 KB-Multimedia Appendix 2\]](#)

Multimedia Appendix 3

Table of excluded papers.

[DOCX File , 75 KB-Multimedia Appendix 3]

References

1. Bauer UE, Briss PA, Goodman RA, Bowman BA. Prevention of chronic disease in the 21st century: elimination of the leading preventable causes of premature death and disability in the USA. *Lancet* 2014 Jul 5;384(9937):45-52 [doi: [10.1016/S0140-6736\(14\)60648-6](https://doi.org/10.1016/S0140-6736(14)60648-6)] [Medline: [24996589](https://pubmed.ncbi.nlm.nih.gov/24996589/)]
2. Health systems 2018. World Health Organization. URL: <http://www.who.int/healthsystems/topics/equity/en/> [accessed 2023-04-24]
3. Chronic disease overview. Centers for Disease Control and Prevention. 2017. URL: <https://www.cdc.gov/chronicdisease/overview/index.htm#ref1> [accessed 2023-04-24]
4. Harrison C, Britt H, Miller G, Henderson J. Examining different measures of multimorbidity, using a large prospective cross-sectional study in Australian general practice. *BMJ Open* 2014 Jul 11;4(7):e004694 [FREE Full text] [doi: [10.1136/bmjopen-2013-004694](https://doi.org/10.1136/bmjopen-2013-004694)] [Medline: [25015470](https://pubmed.ncbi.nlm.nih.gov/25015470/)]
5. Framework on integrated, people-centred health services. World Health Organization. 2016 Apr 15. URL: https://apps.who.int/gb/ebwha/pdf_files/WHA69/A69_39-en.pdf [accessed 2023-04-24]
6. Chronic disease overview. Centers for Disease Control and Prevention. 2016. URL: <https://www.cdc.gov/chronicdisease/resources/publications/aag/pdf/2015/nccdphp-aag.pdf> [accessed 2023-04-24]
7. Duda-Sikuła M, Kurpas D. Barriers and facilitators in the implementation of prevention strategies for chronic disease patients-best practice GuideLines and policies' systematic review. *J Pers Med* 2023 Feb 04;13(2):288 [FREE Full text] [doi: [10.3390/jpm13020288](https://doi.org/10.3390/jpm13020288)] [Medline: [36836522](https://pubmed.ncbi.nlm.nih.gov/36836522/)]
8. Risk factors to health: chronic disease risk factors. Australian Institute of Health and Welfare. URL: <https://www.aihw.gov.au/reports/risk-factors/risk-factors-to-health/contents/chronic-disease-risk-factors> [accessed 2023-04-24]
9. National health survey: first results. Australian Bureau of Statistics. URL: <https://www.abs.gov.au/statistics/health/health-conditions-and-risks/national-health-survey-first-results/latest-release> [accessed 2023-04-22]
10. Ivey FM, Ryan AS, Hafer-Macko CE, Goldberg AP, Macko RF. Treadmill aerobic training improves glucose tolerance and indices of insulin sensitivity in disabled stroke survivors: a preliminary report. *Stroke* 2007 Oct;38(10):2752-2758 [doi: [10.1161/STROKEAHA.107.490391](https://doi.org/10.1161/STROKEAHA.107.490391)] [Medline: [17702957](https://pubmed.ncbi.nlm.nih.gov/17702957/)]
11. Ivey FM, Hafer-Macko CE, Macko RF. Exercise training for cardiometabolic adaptation after stroke. *J Cardiopulm Rehabil Prev* 2008;28(1):2-11 [doi: [10.1097/01.HCR.0000311501.57022.a8](https://doi.org/10.1097/01.HCR.0000311501.57022.a8)] [Medline: [18277823](https://pubmed.ncbi.nlm.nih.gov/18277823/)]
12. Warburton DE, Nicol CW, Bredin SS. Health benefits of physical activity: the evidence. *CMAJ* 2006 Mar 14;174(6):801-809 [FREE Full text] [doi: [10.1503/cmaj.051351](https://doi.org/10.1503/cmaj.051351)] [Medline: [16534088](https://pubmed.ncbi.nlm.nih.gov/16534088/)]
13. Cowell OR, Mistry N, Deighton K, Matu J, Griffiths A, Minihane AM, et al. Effects of a Mediterranean diet on blood pressure: a systematic review and meta-analysis of randomized controlled trials and observational studies. *J Hypertens* 2021 Apr 01;39(4):729-739 [doi: [10.1097/HJH.0000000000002667](https://doi.org/10.1097/HJH.0000000000002667)] [Medline: [33060448](https://pubmed.ncbi.nlm.nih.gov/33060448/)]
14. Australian dietary guidelines. National Health and Medical Research Council. 2013. URL: <https://www.eatforhealth.gov.au/> [accessed 2023-04-25]
15. Schwarz T, Schmidt AE, Bobek J, Ladurner J. Barriers to accessing health care for people with chronic conditions: a qualitative interview study. *BMC Health Serv Res* 2022 Aug 14;22(1):1037 [FREE Full text] [doi: [10.1186/s12913-022-08426-z](https://doi.org/10.1186/s12913-022-08426-z)] [Medline: [35964086](https://pubmed.ncbi.nlm.nih.gov/35964086/)]
16. Thilarajah S, Mentiplay BF, Bower KJ, Tan D, Pua YH, Williams G, et al. Factors associated with post-stroke physical activity: a systematic review and meta-analysis. *Arch Phys Med Rehabil* 2018 Sep;99(9):1876-1889 [doi: [10.1016/j.apmr.2017.09.117](https://doi.org/10.1016/j.apmr.2017.09.117)] [Medline: [29056502](https://pubmed.ncbi.nlm.nih.gov/29056502/)]
17. Woolley AK, Hadjiconstantinou M, Davies M, Khunti K, Seidu S. Online patient education interventions in type 2 diabetes or cardiovascular disease: a systematic review of systematic reviews. *Prim Care Diabetes* 2019 Feb;13(1):16-27 [doi: [10.1016/j.pcd.2018.07.011](https://doi.org/10.1016/j.pcd.2018.07.011)] [Medline: [30131299](https://pubmed.ncbi.nlm.nih.gov/30131299/)]
18. Haberlin C, O'Dwyer T, Mockler D, Moran J, O'Donnell DM, Broderick J. The use of eHealth to promote physical activity in cancer survivors: a systematic review. *Support Care Cancer* 2018 Oct 16;26(10):3323-3336 [doi: [10.1007/s00520-018-4305-z](https://doi.org/10.1007/s00520-018-4305-z)] [Medline: [29909476](https://pubmed.ncbi.nlm.nih.gov/29909476/)]
19. Ester M, Eisele M, Wurz A, McDonough MH, McNeely M, Culos-Reed SN. Current evidence and directions for future research in eHealth physical activity interventions for adults affected by cancer: systematic review. *JMIR Cancer* 2021 Sep 20;7(3):e28852 [FREE Full text] [doi: [10.2196/28852](https://doi.org/10.2196/28852)] [Medline: [34542415](https://pubmed.ncbi.nlm.nih.gov/34542415/)]
20. Wang L, Langlais CS, Kenfield SA, Chan JM, Graff RE, Allen IE, et al. mHealth interventions to promote a healthy diet and physical activity among cancer survivors: a systematic review of randomized controlled trials. *Cancers (Basel)* 2022 Aug 06;14(15):3816 [FREE Full text] [doi: [10.3390/cancers14153816](https://doi.org/10.3390/cancers14153816)] [Medline: [35954479](https://pubmed.ncbi.nlm.nih.gov/35954479/)]
21. Cotter AP, Durant N, Agne AA, Cherrington AL. Internet interventions to support lifestyle modification for diabetes management: a systematic review of the evidence. *J Diabetes Complications* 2014;28(2):243-251 [FREE Full text] [doi: [10.1016/j.jdiacomp.2013.07.003](https://doi.org/10.1016/j.jdiacomp.2013.07.003)] [Medline: [24332469](https://pubmed.ncbi.nlm.nih.gov/24332469/)]
22. Jerant AF, von Friederichs-Fitzwater MM, Moore M. Patients' perceived barriers to active self-management of chronic conditions. *Patient Educ Couns* 2005 Jun;57(3):300-307 [doi: [10.1016/j.pec.2004.08.004](https://doi.org/10.1016/j.pec.2004.08.004)] [Medline: [15893212](https://pubmed.ncbi.nlm.nih.gov/15893212/)]

23. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021 Mar 29;372:n71 [FREE Full text] [doi: [10.1136/bmj.n71](https://doi.org/10.1136/bmj.n71)] [Medline: [33782057](https://pubmed.ncbi.nlm.nih.gov/33782057/)]
24. McKenzie JE, Brennan SE, Ryan RE, Thomson HJ, Johnston RV, Thomas J. Chapter 3: defining the criteria for including studies and how they will be grouped for the synthesis. In: *Cochrane Handbook for Systematic Reviews of Interventions, Second Edition*. London, UK: The Cochrane Collaboration; Sep 20, 2019.
25. Dobrescu A, Nussbaumer-Streit B, Klerings I, Wagner G, Persad E, Sommer I, et al. Restricting evidence syntheses of interventions to English-language publications is a viable methodological shortcut for most medical topics: a systematic review. *J Clin Epidemiol* 2021 Sep;137:209-217 [FREE Full text] [doi: [10.1016/j.jclinepi.2021.04.012](https://doi.org/10.1016/j.jclinepi.2021.04.012)] [Medline: [33933579](https://pubmed.ncbi.nlm.nih.gov/33933579/)]
26. McHugh ML. Interrater reliability: the kappa statistic. *Biochem Med (Zagreb)* 2012;22(3):276-282 [FREE Full text] [Medline: [23092060](https://pubmed.ncbi.nlm.nih.gov/23092060/)]
27. PEDro scale. PEDro Physiotherapy Evidence Data Base. URL: <https://pedro.org.au/english/resources/pedro-scale/> [accessed 2023-04-28]
28. Maher CG, Sherrington C, Herbert RD, Moseley AM, Elkins M. Reliability of the PEDro scale for rating quality of randomized controlled trials. *Phys Ther* 2003 Aug;83(8):713-721 [Medline: [12882612](https://pubmed.ncbi.nlm.nih.gov/12882612/)]
29. Macedo LG, Elkins MR, Maher CG, Moseley AM, Herbert RD, Sherrington C. There was evidence of convergent and construct validity of physiotherapy evidence database quality scale for physiotherapy trials. *J Clin Epidemiol* 2010 Aug;63(8):920-925 [doi: [10.1016/j.jclinepi.2009.10.005](https://doi.org/10.1016/j.jclinepi.2009.10.005)] [Medline: [20171839](https://pubmed.ncbi.nlm.nih.gov/20171839/)]
30. Welcome to RevMan 5.4. The Cochrane Collaboration. URL: https://training.cochrane.org/system/files/uploads/protected_file/RevMan5.4_user_guide.pdf [accessed 2023-04-26]
31. Higgins JP, Li T, Deeks JJ. Chapter 6: choosing effect measures and computing estimates of effect. In: Higgins JP, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, et al, editors. *Cochrane Handbook for Systematic Reviews of Interventions*. London, UK: The Cochrane Collaboration; Sep 20, 2019.
32. Boutron I, Page MJ, Higgins JP, Altman DG, Lundh A, Hróbjartsson A. Chapter 7: considering bias and conflicts of interest among the included studies. In: Higgins JP, Thomas J, Chandler J, Cumpston C, Li T, Page MJ, et al, editors. *Cochrane Handbook for Systematic Reviews of Interventions, Second Edition*. London, UK: The Cochrane Collaboration; Sep 20, 2019.
33. Schünemann HJ, Higgins JP, Vist GE, Glasziou P, Akl EA, Skoetz N, et al. Chapter 14: completing 'summary of findings' tables and grading the certainty of the evidence. In: Higgins JP, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, et al, editors. *Cochrane Handbook for Systematic Reviews of Interventions*. London, UK: The Cochrane Collaboration; Sep 20, 2019.
34. Deeks JJ, Higgins JP, Altman DG. Chapter 10: analysing data and undertaking meta-analyses. In: Higgins JP, Green S, editors. *Cochrane Handbook for Systematic Reviews of Interventions: Cochrane Book Series*. London, UK: The Cochrane Collaboration; Sep 22, 2008.
35. Dennett AM, Peiris CL, Shields N, Prendergast LA, Taylor NF. Moderate-intensity exercise reduces fatigue and improves mobility in cancer survivors: a systematic review and meta-regression. *J Physiother* 2016 Apr;62(2):68-82 [FREE Full text] [doi: [10.1016/j.jphys.2016.02.012](https://doi.org/10.1016/j.jphys.2016.02.012)] [Medline: [26996098](https://pubmed.ncbi.nlm.nih.gov/26996098/)]
36. Kanera IM, Willems RA, Bolman CA, Mesters I, Verboon P, Lechner L. Long-term effects of a web-based cancer aftercare intervention on moderate physical activity and vegetable consumption among early cancer survivors: a randomized controlled trial. *Int J Behav Nutr Phys Act* 2017 Feb 10;14(1):19 [FREE Full text] [doi: [10.1186/s12966-017-0474-2](https://doi.org/10.1186/s12966-017-0474-2)] [Medline: [28187725](https://pubmed.ncbi.nlm.nih.gov/28187725/)]
37. Kanera IM, Bolman CA, Willems RA, Mesters I, Lechner L. Lifestyle-related effects of the web-based Kanker Nazorg Wijzer (Cancer Aftercare Guide) intervention for cancer survivors: a randomized controlled trial. *J Cancer Surviv* 2016 Oct;10(5):883-897 [FREE Full text] [doi: [10.1007/s11764-016-0535-6](https://doi.org/10.1007/s11764-016-0535-6)] [Medline: [26984534](https://pubmed.ncbi.nlm.nih.gov/26984534/)]
38. Duan YP, Liang W, Guo L, Wienert J, Si GY, Lippke S. Evaluation of a web-based intervention for multiple health behavior changes in patients with coronary heart disease in home-based rehabilitation: pilot randomized controlled trial. *J Med Internet Res* 2018 Nov 19;20(11):e12052 [FREE Full text] [doi: [10.2196/12052](https://doi.org/10.2196/12052)] [Medline: [30455167](https://pubmed.ncbi.nlm.nih.gov/30455167/)]
39. Guillaumier A, Spratt NJ, Pollack M, Baker A, Magin P, Turner A, et al. Evaluation of an online intervention for improving stroke survivors' health-related quality of life: a randomised controlled trial. *PLoS Med* 2022 Apr 19;19(4):e1003966 [FREE Full text] [doi: [10.1371/journal.pmed.1003966](https://doi.org/10.1371/journal.pmed.1003966)] [Medline: [35439246](https://pubmed.ncbi.nlm.nih.gov/35439246/)]
40. Chan JM, van Blarigan EL, Langlais CS, Zhao S, Ramsdill JW, Daniel K, et al. Feasibility and acceptability of a remotely delivered, web-based behavioral intervention for men with prostate cancer: four-arm randomized controlled pilot trial. *J Med Internet Res* 2020 Dec 31;22(12):e19238 [FREE Full text] [doi: [10.2196/19238](https://doi.org/10.2196/19238)] [Medline: [33382378](https://pubmed.ncbi.nlm.nih.gov/33382378/)]
41. Finlay A, Evans H, Vincent A, Wittert G, Vandelanotte C, Short CE. Optimising web-based computer-tailored physical activity interventions for prostate cancer survivors: a randomised controlled trial examining the impact of website architecture on user engagement. *Int J Environ Res Public Health* 2020 Oct 28;17(21):7920 [FREE Full text] [doi: [10.3390/ijerph17217920](https://doi.org/10.3390/ijerph17217920)] [Medline: [33126692](https://pubmed.ncbi.nlm.nih.gov/33126692/)]

42. Forbes CC, Blanchard CM, Mummery WK, Courneya KS. Feasibility and preliminary efficacy of an online intervention to increase physical activity in nova Scotian cancer survivors: a randomized controlled trial. *JMIR Cancer* 2015 Nov 23;1(2):e12 [FREE Full text] [doi: [10.2196/cancer.4586](https://doi.org/10.2196/cancer.4586)] [Medline: [28410166](https://pubmed.ncbi.nlm.nih.gov/28410166/)]
43. Holtdirk F, Mehnert A, Weiss M, Mayer J, Meyer B, Bröde P, et al. Results of the Optimune trial: a randomized controlled trial evaluating a novel Internet intervention for breast cancer survivors. *PLoS One* 2021 May 7;16(5):e0251276 [FREE Full text] [doi: [10.1371/journal.pone.0251276](https://doi.org/10.1371/journal.pone.0251276)] [Medline: [33961667](https://pubmed.ncbi.nlm.nih.gov/33961667/)]
44. Kenfield SA, van Blarigan EL, Ameli N, Lavaki E, Cedars B, Paciorenk AT, et al. Feasibility, acceptability, and behavioral outcomes from a technology-enhanced behavioral change intervention (prostate 8): a pilot randomized controlled trial in men with prostate cancer. *Eur Urol* 2019 Jun;75(6):950-958 [doi: [10.1016/j.eururo.2018.12.040](https://doi.org/10.1016/j.eururo.2018.12.040)] [Medline: [30638635](https://pubmed.ncbi.nlm.nih.gov/30638635/)]
45. Lee MK, Yun YH, Park H, Lee ES, Jung KH, Noh D. A web-based self-management exercise and diet intervention for breast cancer survivors: pilot randomized controlled trial. *Int J Nurs Stud* 2014 Dec;51(12):1557-1567 [doi: [10.1016/j.ijnurstu.2014.04.012](https://doi.org/10.1016/j.ijnurstu.2014.04.012)] [Medline: [24856854](https://pubmed.ncbi.nlm.nih.gov/24856854/)]
46. Rabin C, Dunsiger S, Ness KK, Marcus BH. Internet-based physical activity intervention targeting young adult cancer survivors. *J Adolesc Young Adult Oncol* 2011 Dec;1(4):188-194 [FREE Full text] [doi: [10.1089/jayao.2011.0040](https://doi.org/10.1089/jayao.2011.0040)] [Medline: [23610737](https://pubmed.ncbi.nlm.nih.gov/23610737/)]
47. Rees-Punia E, Leach CR, Westmaas JL, Dempsey LF, Roberts AM, Nocera JR, et al. Pilot randomized controlled trial of feasibility, acceptability, and preliminary efficacy of a web-based physical activity and sedentary time intervention for survivors of physical inactivity-related cancers. *Int J Behav Med* 2022 Apr 06;29(2):220-229 [FREE Full text] [doi: [10.1007/s12529-021-09999-5](https://doi.org/10.1007/s12529-021-09999-5)] [Medline: [33954891](https://pubmed.ncbi.nlm.nih.gov/33954891/)]
48. van Blarigan EL, Kenfield S, Chan J, van Loon K, Paciorenk A, Zhang L, et al. Feasibility and acceptability of a web-based dietary intervention with text messages for colorectal cancer: a randomized pilot trial. *Cancer Epidemiol Biomarkers Prev* 2020 Apr;29(4):752-760 [FREE Full text] [doi: [10.1158/1055-9965.EPI-19-0840](https://doi.org/10.1158/1055-9965.EPI-19-0840)] [Medline: [31941707](https://pubmed.ncbi.nlm.nih.gov/31941707/)]
49. Wan ES, Kantorowski A, Homsy D, Teylan M, Kadri R, Richardson CR, et al. Promoting physical activity in COPD: insights from a randomized trial of a web-based intervention and pedometer use. *Respir Med* 2017 Sep;130:102-110 [FREE Full text] [doi: [10.1016/j.rmed.2017.07.057](https://doi.org/10.1016/j.rmed.2017.07.057)] [Medline: [29206627](https://pubmed.ncbi.nlm.nih.gov/29206627/)]
50. Antypas K, Wangberg SC. An internet- and mobile-based tailored intervention to enhance maintenance of physical activity after cardiac rehabilitation: short-term results of a randomized controlled trial. *J Med Internet Res* 2014 Mar 11;16(3):e77 [FREE Full text] [doi: [10.2196/jmir.3132](https://doi.org/10.2196/jmir.3132)] [Medline: [24618349](https://pubmed.ncbi.nlm.nih.gov/24618349/)]
51. Geraghty AW, Stanford R, Stuart B, Little P, Roberts LC, Foster NE, et al. Using an internet intervention to support self-management of low back pain in primary care: findings from a randomised controlled feasibility trial (SupportBack). *BMJ Open* 2018 Mar 09;8(3):e016768 [FREE Full text] [doi: [10.1136/bmjopen-2017-016768](https://doi.org/10.1136/bmjopen-2017-016768)] [Medline: [29525768](https://pubmed.ncbi.nlm.nih.gov/29525768/)]
52. Booth AO, Lewis C, Hunter SJ, Dean M, Cardwell CR, McKinley MC. Development and evaluation of a computer-based, self-management tool for people recently diagnosed with type 2 diabetes. *J Diabetes Res* 2016;2016:3192673-3192611 [FREE Full text] [doi: [10.1155/2016/3192673](https://doi.org/10.1155/2016/3192673)] [Medline: [27446961](https://pubmed.ncbi.nlm.nih.gov/27446961/)]
53. Jennings CA, Vandelanotte C, Caperchione CM, Mummery WK. Effectiveness of a web-based physical activity intervention for adults with Type 2 diabetes—a randomised controlled trial. *Prev Med* 2014 Mar;60:33-40 [doi: [10.1016/j.ypmed.2013.12.011](https://doi.org/10.1016/j.ypmed.2013.12.011)] [Medline: [24345601](https://pubmed.ncbi.nlm.nih.gov/24345601/)]
54. Muller I, Rowsell A, Stuart B, Hayter V, Little P, Ganahl K, et al. Effects on engagement and health literacy outcomes of web-based materials promoting physical activity in people with diabetes: an international randomized trial. *J Med Internet Res* 2017 Jan 23;19(1):e21 [FREE Full text] [doi: [10.2196/jmir.6601](https://doi.org/10.2196/jmir.6601)] [Medline: [28115299](https://pubmed.ncbi.nlm.nih.gov/28115299/)]
55. Kim J, Lee S, Kim J. Effects of a web-based stroke education program on recurrence prevention behaviors among stroke patients: a pilot study. *Health Educ Res* 2013 Jun 19;28(3):488-501 [doi: [10.1093/her/cyt044](https://doi.org/10.1093/her/cyt044)] [Medline: [23515115](https://pubmed.ncbi.nlm.nih.gov/23515115/)]
56. van de Wiel HJ, Stuijver MM, May AM, van Grinsven S, Aaronson NK, Oldenburg HS, et al. Effects of and lessons learned from an internet-based physical activity support program (with and without physiotherapist telephone counselling) on physical activity levels of breast and prostate cancer survivors: the Pablo Randomized Controlled Trial. *Cancers (Basel)* 2021 Jul 21;13(15):3665 [FREE Full text] [doi: [10.3390/cancers13153665](https://doi.org/10.3390/cancers13153665)] [Medline: [34359567](https://pubmed.ncbi.nlm.nih.gov/34359567/)]
57. Yun YH, Lim CI, Lee ES, Kim YT, Shin KH, Kim Y, et al. Efficacy of health coaching and a web-based program on physical activity, weight, and distress management among cancer survivors: a multi-centered randomised controlled trial. *Psychooncology* 2020 Jul 23;29(7):1105-1114 [doi: [10.1002/pon.5394](https://doi.org/10.1002/pon.5394)] [Medline: [32307828](https://pubmed.ncbi.nlm.nih.gov/32307828/)]
58. Engelen MM, van Dulmen S, Puijk-Hekman S, Vermeulen H, Nijhuis-van der Sanden MW, Bredie SJ, et al. Evaluation of a web-based self-management program for patients with cardiovascular disease: explorative randomized controlled trial. *J Med Internet Res* 2020 Jul 24;22(7):e17422 [FREE Full text] [doi: [10.2196/17422](https://doi.org/10.2196/17422)] [Medline: [32706708](https://pubmed.ncbi.nlm.nih.gov/32706708/)]
59. Wong EM, Leung DYP, Chair S, Sit JW. Effects of a web-based educational support intervention on total exercise and cardiovascular risk markers in adults with coronary heart disease. *Worldviews Evid Based Nurs* 2020 Aug 08;17(4):283-292 [doi: [10.1111/wvn.12456](https://doi.org/10.1111/wvn.12456)] [Medline: [32772509](https://pubmed.ncbi.nlm.nih.gov/32772509/)]
60. Jahangiry L, Montazeri A, Najafi M, Yaseri M, Farhangi MA. An interactive web-based intervention on nutritional status, physical activity and health-related quality of life in patient with metabolic syndrome: a randomized-controlled trial (The Red Ruby Study). *Nutr Diabetes* 2017 Jan 09;7(1):e240 [FREE Full text] [doi: [10.1038/nutd.2016.35](https://doi.org/10.1038/nutd.2016.35)] [Medline: [28067891](https://pubmed.ncbi.nlm.nih.gov/28067891/)]

61. Connelly J, Kirk A, Masthoff J, MacRury S. A website to promote physical activity in people with type 2 diabetes living in remote or rural locations: feasibility pilot randomized controlled trial. *JMIR Diabetes* 2017 Oct 19;2(2):e26 [FREE Full text] [doi: [10.2196/diabetes.6669](https://doi.org/10.2196/diabetes.6669)] [Medline: [30291091](https://pubmed.ncbi.nlm.nih.gov/30291091/)]
62. Glasgow RE, Kurz D, King D, Dickman JM, Faber AJ, Halterman E, et al. Outcomes of minimal and moderate support versions of an internet-based diabetes self-management support program. *J Gen Intern Med* 2010 Dec 17;25(12):1315-1322 [FREE Full text] [doi: [10.1007/s11606-010-1480-0](https://doi.org/10.1007/s11606-010-1480-0)] [Medline: [20714820](https://pubmed.ncbi.nlm.nih.gov/20714820/)]
63. Hansel B, Giral P, Gambotti L, Lafourcade A, Peres G, Filipecki C, et al. A fully automated web-based program improves lifestyle habits and HbA1C in patients with type 2 diabetes and abdominal obesity: randomized trial of patient E-coaching nutritional support (the ANODE Study). *J Med Internet Res* 2017 Nov 08;19(11):e360 [FREE Full text] [doi: [10.2196/jmir.7947](https://doi.org/10.2196/jmir.7947)] [Medline: [29117929](https://pubmed.ncbi.nlm.nih.gov/29117929/)]
64. Vluggen S, Candel M, Hoving C, Schaper NC, de Vries H. A web-based computer-tailored program to improve treatment adherence in patients with type 2 diabetes: randomized controlled trial. *J Med Internet Res* 2021 Feb 23;23(2):e18524 [FREE Full text] [doi: [10.2196/18524](https://doi.org/10.2196/18524)] [Medline: [33620321](https://pubmed.ncbi.nlm.nih.gov/33620321/)]
65. van den Berg MH, Ronday HK, Peeters AJ, le Cessie S, van der Giesen FJ, Breedveld FC, et al. Using internet technology to deliver a home-based physical activity intervention for patients with rheumatoid arthritis: a randomized controlled trial. *Arthritis Rheum* 2006 Dec 15;55(6):935-945 [FREE Full text] [doi: [10.1002/art.22339](https://doi.org/10.1002/art.22339)] [Medline: [17139640](https://pubmed.ncbi.nlm.nih.gov/17139640/)]
66. Clark RA, Conway A, Poulsen V, Keech W, Tirimacco R, Tideman P. Alternative models of cardiac rehabilitation: a systematic review. *Eur J Prev Cardiol* 2015 Jan;22(1):35-74 [doi: [10.1177/2047487313501093](https://doi.org/10.1177/2047487313501093)] [Medline: [23943649](https://pubmed.ncbi.nlm.nih.gov/23943649/)]
67. Australia's physical activity and sedentary behaviour guidelines. Physiopedia. URL: https://www.physio-pedia.com/Australia%27s_Physical_Activity_and_Sedentary_Behaviour_Guidelines#:~:text=Physical%20Activity%20Guidelines,-Doing%20any%20physical&text=Accumulate%20150%20to%20300%20minutes,and%20vigorous%20activities%2C%20each%20week [accessed 2023-04-25]
68. Jannasch F, Kröger J, Schulze MB. Dietary patterns and type 2 diabetes: a systematic literature review and meta-analysis of prospective studies. *J Nutr* 2017 Jun 19;147(6):1174-1182 [FREE Full text] [doi: [10.3945/jn.116.242552](https://doi.org/10.3945/jn.116.242552)] [Medline: [28424256](https://pubmed.ncbi.nlm.nih.gov/28424256/)]
69. Fung TT, Brown LS. Dietary patterns and the risk of colorectal cancer. *Curr Nutr Rep* 2013 Mar 01;2(1):48-55 [FREE Full text] [doi: [10.1007/s13668-012-0031-1](https://doi.org/10.1007/s13668-012-0031-1)] [Medline: [24496398](https://pubmed.ncbi.nlm.nih.gov/24496398/)]
70. GBD 2017 Diet Collaborators. Health effects of dietary risks in 195 countries, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 2019 May 11;393(10184):1958-1972 [FREE Full text] [doi: [10.1016/S0140-6736\(19\)30041-8](https://doi.org/10.1016/S0140-6736(19)30041-8)] [Medline: [30954305](https://pubmed.ncbi.nlm.nih.gov/30954305/)]
71. Mummah SA, Mathur M, King AC, Gardner CD, Sutton S. Mobile technology for vegetable consumption: a randomized controlled pilot study in overweight adults. *JMIR Mhealth Uhealth* 2016 May 18;4(2):e51 [FREE Full text] [doi: [10.2196/mhealth.5146](https://doi.org/10.2196/mhealth.5146)] [Medline: [27193036](https://pubmed.ncbi.nlm.nih.gov/27193036/)]
72. Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M, et al. Developing and evaluating complex interventions: the new Medical Research Council guidance. *BMJ* 2008 Sep 29;337(sep29 1):a1655 [FREE Full text] [doi: [10.1136/bmj.a1655](https://doi.org/10.1136/bmj.a1655)] [Medline: [18824488](https://pubmed.ncbi.nlm.nih.gov/18824488/)]
73. Buneviciene I, Mekary RA, Smith TR, Onnela JP, Bunevicius A. Can mHealth interventions improve quality of life of cancer patients? A systematic review and meta-analysis. *Crit Rev Oncol Hematol* 2021 Jan;157:103123 [FREE Full text] [doi: [10.1016/j.critrevonc.2020.103123](https://doi.org/10.1016/j.critrevonc.2020.103123)] [Medline: [33190065](https://pubmed.ncbi.nlm.nih.gov/33190065/)]
74. Kashani M, Eliasson AH, Walizer EM, Fuller CE, Engler RJ, Villines TC, et al. Early empowerment strategies boost self-efficacy to improve cardiovascular health behaviors. *Glob J Health Sci* 2016 Sep 01;8(9):55119 [FREE Full text] [doi: [10.5539/gjhs.v8n9p322](https://doi.org/10.5539/gjhs.v8n9p322)] [Medline: [27157185](https://pubmed.ncbi.nlm.nih.gov/27157185/)]
75. Michie S, Ashford S, Sniehotta FF, Dombrowski SU, Bishop A, French DP. A refined taxonomy of behaviour change techniques to help people change their physical activity and healthy eating behaviours: the CALO-RE taxonomy. *Psychol Health* 2011 Nov;26(11):1479-1498 [doi: [10.1080/08870446.2010.540664](https://doi.org/10.1080/08870446.2010.540664)] [Medline: [21678185](https://pubmed.ncbi.nlm.nih.gov/21678185/)]
76. Hashemzadeh M, Rahimi A, Zare-Farashbandi F, Alavi-Naeini AM, Daei A. Transtheoretical model of health behavioral change: a systematic review. *Iranian J Nursing Midwifery Res* 2019;24(2):83 [doi: [10.4103/ijnmr.ijnmr_94_17](https://doi.org/10.4103/ijnmr.ijnmr_94_17)]
77. Wang W, Zhang Y, Lin B, Mei Y, Ping Z, Zhang Z. The urban-rural disparity in the status and risk factors of health literacy: a cross-sectional survey in central China. *Int J Environ Res Public Health* 2020 May 29;17(11):3848 [FREE Full text] [doi: [10.3390/ijerph17113848](https://doi.org/10.3390/ijerph17113848)] [Medline: [32485790](https://pubmed.ncbi.nlm.nih.gov/32485790/)]
78. Mbunge E, Batani J, Gaobotse G, Muchemwa B. Virtual healthcare services and digital health technologies deployed during coronavirus disease 2019 (COVID-19) pandemic in South Africa: a systematic review. *Glob Health J* 2022 Jun;6(2):102-113 [FREE Full text] [doi: [10.1016/j.glohj.2022.03.001](https://doi.org/10.1016/j.glohj.2022.03.001)] [Medline: [35282399](https://pubmed.ncbi.nlm.nih.gov/35282399/)]
79. Greenberg AJ, Haney D, Blake KD, Moser RP, Hesse BW. Differences in access to and use of electronic personal health information between rural and urban residents in the United States. *J Rural Health* 2018 Feb;34 Suppl 1(Suppl 1):s30-s38 [FREE Full text] [doi: [10.1111/jrh.12228](https://doi.org/10.1111/jrh.12228)] [Medline: [28075508](https://pubmed.ncbi.nlm.nih.gov/28075508/)]
80. Aljassim N, Ostini R. Health literacy in rural and urban populations: a systematic review. *Patient Educ Couns* 2020 Oct;103(10):2142-2154 [doi: [10.1016/j.pec.2020.06.007](https://doi.org/10.1016/j.pec.2020.06.007)] [Medline: [32601042](https://pubmed.ncbi.nlm.nih.gov/32601042/)]

81. Kyaw TL, Ng N, Theocharaki M, Wennberg P, Sahlen K. Cost-effectiveness of digital tools for behavior change interventions among people with chronic diseases: systematic review. *Interact J Med Res* 2023 Feb 16;12:e42396 [FREE Full text] [doi: [10.2196/42396](https://doi.org/10.2196/42396)] [Medline: [36795470](https://pubmed.ncbi.nlm.nih.gov/36795470/)]
82. Xie LF, Itzkovitz A, Roy-Fleming A, Da Costa D, Brazeau A. Understanding self-guided web-based educational interventions for patients with chronic health conditions: systematic review of intervention features and adherence. *J Med Internet Res* 2020 Aug 13;22(8):e18355 [FREE Full text] [doi: [10.2196/18355](https://doi.org/10.2196/18355)] [Medline: [32788152](https://pubmed.ncbi.nlm.nih.gov/32788152/)]

Abbreviations

GRADE: Grading of Recommendations Assessment, Development, and Evaluation

MD: mean difference

PEDro: Physiotherapy Evidence Database

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

SMD: standardized mean difference

Edited by A Mavragani; submitted 25.05.23; peer-reviewed by R Sun, K De Santis; comments to author 29.06.23; revised version received 20.07.23; accepted 09.08.23; published 19.10.23

Please cite as:

Pogrebnoy D, Dennett AM, Simpson DB, MacDonald-Wicks L, Patterson AJ, English C

Effects of Using Websites on Physical Activity and Diet Quality for Adults Living With Chronic Health Conditions: Systematic Review and Meta-Analysis

J Med Internet Res 2023;25:e49357

URL: <https://www.jmir.org/2023/1/e49357>

doi: [10.2196/49357](https://doi.org/10.2196/49357)

PMID: [37856187](https://pubmed.ncbi.nlm.nih.gov/37856187/)

©Dina Pogrebnoy, Amy M Dennett, Dawn B Simpson, Lesley MacDonald-Wicks, Amanda J Patterson, Coralie English. Originally published in the *Journal of Medical Internet Research* (<https://www.jmir.org>), 19.10.2023. This is an open-access article distributed under the terms of the Creative Commons Attribution License (<https://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work, first published in the *Journal of Medical Internet Research*, is properly cited. The complete bibliographic information, a link to the original publication on <https://www.jmir.org/>, as well as this copyright and license information must be included.