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Using electronic/computer interventions to promote physical activity

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Abstract

The internet has been used as a method to deliver various health interventions (eg, weight management, smoking cessation, increasing physical activity). An electronic search (ie, PubMed, PsycInfo, Web of Science) for internet-based physical activity interventions among adults yields fewer than 25 studies. Although many have considered physical activity as one element of a multifactorial behavioural intervention, few have focused exclusively on changing sedentary behaviour. Overall, current results are encouraging and it appears that response to an internet-based physical activity intervention is similar to response to other more established, effective interventions. Given that primary care referrals for physical activity are successful in changing sedentary behaviour to some extent, there is an urgent need for investigations into the effect of using an internet-based physical activity programme within the context of primary care. Although no studies that have combined an established internet-based physical activity programme with primary care were found, there is evidence that significant progress would probably be made by providing clinicians with information on internet-based physical activity programmes.

There is now a growing body of literature on the use of the internet as a tool to promote health behaviour change. Researchers have used internet interventions for numerous topics including weight management, smoking cessation, stress reduction, blood glucose control, reducing alcohol consumption and increasing physical activity. Currently, interventions focused specifically on changing physical activity behaviour are in their infancy, with fewer than 15 randomised controlled trials having been conducted. Thus far, the studies completed suggest that internet programmes are helpful in changing sedentary behaviour. However, more studies with larger samples and individualised treatment plans are needed,¹² including those that take into account how primary care can facilitate a change in behaviour by utilising internet-based health-promoting resources. In this review, we describe several

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internet-based studies that have produced a beneficial effect on changing participants' physical activity behaviour and we present some of the limitations of these studies. We also describe how the internet can be used to enhance the provider–patient relationship, and we offer encouragement to primary care providers to play a larger role in using internet-based resources to help promote changes in their patients' physical activity behaviour.

INTERNET USE

Worldwide, it is estimated that 21.9% of the population (ie, roughly 1.5 billion) use the internet.³ The USA and the UK are among the top 10 countries with the highest internet usage (the USA is ranked second and the UK is ranked seventh),³ with 72% of US and 67% of UK internet users going online every day or almost every day. Although only 27% of internet users in the UK have looked for health information online,⁴ approximately 80% of the internet users in the USA have reported searching for health information⁵ and 44% have searched for information specifically about fitness and nutrition.⁶ In both the USA and the UK, use is high among all age groups, with approximately 90% of younger individuals (aged 16–24 years) and up to 72% of older adults (aged 55 years and older) online.⁴⁷ Rates are similar for both genders, with 76% of men and 74% of women in the USA and 71% of men and 62% of women online in the UK.⁴⁷ Whereas there are some demographic differences among users; overall, the internet has broad reach in the USA. Although internet use is lower among those who live in a rural area (64% online), those with less than a high school education (38% online), or those with an annual income of less than US\$30 000 (61% online),⁸ its use remains high among all racial/ethnic groups, with 76% of non-Hispanic whites, 60% of African Americans and 56% of Hispanics online. Moreover, among English-speaking Hispanics, internet use exceeds that of non-Hispanic whites (79% vs 76%).⁹

Given the above, it is clear that the internet can now be used to reach a very large number of individuals, covering a wide spectrum of the population. Moreover, because individuals' lifestyles often do not permit the time for office visits on health information and advice and physicians counsel only a minority of their patients about physical activity,¹⁰ the internet can also provide a more time-efficient and convenient method of information delivery, particularly if it were to be paired with primary care. Yarnall and colleagues¹¹ estimated that providing preventive care alone, in keeping with evidence-based guidelines, may take up to 8 h per day for a primary care provider, highlighting the time constraints of activities such as physical activity counselling. As such, using the internet as a resource to provide physical activity advice or programming for those who would otherwise not receive it is now a potential possibility.

THE EFFICACY OF INTERNET PHYSICAL ACTIVITY PROGRAMMES

In this next section, we provide a general overview of the internet-based physical activity studies completed thus far, and we outline those studies that have contributed uniquely to the literature (see table 1). Currently, an electronic search (ie, Pubmed, PsycInfo, Web of Science) of internet-based physical activity interventions among adults will yield less than 25 studies. Many studies have considered physical activity in addition to other health

behaviours (eg, weight loss, stress management, smoking cessation), with fewer focusing exclusively on changing sedentary behaviour.

When considering those internet-based studies that have focused on changing physical activity, the majority have utilised similar approaches, which have typically included: (1) assessing short-term outcomes (ie, no follow-up after treatment); (2) comparing the use of an internet-delivered intervention versus a non-internet alternative treatment; (3) using an internet-based intervention that also requires face-to-face visits and (4) using self-reported data (eg, minutes of physical activity or number of steps taken) as the outcome measure.

Overall, the results of internet-based physical activity studies are encouraging, with many studies finding significant differences in physical activity over time, as well as in other factors that have been associated with being physically active. For example, in a 16-week internet-based trial, Carr and colleagues¹⁷ found a significant increase in estimated aerobic fitness and the average number of steps taken per day in 32 previously sedentary overweight/obese adults. The differences were not significantly different between intervention and control groups; however, significant differences between groups for waist circumference, total cholesterol to high-density lipoprotein (HDL) ratio, and total triglycerides were found after controlling for age. Results such as these thus show promise for changing both behavioural and physiological variables when using an internet-based programme.

Although the above study is an example of how the internet can be useful in changing physical activity, there is still not yet enough evidence for efficacy. In particular, although many studies have shown differences across time (ie, from baseline to the end of treatment), only a few have shown differences between intervention and control groups. This is probably the result of the number of studies that have had significant limitations in their study design. For example, many studies have not used an adequate number of participants, or a no-treatment control comparison group.^{1215–1719–2224–26} In particular, only a small number of internet-based physical activity studies have used a control group,^{121317182327–30} with just a few of those having used an adequately powered sample size.¹⁸²⁷²⁹³⁰ Other limitations of previous studies that may add to the current findings is the length of the intervention and lack of follow-up. Very few studies have been longer than 6 months,¹⁵²⁷ and we are aware of only one study that followed participants for a significant period of time post-treatment.¹³ As such, the current reported changes in physical activity are only well supported immediately after treatment, with no indication of a maintenance effect.

Finally, research with internet-based physical activity programmes has failed to take full advantage of the internet by constructing fully automated programmes (ie, no face-to-face contact). A clear benefit of using the internet is to allow for the reduction of multiple barriers that would otherwise prevent participants from beginning a physical activity programme. In particular, using a fully automated design allows the individual full access to an activity programme, at his or her convenience, 24 h per day, 7 days per week. Despite this, we are aware of only four studies that have executed a fully automated intervention,¹³¹⁶²³²⁸ and one of these had differential dropout between the intervention and control groups.²³ More research using a fully automated design is thus needed. Such studies will be able to enroll

those who otherwise may not have participated in a face-to-face study, thereby generalising the results to a larger population.

In summary, on the basis of preliminary evidence, it appears that internet-based physical activity programmes are helpful in changing sedentary behaviour and those factors related to being sedentary; however, more evidence is needed. Future studies will need to be larger and adequately powered; they will need to determine whether or not changes in physical activity can be sustained over a longer period of time and after the end of treatment (ie, maintenance of change); studies will need to determine if the intervention used can be completed with a fully automated programme and if it is effective to integrate an established programme fully into primary care practice, as no study has previously done.

USING AN INTERNET-BASED PHYSICAL ACTIVITY RESOURCE WITHIN THE PROVIDER–PATIENT RELATIONSHIP

It is well known that rates of primary care health behaviour counselling and advice are low.¹⁰³¹ Physicians and other clinicians often report issues that include not having enough time during an office visit, being uncertain of an intervention's effectiveness, or not receiving reimbursement as barriers to providing behavioural advice and counselling.¹⁴³²³³ However, the increased use and reach of the internet has the potential to change how patients and clinicians interact and in some cases has already created a new expectation for patients during their primary care visits. In particular, some patients now anticipate that in addition to the routine care delivered during their visit, the healthcare provider will also guide them to an outside internet-based resource that offers additional information about managing the changes in their health.³⁴ This is probably a valuable addition to routine care, as evidenced by a recent study, which showed that when physicians had access to an internet-based database of community health programmes the rates of discussion for various health behaviours, including physical activity, increased.³² It is further supported by another study showing improvements in light to moderate physical activity and readiness to change dietary fat intake when physicians referred patients to an interactive, tailored website offering extensive health-promoting resources for multiple health behaviours (eg, nutrition, physical activity, smoking, alcohol use).¹⁴ Unfortunately, however, many clinicians currently do not have knowledge of publicly available, easily accessible, outside resources,³⁵ and therefore the opportunity to offer advice and provide referrals to potentially useful physical activity programmes is lost.

As such, the future of using the internet for physical activity promotion will probably include using internet-based physical activity programmes and websites as a resource in primary care. Currently, primary care referrals for physical activity have been shown to be somewhat successful in changing sedentary behaviour;^{36–38} however, whether or not referrals to an established internet-based physical activity programme are effective is uncertain. Investigations that seek to determine the impact of using an internet-based physical activity programme within the context of primary care are thus needed. Although referring patients to the internet may not substitute the potential gains made from a more

time-consuming and costly clinician-delivered behavioural counselling session,³⁹⁴⁰ it does carry the potential to change behaviour without a dramatic change in routine care.

CONCLUSIONS

Using the internet offers great potential to provide programming for a wide section of the population. Although the efficacy of internet-based physical activity programmes is still being investigated, current results are promising, and beneficial changes in both physiological and psychological factors have been shown. Overall, it appears that individuals respond similarly to an internet-based physical activity intervention as they do to other more established, effective interventions. As such, more research is needed to determine the best way to use and promote internet-based physical activity programmes. In particular, this would include the role of clinicians, as they are well positioned to begin to offer their patients quick referrals to internet-based resources. Although we are unaware of any study that has tested the impact of combining an established internet-based physical activity programme with primary care, significant progress will probably be made by providing clinicians with information on internet-based physical activity programmes. Research will be needed to determine how effective referrals to an internet website or programme can be and whether or not it would significantly enhance behaviour change. Ideally, in the future there will be systems in place that will give clinicians access to a useful electronic database from which they can choose an appropriate programme to refer their patients to, ultimately facilitating a change in behaviour.

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What is already known on this topic

- ▶ Internet use continues to grow throughout the world, and can now be used to reach an extensive array of individuals, covering a wide spectrum of the world population.
- ▶ Internet-based physical activity interventions have been shown to be just as effective as other types of physical activity interventions (eg, print based); however, more work is needed.
- ▶ More often than not, physicians counsel only a minority of their patients about making a health behaviour change, as time is a major limiting factor.

What this study adds

- ▶ This paper serves as a call to action for increasing research on using internet-based physical activity programmes within the context of a primary care setting.
- ▶ Clinicians need access to electronic databases from which they can choose effective programmes to refer their patients to, as this has the potential to facilitate a successful change in behaviour.
- ▶ The future of internet-based physical activity research will harness the power of the internet; that is, a low cost, high reach, easily accessed physical activity programme available upon consumer demand.

Summary of the most recent studies using internet interventions to promote physical activity

First author	Sample size and population	Study design	Intervention design	Intervention duration	Major dependent variable(s)	Results	Unique features
Napolitano ¹²	65 Worksite men and women; mean age 43 years	Internet vs control	Access to interactive website with weekly e-mail	3 Months; 1 and 3-month follow-up	Stage of change for PA; minutes of PA	Significant differences between groups for progression in stage of change and minutes of PA	One of the first internet-based PA studies
Rovniak ¹³	61 Women; mean age 40 years	General feedback vs tailored feedback	Introductory walking session; 2 e-mails/week	12 Weeks; 3-week and 1-year follow-up	1-Mile walk; minutes walking/2 weeks	Significant improvement in 1-mile walk in tailored feedback; no other significant differences between groups	1-Year follow-up
Woolf ¹⁴	256 Men and women; aged 18–60 years	Interactive tailored vs static website	Physician referral to interactive or static website	1 and 4-month follow-up after initial log on to website	Multiple measures of PA, diet, alcohol use, smoking	Significant increase in light/moderate PA at 1 month; no other significant changes	Used physician referrals to website
Marcus ¹⁵	239 Men and women; mean age 44 years	Tailored internet vs tailored print vs standard internet	Interactive stage-based website with e-mail prompts	12 Months, no follow-up	Minutes of PA; meeting national PA guidelines	Significant changes from baseline to 6 and 12 months in all three groups. No significant differences among groups at any time point	12-Month intervention
Spittaels ¹⁶	526 Belgian men and women; mean age 40 years	Tailored PA advice with e-mail vs tailored PA advice vs non-tailored PA advice	One-time log on for tailored/standard advice; 5 e-mails delivered over 8 weeks	8 Weeks; 6-month follow-up	Minutes of PA; sitting time	Significant increase in all three groups. No significant differences among groups	First fully automated internet-based intervention
Carr ¹⁷	N = 32; US male and female adults; mean age 35 years	Internet vs wait-list control	Weekly e-mail or phone contact with study facilitators for the first 2 weeks; then e-mail contact every other week until week 16	16 Weeks; assessments at baseline and 16 weeks	Steps/week; body mass index; total cholesterol/HDL and triglycerides; 1-mile walk test	Significant changes in steps/week and 1-mile walk test in both groups; significant differences between groups in waist circumference, total cholesterol/HDL, and triglycerides when controlling for age	Found significant changes in blood lipids
Franko ¹⁸	N = 476; US college students from six universities nationwide; mean age 20 years	2 Sessions on website vs 2 sessions on website with a booster session vs 2 sessions on control website	Interactive website targeting nutrition and physical activity	6 Months; assessments at baseline, 2 weeks post-baseline, 3 and 6 months	Fruit/vegetable intake; readiness to change fruit/vegetable intake; nutrition knowledge; previous 7 day physical activity; social support/self-efficacy for dietary change; benefits/barriers for physical activity	Groups 1 and 2 significantly increased fruit and vegetable intake, motivation to change eating, social support and self-efficacy for dietary change and attitude towards exercise	Nationwide recruitment targeting college students

HDL, high-density lipoprotein; PA, physical activity.