EHPS

volume 17 issue 1
february | 2015

www.ehps.net/ehp

The European Health Psychologist

Bulletin of the European Health Psychology Society

editorial

Tailor made for Health Psychology: Issues in the design and effectiveness of Internet interventions

Thomas Fuller
Co-editor
Floor Kroese
Co-editor

The rapid emergence of the Internet has yielded immense changes in peoples' daily lives, from the way we gather information to the way we communicate with others. Not without reason the last decades have been labeled the 'digital revolution'.

Naturally, health psychologists have also turned their eyes toward the possibilities of reaching out to people through the Internet. A principle reason for the popularity of online treatment is that, compared to face-to-face interventions, it is potentially much easier and cheaper to implement. Furthermore, target groups that would otherwise be less likely to participate or engage in treatment can be reached at any time. Online interventions, be they for example, fully automated with or without therapist contact, typically have a low threshold to access and thus may also play a role in prevention activities as well as treatment (for a comprehensive description of types of internet supported interventions and relevant terminology see Barak, Klein, & Proudfoot, 2009). That is, for example, they can be accessed and used by people who have no formal diagnosis of a psychological disorder, yet could still benefit from help in various life domains. Lastly, while Internet interventions are particularly suitable for delivering individual-tailored programs, they can also be used to initiate and/or facilitate groups of likeminded people dealing with particular mental or physical health conditions.

Alongside these clear advantages, however, online interventions have limitations and pitfalls that are important to keep in mind. For example, the absence of a regulatory framework/agency and ease of uploading an intervention means that is possible that an intervention be made available without due care being taken in its development and testing. Also, Internet interventions may not be suitable for all users: for example, while treatment adherence might increase for certain groups of patients, others may be more likely to disengage or dropout completely from treatment due to having different preferences for modes of communication or types of information. Finally, face-to-face contact might in some cases be necessary to establish patients' motivation or to monitor their understanding and evaluation of the treatment (Paxton, McLean, Gollings, Faulkner, & Wertheim, 2007).

The contributions to this special issue all relate to the considerations raised above. We present a series of articles examining key issues in the design, economic evaluation and dissemination of Internet evaluations. With these contributions we aim to stimulate further thought on how Internet interventions can be used in an optimal way.

Contents of this issue

While Internet interventions have the potential to efficiently reach large numbers of people, enticing people to actually translate curiosity about Internet interventions into using them remains a domain of research that is relatively understudied. Crutzen and Ruiter (2015, this issue) propose a conceptual model that focuses on issues to consider in generating "interest" as a means of enticing potential users of Internet interventions to go on to use the intervention. Drawing upon the works of Silvia (2006), Lazarus (1991) and Rogers (1983), they argue

that "interest" can be viewed as a product of person's primary and secondary appraisals of a particular intervention. Specifically, and initially, a combination of novelty and complexity is required to draw and sustain attention to an intervention, and is then (assuming an intervention holds the attention of the potential user) followed by an assessment of self and response-efficacy. Crutzen and Ruiter conclude by suggesting areas for further research.

Once people start using an intervention, the challenge for the developers is then to try and increase the likelihood that people will adhere to/or use the intervention for as long as possible. There is after all, research showing that the more people adhere to an intervention, the greater the chance of them benefitting from it. (That is not to say that non-adherence or dropout, necessarily or automatically equates to ineffectiveness as people might stop using an Internet intervention earlier than recommended because they have recovered or at least got what they wanted from the intervention.) Regardless, adherence rates to Internet interventions typically range from approximately 1% (Christensen, Griffiths, Korten, Brittliffe, & Groves, 2004) to levels similar to face-to-face interventions (van Ballegooijen et al., 2014).

Tailoring interventions to individual users' needs and/or preferences is considered a promising domain/method of improving rates of adherence. This special issue features four articles examining tailoring from different perspectives. First, Wienert and Kuhlmann (2015, this issue) provide important guidelines for designing and reporting on tailored online interventions. The authors argue that individual tailoring has crucial consequences for the comparability of the effects of an intervention within a study as well as between studies. To adequately analyze the effects of a tailored intervention, it does not make sense to use generic analyses grouping all participants (who received different treatments) together. Therefore, Wienert and Kuhlmann (2015, this issue) advocate using larger sample sizes to allow for the possibility of analyzing subgroups of patients who received similar 'intervention paths. Second, to improve comparability of tailored interventions *between* studies, the authors argue that it is essential to include a detailed report of used intervention techniques – a reasoning that fits well with the standardized taxonomy of behavior change techniques as proposed by Abraham and Michie (2008). Next, Rodgers and colleagues (2015, this issue) go on to point out that for Internet-delivered interventions to be effective, target groups' willingness and confidence to use electronic devices should not be taken for granted but instead must be explicitly considered as a factor when designing an intervention, in addition to its content. This is particularly relevant for interventions targeting patient groups that may not be particularly experienced with using the Internet or mobile devices, such as the elderly. Similarly, Smit, Linn and van Weert (2015, this issue) argue that tailoring should consider more than just the content of the intervention. Specifically, they argue that in addition to computer tailoring of content, tailoring of interventions to users' preferences for mode of delivery and needs for cognition, affect and autonomy need to be incorporated. They suggest that adding this strategy or capacity to existing interventions might be a relatively efficient way of increasing intervention effectiveness. Finally, Short, Rebar, Plotnikoff and Vandelanotte (2015, this issue) propose a model that addresses user engagement. Their model provides an overarching framework and describes a set of relationships between environmental, individual and intervention (including tailoring) factors that ultimately contribute to users' engagement with a specific intervention.

After the hard work of developing an intervention, naturally we then need to establish how effective the intervention is and critically, whether it represents good value for money. Just as there is no point having an intervention that is too complex to use, there is no point developing one that costs considerably more than a comparative treatment with similar effects. Economic evaluations of Internet

interventions thus play a crucial role in providing evidence to help policy makers with decisions about whether or not to provide funding for a particular intervention. Smit, de Vries, Oberje and Evers (2015, this issue) mention the fact that relatively few economic evaluations of Internet interventions have actually been conducted. However of those that have been conducted, results indicate that health related Internet interventions are indeed likely to be cost effective. There might be many reasons for the relative lack of economic evaluations, but Smit et al. (2015, this issue) discuss and propose possible solutions to five specific challenges that researchers should consider. The issues raised and proposed solutions provide a sound starting point for those considering conducting economic evaluations alongside trials of Internet interventions. Like Smit et al. (2015, this issues), we would encourage researchers to complement their trials with economic evaluations.

Finally, Ruwaard and Kok (2015, this issue) caution against 'quick and dirty' implementations of Internet interventions, and articulate the need for evidence-based intervention programs. Their thought-provoking contribution warns of a "Wild West" arena in which interventions are disseminated too hastily, without any adequate foundation for their effectiveness. The authors argue for the importance of sticking to the 'preferred order of things' and suggest it may be time to 'hold our horses'.

Conclusion

Altogether, the contributions to this special issue illustrate the rich opportunities of Internet interventions in the domain of health psychology, while at the same time pointing towards the pitfalls and considerations that we all should keep in mind.

We would also like to take this opportunity to invite all readers to initiate or contribute to discussions on this and other topics on the European Health Psychologist Facebook page or by submitting commentaries or letters to future editions of the European Health Psychologist. We wish everyone a happy and successful 2015.

References

Abraham, C., & Michie, S. (2008). A taxonomy of behavior change techniques used in interventions. *Health Psychology, 27*(3), 379-387. doi:10.1037/0278-6133.27.3.379

Barak, A., Klein, B., & Proudfoot, J. G. (2009). Defining internet-supported therapeutic interventions. *Annals of Behavioral Medicine, 38*(1), 4-17. doi:10.1007/s12160-009-9130-7

Christensen, H., Griffiths, K. M., Korten, A. E., Brittliffe, K., & Groves, C. (2004). A comparison of changes in anxiety and depression symptoms of spontaneous users and trial participants of a cognitive behavior therapy website. *Journal of Medical Internet Research, 6*, e46. doi:10.2196/jmir.6.4.e46

Crutzen, R., & Ruiter, R. A. C., (2015). Interest in behaviour change interventions: a conceptual model. *The European Health Psychologist, 17*(1), 6-11.

Lazarus, R. S. (1991). Progress on a cognitive-motivational-relational theory of emotion. *The American Psychologist, 46*(8), 819-834. doi:10.1037/0003-066X.46.8.819

Paxton, S. J., McLean, S. A., Gollings, E. K., Faulkner, C., & Wertheim, E. H. (2007). Comparison of face-to-face and internet interventions for body image and eating problems in adult women: an RCT. *International Journal of Eating Disorders, 40*(8), 692-704. doi:10.1002/eat.20446

Rodgers, W.M. Selzer, A-M., Vandelanotte, C., & Stickland, M. K. (2015). Adapting to the medium and the message: Willingness and confidence of COPD patients to use electronic devices for health information management. *The European Health Psychologist, 17*(1), 18-24.

Rogers, R. W. (1983). Cognitive and physiological processes in fear appeals and attitude change: a

revised theory of protection motivation. In J. Cacioppo & R. Petty (Eds.), *Social Psychophysiology* (pp. 153-176). New York: Guilford Press.

Ruwaard, J., & Kok, R. N. (2015). Wild West eHealth: Time to hold our horses? *The European Health Psychologist, 17*(1), 45-49.

Short, C., Rebar, A. L., Plotnikoff, R. C. & Vandelanotte, C. (2015). Designing engaging online behaviour change interventions: a proposed model of user engagement. *The European Health Psychologist, 17*(1), 32-38.

Silvia, P. J. (2006). *Exploring the psychology of interest*. New York: Oxford University Press.

Smit, E. S., de Vries, H., Oberje, E. J. M. & Evers, S. M. A. A. (2015). Easier said than done. Overcoming challengs in the economic evaluation of Internet-based lifestyle interventions. *The European Health Psychologist, 17*(1), 39-44.

Smit, E. S., Linn, A. J.,& van Weert, J. C. M. (2015). Taking computer tailoring forward. *The European Health Psychologist, 17*(1), 25-31.

Wienert, J., & Kuhlmann, T. (2015). A stich in time saves nine: Things to consider when tailoring your online intervention. *The European Health Psychologist, 17*(1), 12-17.

van Ballegooijen, W., Cuijpers, P., van Straten, A., Karyotaki, E., Andersson, G., Smit, J. H., & Riper, H. (2014). Adherence to Internet-Based and Face-to-Face Cognitive Behavioural Therapy for Depression: A Meta-Analysis. *PLoS ONE, 9*, e100674. doi:10.1371/journal.pone.0100674

Thomas Fuller
Faculty of Psychology and Neuroscience, Maastricht University, The Netherlands
thomas.fuller@maastrichtuniversity.nl

Floor Kroese
Faculty of Social and Behavioral Sciences, Utrecht University, The Netherlands
F.M.Kroese@uu.nl

original article

Interest in behaviour change interventions: A conceptual model

Rik Crutzen
Maastricht University
Rob Ruiter
Maastricht University

The use of the Internet as the (primary) delivery mode for interventions has expanded substantially in the field of public health (Kohl, Crutzen, & De Vries, 2013). Internet-delivered interventions have proved efficacious in changing people's behaviours (Portnoy, Scott-Sheldon, Johnson, & Carey, 2008), but actual participation by the target group is often very low because the target group is not necessarily interested in such interventions (Bennett & Glasgow, 2009; Kohl et al., 2013; Lieberman & Massey, 2008). Meta-interventions, i.e. procedures designed to promote a target group's uptake of an existing intervention (Albarracín, Durantini, Earl, Gunnoe, & Leeper, 2008), are needed to increase the interest of the target population for Internet-delivered interventions and thus their use and potential public health impact. The importance of interest is not limited to Internet-delivered interventions (i.e., the focus of this special issue), but applies to behaviour change interventions in general.

Why is interest of importance?

Interest in using an intervention is different from motivation to change behaviour. Somebody might be *interested* in an Internet-delivered intervention aimed at weight reduction, for example, but not *motivated* to exercise daily. Or conversely: somebody might be *motivated* to quit smoking, but still not be *interested* in using an Internet-delivered intervention to guide him/her through the smoking cessation process. Although there is a long-standing research tradition on motivational determinants of behaviour change (Atkinson, 1957), knowledge on the uptake of interventions is still limited (Glasgow, Lichtenstein, & Marcus, 2003). A research focus on interest as an important determinant for the decision to participate in behaviour change interventions might provide insight in ways to increase intervention uptake. Indeed, in a previous study, arousing interest successfully increased intention to visit a website about Hepatitis A, B and C virus infections and the likelihood of clicking on the link to visit the website (Crutzen, Ruiter, & De Vries, 2014).

Interest is strongly related with emotional engagement (Sun & Rueda, 2012). Arousing interest is a first step in intervention adoption, which might ultimately result in people using an intervention. This is in line with functional approaches to interest suggesting that it is a positive emotion strongly associated with approach motivation (Thoman, Smith, & Silvia, 2011). Interest seems to be especially relevant in an online context, because there is often discontinuous communication (nobody waiting for and judging your response, in contrast to, for example, face-to-face conversations), which increases the likelihood of selectively picking an interesting option (e.g., a website) (Berger & Raghuram, 2013). However, future applications are not limited to websites, but also concern other media. For example, to guide people to the right app in the current "health app overload" (Van Velsen, Beaujean, & Van Gemert-Pijnen, 2013).

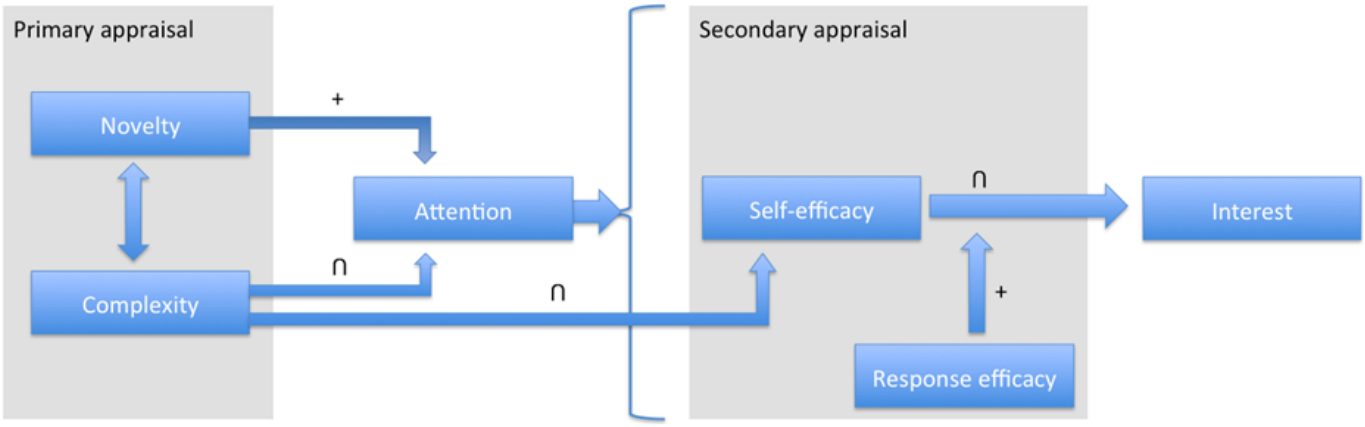

Figure 1. A conceptual model of interest in behaviour change interventions.
Note: A plus sign indicates a positive relationship and an inverted U indicates an inverted u-shaped relationship.

Why is something interesting to people?

Individual differences in interest are the result of variability in subjective appraisals of novelty-complexity and coping potential (Silvia, 2006). Or, as described by Silvia (2008); "Interest stems from events that are new, complex and unfamiliar [novelty-complexity], provided that people feel able to comprehend them and master the challenges they pose [coping potential]." Paul J. Silvia presented his ideas about interest in his thought-provoking book *Exploring the psychology of interest* (Silvia, 2006) and has also conducted experimental studies focused on the underlying appraisal structures (e.g., Turner & Silvia, 2006). Below we elaborate on his ideas to provide more insight into the process from perceiving a stimulus to increased interest. We do this by integrating insights from the structural model of appraisal (Lazarus, 1991) and the coping-appraisal process, as depicted in the Protection Motivation Theory (Rogers, 1983), into a conceptual model of interest in behaviour change interventions (Figure 1). We propose that novelty/complexity should be seen as a primary appraisal and coping potential as a secondary appraisal in the decision making process of intervention uptake.

The primary and secondary appraisal distinction is derived from the structural model of appraisal (Lazarus, 1991) in which the first appraisal concerns whether a stimulus is relevant to a person and the second appraisal whether a person is able to deal with the stimulus. This idea is also reflected in the Protection Motivation Theory in which there is a threat appraisal process to determine the relevance of a health threat and a coping appraisal process to evaluate the effectiveness of actions to avert the threat (Rogers, 1983). The primary appraisal thus concerns the novelty-complexity appraisal, because before people reflect on their ability to deal with the stimulus (i.e., the secondary appraisal being of relevance), it must be clear that the stimulus is unknown (i.e., novelty). If there is no novelty, then it is already clear what to do from previous encounters (and people react without much reflection). Moreover, there should also be a certain amount of complexity, because if the stimulus is so obvious that it is immediately clear what to do (i.e., low complexity) or that it can be taken for granted that it is beyond the capability of people to deal with it (i.e., high complexity), then less attention to the stimulus is needed and the secondary appraisal becomes less relevant. So, in line with Silvia's idea, the combination of novelty and a moderate level of

complexity is optimal. We propose that this combination results in attention to the intervention, and thus in engagement with regard to the secondary appraisal.

The second phase concerns the secondary appraisal of coping potential in which both self-efficacy and response efficacy come into play. If the complexity of a stimulus increases, then self-efficacy decreases. In other words, if something is deemed complex, then the perception of being able to deal with it decreases. However, this does not directly translate into a negative linear relationship between self-efficacy and interest, because of the previously described inverted u-shaped relationship between complexity and attention. Most attention is being paid to stimuli that are moderate in terms of complexity, which is also reflected in the relationship between self-efficacy and interest. Silvia refers to John Dewey (1913) as the first person to argue for nonlinear effects of self-efficacy on interest: "It is not too much to say that a normal person demands a certain amount of difficulty to surmount in order that he may have a full and vivid sense of what he is about, and hence have a lively interest in what he is doing." On top of that, Bandura (1997) suggested that "at least moderate perceived efficacy may be required to generate and sustain interest in an activity, but increases in perceived efficacy above the threshold level do not produce further gains in interest. Indeed, supreme self-assurance may render activities unchallenging and, thus, uninteresting."

We propose that the relationship between self-efficacy and interest is moderated by response efficacy. This idea is substantiated by the assumption that "people form enduring interest in activities in which they view themselves to be efficacious and in which they anticipate positive outcomes" (Lent, Brown, & Hackett, 1994). The latter is closely related to the notion of response efficacy as depicted in the Protection Motivation Theory (Rogers, 1983): the perceived effectiveness of the recommended behaviour in removing or preventing possible harm. When relating this to interest in behaviour change interventions, the recommended behaviour is the uptake of the intervention. Figure 1 combines our ideas about the subjective appraisals related to interest in a conceptual model.

Pointers for future research

The conceptual model is rooted in well-established theories and builds upon previous empirical findings (e.g., Crutzen, Cyr, Larios, Ruiter, & De Vries, 2013; Crutzen et al., 2014; Silvia, Henson, & Templin, 2009; Turner & Silvia, 2006). The key recommendation for future research, however, is to conduct experimental studies focusing on the relationships as depicted in the model in the domain of intervention uptake. As this conceptual model is 'work in progress', we recommend starting with manipulating constructs within the model, using a full factorial design (Peters, De Bruin, & Crutzen, 2013). This enables examining both main and interaction effects and might give more concrete answers to questions such as: To what extent are both novelty and complexity needed to draw attention to the stimulus? And how does response efficacy influence the relationship between self-efficacy and interest?

The conceptual model describes the complete process from perceiving the stimulus to increased interest. An additional question to be answered is how to manipulate stimuli in such a way that it positively affects the novelty-complexity appraisal (see Crutzen et al., 2014). Silvia (2006) proposed a speculative appraisal model of the sources of interest. According to this model, appraisal of novelty-complexity can be increased by, for example, manipulating vividness, surprisingness, or imagery. For example, a previous study demonstrated that JPEG files sizes of screenshots are a good proxy for the complexity of homepages (Tuch, Bargas-Avila, Opwis, & Wilhelm, 2009), which subsequently affects attitude towards the website (Crutzen, De Kruif, & De Vries, 2012). Future systematic manipulations based on this provisional appraisal model are needed to gain

more insight into the ways to positively influence novelty-complexity and coping potential appraisals.

Another issue to explore in future research is the measurement of interest. Previous studies have used self-reports of interest (e.g., Turner & Silvia, 2006) or outcomes that are the result of interest, such as increased intention to visit a website and the likelihood of clicking on the link to visit a website (e.g., Crutzen et al., 2014). The latter is of course an ultimate behavioural outcome demonstrating the relevance of increasing interest, but other measures are needed to provide more insight into the process from perceiving the stimulus to increased interest, as depicted in the conceptual model. For example, there is general agreement on the strong association between eye movements and attention (Rayner, 1998). Moreover, previous research also focused on using neural measures of attention, using measures from electrophysiology and functional neuroimaging (Coull, 1998; Ruiter, Kessels, Jansma, & Brug, 2006; Treue, 2001). It is worthwhile to explore whether such measures can be extended from attention to interest.

Conclusion

A focus on (the underlying process of) ameliorating interest might provide insight in ways to increase intervention uptake. The conceptual model presented in this article could serve a starting point for future experimental studies.

References

Albarracín, D., Durantini, M. R., Earl, A., Gunnoe, J. B., & Leeper, J. (2008). Beyond the most willing audiences: a meta-intervention to increase exposure to HIV-prevention programs by vulnerable populations. *Health Psychology, 27*(5), 638-644. doi:10.1037/0278-6133.27.5.638

Atkinson, J. W. (1957). Motivational determinants of risk-taking behavior. *Psychological Review, 64*(6), 359-372. doi:10.1037/h0043445

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.

Bennett, G. G., & Glasgow, R. E. (2009). The delivery of public health interventions via the Internet: Actualizing their potential. *Annual Review of Public Health, 30*, 273-292. doi:10.1146/annurev.publhealth.031308.100235

Berger, J., & Raghuram, I. (2013). How interest shapes word-of-mouth over different communication channels. *Journal of Consumer Research, 40*(3), 567-579. doi:10.1086/671345

Coull, J. T. (1998). Neural correlates of attention and arousal: Insights from electrophysiology, functional neuroimaging and psychopharmacology. *Progress in Neurobiology, 55*(4), 343–361. doi:10.1016/S0301-0082(98)00011-2

Crutzen, R., Cyr, D., Larios, H., Ruiter, R. A. C., & De Vries, N. K. (2013). Social presence and use of Internet-delivered interventions: A multi-method approach. *PLOS ONE, 8*, e57067. doi:10.1371/journal.pone.0057067

Crutzen, R., De Kruif, L., & De Vries, N. K. (2012). You never get a second chance to make a first impression: The effect of visual complexity on intention to use Internet-delivered interventions. *Interaction Studies, 13*(3), 469-477. doi:10.1075/is.13.3.07cru

Crutzen, R., Ruiter, R. A. C., & De Vries, N. K. (2014). Can interest and enjoyment help to increase use of Internet-delivered interventions? *Psychology & Health, 29*(11), 1227-1244. doi:10.1080/08870446.2014.921300

Dewey, J. (1913). *Interest and effort in education*. Boston: Riverside.

Glasgow, R. E., Lichtenstein, E., & Marcus, A. C. (2003). Why don't we see more translation of health promotion research to practice? Rethinking the efficacy-to-effectiveness transition. *American Journal of Public Health, 93*(8), 1261-1267. doi:10.2105/AJPH.93.8.1261

Kohl, L., Crutzen, R., & De Vries, N. K. (2013). Online prevention aimed at lifestyle behaviours: a

systematic review of reviews. *Journal of Medical Internet Research, 15*, e146.

Lazarus, R. S. (1991). Progress on a cognitive-motivational-relational theory of emotion. *The American Psychologist, 46*(8), 819-834. doi:10.1037/0003-066X.46.8.819

Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of Vocational Behavior, 45*(1), 79-122. doi:10.1006/jvbe.1994.1027

Lieberman, D. Z., & Massey, S. H. (2008). Pathways to change: The effect of a web application on treatment interest. *The American Journal on Addictions, 17*(4), 265-270. doi:10.1080/10550490802138525

Peters, G.-J. Y., De Bruin, M., & Crutzen, R. (2013). Everything should be as simple as possible, but no simpler: Towards a protocol for accumulating evidence regarding the active content of health behaviour change interventions. *Health Psychology Review*. Advance online publication. doi:10.1080/17437199.2013.848409

Portnoy, D. B., Scott-Sheldon, L. A. J., Johnson, B. T., & Carey, M. P. (2008). Computer-delivered interventions for health promotion and behavioral risk reduction: A meta-analysis of 75 randomized controlled trials, 1988-2007. *Preventive Medicine, 47*(1), 3-16. doi:10.1016/j.ypmed.2008.02.014

Rayner, K. (1998). Eye movements in reading and information processing: 20 years of research. *Psychological Bulletin, 124*(3), 372-422. doi:10.1037/0033-2909.124.3.372

Rogers, R. W. (1983). Cognitive and physiological processes in fear appeals and attitude change: A revised theory of protection motivation. In J. Cacioppo & R. Petty (Eds.), *Social Psychophysiology* (pp. 153-176). New York: Guilford Press.

Ruiter, R. A. C., Kessels, L. T. E., Jansma, B. M., & Brug, J. (2006). Increased attention for computer-tailored health communications: An event-related potential study. *Health Psychology, 25*(3), 300-306. doi:10.1037/0278-6133.25.3.300

Silvia, P. J. (2006). *Exploring the psychology of interest*. New York: Oxford University Press.

Silvia, P. J. (2008). Interest - the curious emotion. *Current Directions in Psychological Sciene, 17*(1), 57-60. doi:10.1111/j.1467-8721.2008.00548.x

Silvia, P. J., Henson, R. A., & Templin, J. L. (2009). Are the sources of interest the same for everyone? Using multilevel mixture models to explore individual differences in appraisal structures. *Cognition & Emotion, 23*(7), 1389-1406. doi:10.1080/02699930902850528

Sun, J. C.-Y., & Rueda, R. (2012). Situational interest, computer self-efficacy and self-regulation: Their impact on student engagement in distance education. *British Journal of Educational Technology, 43*(2), 191-204. doi:10.1111/j.1467-8535.2010.01157.x

Thoman, D. B., Smith, J. L., & Silvia, P. J. (2011). The resource replenishment function of interest. *Social Psychological and Personality Science, 2*(6), 592-599. doi:10.1177/1948550611402521

Treue, S. (2001). Neural correlates of attention in primate visual cortex. *Trends in Neurosciences, 24*(5), 295–300. doi:10.1016/S0166-2236(00)01814-2

Tuch, A. N., Bargas-Avila, J. A., Opwis, K., & Wilhelm, F. H. (2009). Visual complexity of websites: Effects on users' experience, physiology, performance, and memory. *International Journal of Human-Computer Studies, 67*(9), 703-715. doi:10.1016/j.ijhcs.2009.04.002

Turner, S. A., & Silvia, P. J. (2006). Must interesting things be pleasant? A test of competing appraisal structures. *Emotion, 6*(4), 670–674. doi:10.1037/1528-3542.6.4.670

Van Velsen, L., Beaujean, D. J. M. A., & Van Gemert-Pijnen, J. E. W. C. (2013). Why mobile health app overload drives us crazy, and how to restore the sanity. *BMC Medical Informatics and Decision Making, 13*, 23. doi:10.1186/1472-6947-13-23

Rik Crutzen
is an Assistant Professor at the Department of Health Promotion Maastricht University, Maastricht, The Netherlands
rik.crutzen@maastrichtuniversity.nl

Rob Ruiter
is a Professor at the Department of Work and Social Psychology Maastricht University, Maastricht, The Netherlands
r.ruiter@maastrichtuniversity.nl

original article

A stitch in time saves nine: Things to consider when tailoring your online intervention

Julian Wienert
University of Lübeck
Jacobs University Bremen
Tim Kuhlmann
University of Konstanz

Background

Web-based online interventions to promote health and to provide support in the prevention of chronic diseases have received increasing interest from researchers and health care professionals throughout the last years. Such web-based health promoting programs can provide support to a wide range of populations, especially to people with time constraints or in rural areas, at any time and any place. Only a stationary or mobile device with internet access is needed to benefit from such programs (Krebs, Prochaska, & Rossi, 2010). Furthermore, they have the potential to save health care costs as their running costs are low compared to costs of a standard therapy (cf., Krebs et al., 2010)

A special category of such web-based interventions are tailored interventions. By using a tailoring approach participants receive personalized content not only on the basis of previously indicated information, such as gender and age, but also on the basis of social-cognitive variables or prior assessments of health behaviors (Krebs et al., 2010). Krebs and colleagues (2010) define web-based or computer-tailored content as "(…) a method of assessing individuals and selecting communication content using data-driven decision rules that produce feedback automatically from a database of content elements". Such individualized content is expected to have a higher personal relevance to the participant, leading to increased intervention effects (cf. Hawkins, Kreuter, Resnicow, Fishbein, & Dijkstra, 2008; Lustria et al., 2013). To illustrate the progress through a tailored intervention, an example of two participants receiving tailored content is displayed in Figure 1. The example consists of four feedbacks with two tailoring options each. Exemplary intervention paths for two participants partaking in the same intervention are indicated.

Meta-analyses by Krebs et al. (2010) and Lustria et al. (2013) point out effects of different modes of tailored interventions and their advantages compared

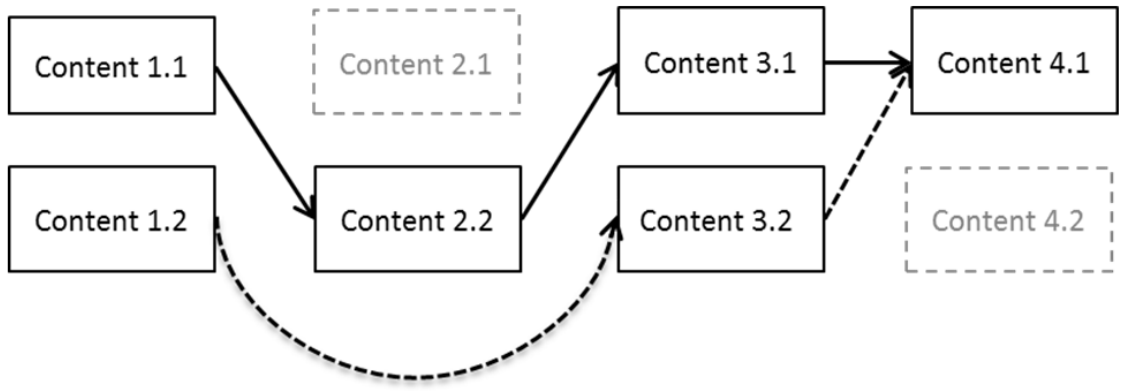

Figure 1. Basic structure of four feedbacks and examples of two intervention paths.

Table 1

Overview of effects and effects sizes from two meta-analyses

Effect	Effect size	Source
Health behaviors	g = .13 – .22***	Krebs et al., 2010
Tailoring methods	g = .14 – .19**	Krebs et al., 2010
Number of contacts	g = .13 – .20*	Krebs et al., 2010
Longitudinal effects	g = .12 – .20*	Krebs et al., 2010
Number of behaviors intervened upon	g = .12 – .24**	Krebs et al., 2010
Number of behaviors addressed	d = .12 – .15***	Lustria et al. 2013
Type of feedback	d = .14 – .19***	Lustria et al. 2013
Sample specificity	d = .14 – .18*	Lustria et al. 2013
Study design	d = .07 – .16*	Lustria et al. 2013
Comparison condition	d = .07 – .18*	Lustria et al. 2013

Note. * p < .05, ** p < .01, *** p < .001

to *one-size-fits-all* approaches where all participants receive the same content. Krebs and colleagues (2010) investigated tailored approaches using different communication channels (e.g. internet, letters, and flyers.) They report significant small to medium effect sizes for several health behaviors, tailoring methods, number of contacts, longitudinal effects, and number of behaviors intervened upon. Lustria and colleagues (2013), however, focus on *web-based* tailored interventions. They report neither significant differences in addressing single vs. multiple health behaviors, nor in providing baseline feedback or iterative feedback (Lustria et al., 2013). Significant differences were present when addressing the broader population compared to patient samples as well as for study designs with randomized trial and quasi-experimental design, and no treatment or non-tailored website as comparison conditions (Lustria et al., 2013). In general, tailored web-based interventions seem to lead to significantly greater improvement in health outcomes as compared to control conditions at post-testing (d = .14, p < .001) and follow-up (d = .16, p < .001; Lustria et al., 2013). Table 1 provides an overview of the different effects, in addition to the aforementioned comparisons.

Though the current research provides first evidence for the effectiveness of web-based tailored interventions, further research is needed to disentangle the effectiveness of tailored interventions. Tailored interventions contain many different components and on top of that, due to the tailoring, a variety of different paths through those components. To disentangle the effectiveness of such different components, the present article will raise awareness on the importance of two issues by providing recommendations for researchers to design and report results from web-based tailored interventions in a more optimal way.

The present article

The present paper will briefly discuss two major issues concerning the analysis and display of results of web-based tailored interventions. Part one will address the *intra-comparability* of intervention effects. We focus on problems when analyzing data of web-based tailored interventions. Oftentimes not all available information in the data is used to investigate the effectiveness of different components in web-based tailored interventions more thoroughly. Furthermore, some of the analyses and results might also oppose basic assumptions in inferential statistics, as will be outlined in the following section. Part two

will focus on the *inter-comparability* of web-based tailored interventions and their effects. This part addresses the benefits of using the taxonomy of behavior change techniques (BCTs; Abraham & Michie, 2008) as well as using appropriate analyses to extract the most information from different studies. Potential solutions on how to address both points will be addressed in the final section.

Problems when analyzing data of tailored interventions

By providing individualization via tailored content, each participant undergoes a very specific and individual intervention which cannot easily be compared to *the rest* of the sample. This might oppose basic assumptions on inferential statistics and further also decreases the informative value of web-based tailored interventions.

The basic thought of inferential statistics is to compare data and draw conclusions from random variation. Following the basic assumption of tailored interventions, each tailored component provides additional variation according to the extent to which the content is tailored. This variation is not only limited to each tailored component itself, but also provides additional variation to the whole intervention – which is of importance when analyzing the effectiveness of tailored components and the effectiveness of the intervention of a whole. Hence, every tailored intervention provides y^x variation, depending on the amount of tailoring. Each additional tailoring component results in more variation which is not a bad thing per se. However, analyzing the effectiveness of tailored interventions rarely takes into account the additional amount of information provided by additional variance due to the tailored components. Instead, studies often disregard this additional amount of information and focus only on the statement that *tailored interventions are better than generic ones*.

Not considering the additional amount of information due to the tailoring process is still common practice when analyzing tailored interventions. Reviewing past and current studies about tailored interventions leads to the conclusion that little awareness is spent concerning this issue. Meta-analyses regarding the effectiveness of tailored online interventions also seem to neglect thoughts on such crucial issues and rather focus on the aforementioned statements that tailored interventions are better than one-size-fits-all approaches. This is not surprising as they represent the synthesis of several studies that also neglected more precise evaluations of interventions and their mechanisms, possibly not using the full information available from tailored interventions. But what does this mean for the current state of research and its future? In general it is not bad or wrong to come to the conclusion that tailored interventions do better than generic ones or that they are effective. However, it seems counter-intuitive to provide *tailored feedback* to study participants, but applying *generic analyses* afterwards. Considering *intra-comparability*, researchers should be aware that they can draw such very broad conclusions from their results when shuffling data together, but this bears the risk that they miss crucial mechanisms within the data to further understand why tailored interventions have been successful and why not or even more precisely who have they been successful to and why?

Problems when comparing tailored interventions

A researcher or practitioner trying to create a new intervention usually first tries to assess the state of the current research as a guideline of how to proceed. This process becomes increasingly complicated when trying to summarize data on several tailored web-based interventions. Not only are these interventions usually tailored to a specific target group and address

different behaviors, the comparability is further lowered by an increased heterogeneity of content within each intervention (Lustria et al., 2013). Another obstacle considering comparability is the amount and type of tailoring used in interventions. One often-used distinction is baseline vs. iterative feedback (Lustria et al., 2013), also named static vs. dynamic tailoring (Krebs et al., 2010). This distinction categorizes interventions into two groups: (1) Baseline-feedback interventions adjust the content of the following intervention based on baseline information only; (2) Iterative tailoring describes the process of adjusting the content multiple times according to information given during the intervention phase, e.g. depending on the progress of a participant in performing a certain target behavior.

These categories capture broad differences between interventions in terms of tailoring. The actual amount of tailoring encompassed or the number of times that information is used to adjust content is not captured by this distinction. Though the categorization is certainly useful, a lot of information is lost without further, detailed descriptions. We argue that a more *fine-grained reporting* and analysis is required when trying to synthesize tailored interventions. Some suggestions for approaching this are outlined in the next section. The difficulties in integrating results from different interventions are amplified for web-based tailored interventions. Tailoring opportunities are readily available and easy to implement which leads to an increase in diversity of the interventions. The problem of an increase in diversity also affects the reporting of the interventions when the research gets published. Providing a detailed description of an intervention is already difficult in the limited space of a journal article (Abraham & Michie, 2008; Johnston, 2014). This process becomes more difficult, bordering on the impossible, when facing the task of describing a tailored web-based intervention with a high amount of different content depending on the amount of tailoring encompassed, challenging *inter-comparability*. As mentioned in the previous section, every participant of a tailored intervention undergoes an individualized program. Describing these differences within the intervention is difficult due to the sheer number of possible combinations of content and paths through the intervention. With limited space available, accurate reporting gets increasingly difficult.

Suggestions to move forward

The previous sections described the specific challenges tailored web-based interventions pose when trying to draw adequate conclusions. The comparability of effects within a tailored intervention is complicated due to the individual nature of the content each participant receives. Tailoring also has an effect on the comparability between interventions due to the increased heterogeneity. This encompasses a lack of given information about each intervention as well as the different magnitude of tailoring across interventions. We certainly cannot solve all the aforementioned challenges, but there are ways to increase the accumulation of knowledge and ease future analyses.

With regard to the individualized nature of a web-based tailored intervention, an adequate sample size which allows for the analysis of relevant subgroups is strongly advised. There needs to be a balance between the number of relevant subgroups and the remaining power for analyses. This should already be taken into account before the start of the intervention and influence the decision on the amount of tailoring and recruiting strategy used. More tailoring leads to more possible intervention paths, which in turn increases the number of meaningful subgroups that should be analyzed (see Figure 1). Otherwise, we encourage the use of *n*-of-1 trials to test for individual effectiveness, especially when the provided content was developed on the basis of theoretical models (Hobbs, Dixon, Johnston, & Howe, 2013). Nevertheless, researchers should be

more aware of the limitations of their conclusions and discuss this issue properly in their studies.

Meta-analyses address the problem of heterogeneity by taking an increased number of potential moderators into account. These include, for example, socio-demographic variables, BCTs (Abraham & Michie, 2008) and modes of delivery. The length of an intervention or certain parts of it is often influenced by tailoring and thus needs to be taken into account (number of contacts: g = .13 - .20, p < .05, Krebs et al., 2010; see also Table 1). To analyze possible effects, differences in interventions lengths have to be assessed and reported. Length in conjunction with the effect may also be used to judge the efficiency of an intervention in general or specific BCTs. To take the aforementioned and other possible moderators into account, however, the use of a standardized taxonomy is crucial. Without the detailed reporting of the techniques applied, a categorization with the appropriate detail for analysis is not possible. The advantages of a standardized taxonomy have been outlined for intervention reporting in general by Abraham and Michie (2008). In our opinion their arguments apply even stronger when considering tailored online interventions. An advantage of online interventions is the possibility of storing the intervention online to give future researchers easy access to intervention content. This is certainly no alternative to proper reporting of content, but offers other researchers the ability to clarify interpretations of the content or categorize intervention content in other ways than the original authors.

One way to improve *intra-* and *inter*-comparability is the use of detailed research and study protocols. Such protocols could aim at describing detailed mechanisms of several intervention parts and their effectiveness (e.g., van Genugten, van Empelen, Oenema, 2014) and further describe the use of BCTs by using the taxonomy accordingly (e.g., Reinwand et al., 2013). In tailored interventions, these study protocols should not only contain information about the applied BCTs, but should also describe the tailoring in more detail. This includes the possible paths participants could take through the intervention, combinations of contents possible, as well as the way feedback and information is individualized.

To conclude, tailored web-based interventions offer a wide range of opportunities to enhance the effectiveness of a behavior change program. Addressing idiosyncrasies of the approach while planning the intervention and also anticipating possible challenges for the analysis can go a long way in speeding up the accumulation of knowledge and spare the researcher a lot of headache when trying to interpret the data and implications. Our recommendations will hopefully help with this process.

References

Abraham, C. & Michie, S. (2008). A taxonomy of behavior change techniques used in interventions. *Health Psychology, 27*(3), 379-387. doi:10.1037/0278-6133.27.3.379

Hawkins, R. P., Kreuter, M., Resnicow, K., Fishbein, M., & Dijkstra, A. (2008). Understanding tailoring in communicating about health. *Health Education Research, 23*(2), 454-466. doi:10.1093/her/cyn004

Hobbs, N., Dixon, D., Johnston, M., & Howie, K. (2013). Can the theory of planned behaviour predict the physical activity behaviour of individuals? *Psychology & Health, 28*(3), 234-249. doi:10.1080/08870446.2012.716838

Johnston, M. (2014). Improving the reporting of behaviour change interventions. *The European Health Psychologist, 16*(5), 181-189.

Krebs, P., Prochaska, J. O., & Rossi, J. S. (2010). A meta-analysis of computer-tailored interventions for health behavior change. *Preventive Medicine, 51*(3-4), 214-212. doi:10.1016/j.ypmed.2010.06.004

Lustria, M. L., Noar, S. M., Cortese, J., van Stee, S. K., Glueckauf, R. L., & Lee, J. (2013). A meta-analysis of web-delivered tailored health behavior change

interventions. *Journal of Health Communication, 18*(9), 1039-1069. doi:10.1080/10810730.2013.

Reinwand, D., Kuhlmann, T., Wienert, J., de Vries, H., & Lippke, S. (2013). Designing a theory- and evidence-based tailored eHealth rehabilitation aftercare program in Germany and the Netherlands: study protocol. *BMC Public Health, 13*, 1081. doi:10.1186/1471-2458-13-1081

van Genugten, L., van Empelen, P., & Oenema, A. (2014). Intervention use and action planning in a web-based computer-tailored weight management program for overweight adults: randomized controlled trial. *Journal of Medical Internet Research: Research Protocols, 3*(3), e31. doi:10.2196/resprot.2599

Julian Wienert
is a Research Assistant at the Institute for Social Medicine and Epidemiology at the University of Lübeck, Lübeck, Germany
and PhD Candidate at the Jacobs Center on Lifelong Learning and Institutional Development Jacobs University Bremen, Bremen, Germany
julian.wienert@uksh.de

Tim Kuhlmann
is a PhD Candidate at the iScience group, Department of Psychology, University of Konstanz, Konstanz, Germany
tim.kuhlmann@unikonstanz.de

original article

Adapting to the medium and the message

Willingness and confidence of COPD patients to use electronic devices for health information management.

Wendy M. Rodgers
University of Alberta
Anne-Marie Selzler
University of Alberta
Corneel Vandelanotte
Central Queensland University
Michael K. Stickland
University of Alberta
G.F. MacDonald Centre for Lung Health

Numerous factors, including the aging population, are contributing to increased rates of chronic disease that are out-pacing traditional health care delivery. Efforts to influence health behaviours through non-traditional delivery of information have grown precipitously in the last 10 years (Vandelanotte, Spathonis, Eakin, & Owen, 2007; Davies, Spence, Vandelanotte, Caperchione, & Mummery, 2012). Non-traditional information delivery has focused on the internet, including web-sites, interactive programming, email notices, cell-phones and smart-phones. These media allow for transmission of high quality text- and image-based messages through web-sites, emails, and text-messaging. A spate of systematic and quantitative reviews of such interventions in the last few years, including four Cochrane reviews of the effectiveness of mobile phone messaging, have revealed great promise, but also limitations and gaps in understanding. The majority of empirical evidence suggests that device or internet based interventions are more effective than no intervention, but evidence is equivocal regarding whether such interventions are better than paper-based, land-line phone based, or other traditional interventions (Maher, Lewis, Ferrar, Marshall, De Bourdeaudhuji, & Vandelanotte, 2014). One reason might be motivational and behavioural factors influencing willingness and confidence to use information technology (IT) based media. The general willingness and confidence of targeted patients for using the media itself has been largely ignored in the development of technology-based or communication device-based interventions (Vandelanotte et al., 2013).

We will use Chronic Obstructive Pulmonary Disease (COPD) as an exemplar to explore these possibilities. Like most chronic conditions, COPD requires on-going self-monitoring of symptoms and adherence to pharmacological and non-pharmacological treatments. COPD is a respiratory disorder primarily caused by smoking, characterized by progressive, partially reversible airway obstruction, with increasing frequency and severity of exacerbations (O'Donnell et al., 2007). As lung damage builds up over years of exposure to an aversive agent, diagnosis of COPD tends to occur in late life (usually over 65 years of age). Symptoms include shortness of breath (dyspnea), cough, and frequent respiratory infections that can lead to reduced activity and deconditioning that exacerbate the condition (O'Donnell, et al., 2007). Pulmonary rehabilitation (PR) is recommended for COPD patients who remain symptomatic despite inhaled pharmacotherapy. There is substantial evidence of the benefit of PR in terms of medical outcomes and improved quality of life, largely believed to be associated with the educational components and improved functional and exercise capacity that increase activities of daily living and reduce severity of exacerbations (acute episodes of inflammation or infection) and associated hospitalizations (Criner et al., 2014). Although attendance at PR is quite good, subsequent adherence to exercise and other recommended behaviours is low (e.g., Fischer et al., 2009; Rodgers, Selzler, Haennel,

Wong, & Stickland, 2013; Sabit et al., 2008; Wong et al., 2014). Therefore, support to maintain adherence to chronic disease management behaviours is needed. COPD patients are an excellent target for internet- or device-based information and support because of the commonalities in post-rehabilitation prescriptions including the type and delivery of medications; the nature and treatment for symptoms; the need to maintain 'pulmonary hygiene' exercises; and the need to maintain exercise. Thus, message content is relatively consistent across patients, and is not novel following PR.

In a systematic review of internet-based approaches to cardiac rehabilitation, Munro, Angus, and Leslie (2013) identified only nine studies that revealed equivocal evidence of the intervention effectiveness. Four recent Cochrane reviews focused on mobile phone messaging for preventive care (Vodopivec-Jamsek, de Johngh, Gurol-Ugfanci, Autn & Car, 2012); facilitating self-management of long-term illnesses (de Jongh, Gurol-Urganci, Vodopivec-Jamsek, Car, & Atun, 2012); attendance at healthcare appointments (Car, Guron-Urganci, de Jongh, Vodopivec-Jamsek, & Atun, 2012); and smartphone and tablet self-management for asthma (Belisario, Huckvale, Greenfield, Car, & Gunn, 2013). Each review included only two to four studies; far too few from which to draw firm conclusions, and demonstrating the limited research addressing the effectiveness of internet-based approaches to maintaining health-behaviour change and chronic disease management in older people. Among the Cochrane reviews, for example, mobile-messaging had positive effects on diabetes care self-efficacy, but did not improve outcomes in other conditions (hypertension, asthma) or treatment compliance. Mobile messages improved attendance at health-care appointments better than no reminders, but similarly to land-line phone messages. Mobile messages can improve pre-natal confidence, vitamin protocol adherence, smoking cessation efforts, and reduce anxiety. One study examining cell phone applications (apps) to increase physical activity found tracking information (i.e., behavioral monitoring) was preferred (Rabin & Bock, 2011) suggesting people already knew what to do. Kirwan, Duncan, Vandelanotte, and Mummery (2012) found that a self-monitoring smartphone app increased adherence to a 10,000 steps prescription compared to no support. Thus, mobile apps seem to support self-monitoring, an important aspect of behaviour maintenance.

One of the expected challenges to effectiveness of internet or device-based interventions with COPD patients is their age (cf. Ammann, Vandelanotte, de Vries, & Mummery, 2013). There is abundant evidence that preference for internet and device use is negatively associated with age. In a sample of Australian adults, Short, Vandelanotte, and Duncan (2014) showed increased preference for print media with age, especially among men. Preference for internet interventions was highest in rural dwellers, women, those aged 35-44, and previous internet users. In a sample of urban Americans, Kim, Choo, and Ranney (2014) also showed a preference for technology-based interventions among women and a negative association with age, even though their participants' average age was only in the 40s, suggesting more of a concern in older people. Few studies have addressed people older than 50, leaving a large knowledge gap. Also, women appear to be more willing users of the internet and more enthusiastic seekers health-related information. Even when they might be effective, there is limited evidence of good uptake of internet or device based interventions in patient groups. For example, Crutzen, Ruiter, and de Vries (2014), in a sample of Dutch adults already participating on an internet research panel, showed little improvement in uptake of information from web-sites compared to paper sources. However, the information presented (about Hepatitis) was not necessarily salient to their sample. Results might be different when patients already receiving treatment for a chronic condition are offered internet or device based support relevant to that condition.

Few studies have addressed provision of health-

Table 1

Multiple Regression Models of Electronic Device Use Cognitions Predicting Interest for Using Electronic Devices (ED)

		Dependent Variables			
		Interest in ED to manage health[1]	Interest in ED to find health information[2]	Interest in ED to increase PA[3]	Interest in ED to take medications[4]
		M = 3.26, SD = 1.48	M = 3.88, SD = 1.31	M = 3.39, SD = 1.36	M = 2.95, SD = 1.40
		R^2_{adj} = .48, p < .0001	R^2_{adj} =.313, p < .0001	R^2_{adj} =.415, p < .0001	R^2_{adj}=.236, p < .001
Predictors	Mean (SD)	β (standardized)	β (standardized)	β (standardized)	β (standardized)
Electronic Device (ED) Use Cognitions					
Subjective norms	5.27 (1.56)	.173	-.052	.121	-.040
Descriptive norms	4.80 (1.52)	-.087	.011	.263	.263*
Instrumental attitude ED to manage health	5.06 (1.39)[+]	.471	.362		.312
Affective attitude ED to manage health	4.62 (1.37)[+]	-.142	-.127		.022
Internet confidence	3.26 (1.11)	.320***	.454**	.299*	.189
Instrumental attitude ED to exercise	4.90 (1.35)[++]			.477	
Affective attitude ED to exercise	4.48 (1.45)[++]			-.092	

Note. Dependent variables and Internet confidence scales = (0-5), all other measurement scales = (0-7); ED = electronic device, PA = physical activity; ǂp < .10, *p < .05, **p < .01, ***p < .001; [1] $F(5,60) = 13.16$, p < .0001, [2] $F(5,60) = 6.91$, p < .0001, [3] $F(5,60) = 10.21$, p < .0001, [4] $F(5,60) = 4.025$, p < .001, [+]Significantly different from each other, Eta^2 = .31, p <.0001; [++] Significantly different from each other Eta^2 = .293, p <.0001.

related information subsequent to an intensive training/rehabilitation program when, arguably, less information seeking is needed compared to confirmation and reminders of appropriate self-care. Additionally, few studies have addressed the idea that internet/device use itself is a behaviour that must be learned and incorporated into daily life to be effective. There is, however, evidence that reminders delivered by mobile phone can improve medication adherence, achievement of daily step targets, and support smoking cessation attempts, all of which seem relevant to the post-rehabilitation goals of COPD patients. Therefore, internet or mobile phone based behaviour maintenance interventions might be useful to this group.

Social cognitive theories posit a number of pre-requisite cognitions to support the initiation and

maintenance of behaviour. Bandura (1997) suggests that for self-efficacy to predict behaviours, the necessary skills and incentives must already be in place. It is possible that the effectiveness of internet or smartphone delivered interventions/messages is impaired by the lack of these pre-requisite skills and abilities for using the medium itself. We conducted a small survey to explore this possibility.

We recruited 75 patients from a PR program (mean age 68.70 years; n = 36 men; n = 37 women), with a smoking history of 36.47 pack years (i.e., smoked one pack per day for 36 years), and a one second forced expiratory volume (FEV1) of 63.14% of predicted. Using a paper and pencil survey, we assessed variables including what devices they owned (desktop computer, laptop computer, cell phone, smart phone, tablet, email address), how frequently they used devices for email, text messages, apps; and interest for using devices to manage health. We also assessed instrumental (function) and affective (preference) attitudes, subjective (i.e., social pressure) and descriptive norms (perceptions similar others' behavior) for using devices to manage health and physical activity. These were assessed on 7-point scales according to basic tenets of social-cognitive theories, particularly the theory of planned behaviour, and standards of assessment recommended by Godin and colleagues (e.g., Godin et al., 2010). We assessed 'internet confidence' on 5-point scales using nine items that assessed confidence for things like using email, understanding terms like 'modem', loading web pages, and using online discussion groups (Eastin & LaRose, 2000). We assessed their preferred device to receive health and exercise information and their interest in receiving health and exercise advice via social network sites. We were interested in absolute scores for internet and device usage and the relative influence of the social cognitions for internet and device use on their interest in using devices for managing health, finding health information, increasing physical activity, and taking medications.

Of 73 patients providing responses, 12 had no desktop or laptop computer, while the rest had either one or both. Fifty (68%) had a cell phone of which 20 (27%) were smart phones, 34% had a tablet, and 72% (n = 53) had an email account. The frequency of device use among those who had them was between never and daily. About 50% used a computer at least once per week, but sent or received texts less than once a month; 61% used apps once a month or less. These data suggest COPD patients are low, but nonetheless users, of email and the internet. Asked their most preferred device to receive health-management information, only 23% did not want to receive information on a device; 51% preferred a computer; the remainder preferred an app or text message. On a 5-point scale, mean interest in using devices to manage health, find health information, increase physical activity, and help take medications was moderate, suggesting willingness. Regressions were conducted to examine the influences on interest in using devices to support health behavior. All descriptive statistics and analytical results are reported in Table 1.

Generally, the differential associations of the predictors with interest in using devices to support each of the target behaviours (e.g., increasing physical activity or taking medications) support the proposition that device usage is distinct from the target behaviours. Internet confidence was an important predictor of interest in device use for all behaviours but taking medications. Descriptive norms were an important predictor of interest in using devices to support taking medication, but no other target behaviour. Thus, descriptive norms (what similar others are perceived to do) seems to be related to taking medications. This might be because this behavior is more normatively contextualized than general health management or physical activity. Medication use reminders are a strong candidate for device based intervention. Instrumental attitudes were significantly stronger than affective attitudes for using devices for managing health and increasing physical activity, suggesting patients see the usefulness of devices more strongly than they like

using them. The overall means for the attitudinal variables were well above the scale mid-point, suggesting openness to the behaviours. Training and experience with devices might develop a preference for using them. Confidence, however, hovered near the mid-point of the scale, suggesting this might be a good place to start to assist patients to make effective use of potentially strong supports for health behavior change maintenance. It is clear that device use behavior is distinct from the health behaviours it is intended to support, and appropriate training and motivation is necessary for implementing both the medium and the message.

References

Ammann, R., Vandelanotte, C., de Vries, H., & Mummery, K. (2013). Can a website-delivered computer tailored physical activity intervention be acceptable, usable, and effective for older people? *Health Education and Behaviour, 40*(2), 160-170. doi:10.1177/1090198112461791

Bandura A. (1997). *Self-Efficacy: The Exercise of Control*. New York: W. H. Freeman.

Belisario, J. S. M., Huckvale, K., Greenfield, G., Car, J., & Gunn, L. H. (2013). Smartphone and tablet self management apps for asthma. *Cochrane Database of Systematic Reviews, 11*. doi:10.1002/1465/14651858.CD010013.pub2

Car J., Gurol-Urganci, I., de Jongh, T., Vodopivec-Jamsek, V., & Atun, R. (2012). Mobile phone messaging reminders for attendance at healthcare appointments. *Cochrane Database of Systematic Reviews, 7*. doi:10.1002/14651858.CD007458.pub2

Criner, G. J., Bourbeau, J., Diekemper, R. L., Ouellette, D. R., Goodridge, D., Hernandez, P., … Stickland, M. K. (2014). Prevention of acute exacerbations of chronic obstructive pulmonary disease: American College of Chest Physicians and Canadian Thoracic Society Guideline. *Chest*. Advance online publication. doi:10.1378/chest.14-1676

Crutzen, R., Ruiter, R. A. C., & de Vries, N. K. (2014). Can interest and enjoyment help to increase use of Internet-delivered interventions? *Psychology & Health, 29*(11), 1227-1244. doi:10.1080/08870446.2014.921300

Davies, C. A., Spence, J. C., Vandelanotte, C., Caperchione, C. M., & Mummery, K. W. (2012). Meta-analysis of internet-delivered interventions to increase physical activity. *International Journal for Behavioral Nutrition & Physical Activity, 9*(52). doi:10.1186/1479-5868-9-52

de Jongh, T., Gurol-Urganci, I., Vodopivec-Jamsek, V., Car, J., & Atun, R. (2012). Mobile phone messaging for facilitating self-management of long-term illnesses. *Cochrane Database of Systematic Reviews, 12*. doi:10.1002/14651858.CD007459.pub2

Duncan, M., Vandelanotte, C., Kolt, G. S., Rosenkranz, R. R., Caperchione, C. M., George, E. S., … Mummery, W. K. (2014). Effectiveness of a web- and mobile phone-based intervention to promote physical activity and healthy eating in middle-aged males: Randomized controlled trial of the ManUp study. *Journal of Medical Internet Research, 16*(6), e136. doi:10.2196/jmir.3107

Eastin, M. S., & LaRose, R. (2000). Internet self-efficacy and the psychology of the digital divide. *Journal of Computer-Medicated Communication, 6*(1). doi:10.1111/j.1083-6101.2000.tb00110.x

Fischer M. J., Scharloo M., Abbink, J. J., van 't Hul, A. J., van Ranst, D., Rudolphus, A., …Kaptein, A. A. (2009). Drop-out and attendance in pulmonary rehabilitation: The role of clinical and psychosocial variables. *Respiratory Medicine, 103*(10), 1564-1571. doi:10.1016/j.rmed.2008.11.020

Godin, G., Sheeran, P., Conner, M., Bélanger-Gravel, A., Gallani, M. C. B. J., & Nolin, B. (2010). Social structure, social cognition, and physical activity: A test of four models. *British Journal of Health Psychology, 15*(1), 79-95. doi:10.1348/135910709X429901

Kim, D. J., Choo, E. K., & Ranney, M. L. (2014). Impact of gender on patient preferences for technology-based behavioral interventions. *Western Journal of Emergency Medicine, 15*(5), 593-599. doi:10.5811/westjem.2014.4.21448

Kirwan, M., Duncan, M. J., Vandelanotte, C., & Mummery, W. K. (2012). Using smartphone technology to monitor physical activity in the 10,000 steps program: A matched case-control trial. *Journal of Medical Internet Research, 14*(2), e55. doi:10.2196/jmie/1950

Maher C. A., Lewis, L. K., Ferrar, K., Marshall, S., De Bourdeaudhuij, I., & Vandelanotte, C. (2014). Are health behaviour change interventions that use online social networks effective? A systematic review. *Journal of Medical Internet Research, 16*(2), e40. doi:10.2196/jmir.2952

Munro, J., Angus, N., & Leslie, S. J. (2013). Patient focused internet-based approaches to cardiovascular rehabilitation – a systematic review. *Journal of Telemedicine and Telecare, 19*(6), 347-353. doi:10.1177/1357633X13501763

O'Donnell, D. E., Aaron, S., Bourbeau, J., Hernandez, P., Marciniuk, D. D., ...Voduc, N. (2007). Canadian Thoracic Society recommendations for management of chronic obstructive pulmonary disease - 2007 update. *Canadian Respiratory Journal, 14*(Suppl B), 5B-32B.

Rabin, C., & Bock, B. (2011). Desired features of smartphone applications promoting physical activity. *Telemedicine and e-Health, 17*(10), 801-803. doi:10.1089/tmj.2011.0055

Rodgers, W. M., Selzler, A.-M., Haennel, R. G., Wong, E. Y. L., & Stickland, M. K. (2013). An experimental assessment of the influence of exercise versus social implementation intentions on physical activity during and following pulmonary rehabilitation. *Journal of Behavioral Medicine, 37*(3), 480-490. doi:10.1007/s10865-013-9503-z

Rodgers W. M., Wilson, P. M., Hall, C. R., Fraser, S. N., & Murray, T. C. (2008). Evidence for a multidimensional self-efficacy for exercise scale. *Research Quarterly for Exercise and Sport, 79*(2), 222-234. doi:0.1080/02701367.2008.10599485

Sabit, R., Griffiths, T. L., Watkins, A. J., Evans, W., Bolton, C. E., Shale, D. J., & Lewis, K. E. (2008). Predictors of poor attendance at an outpatient pulmonary rehabilitation programme. *Respiratory Medicine, 102*(6), 819-824. doi:10.1016/j.rmed.2008.01.019

Short, C. E., Vandelanotte, C., & Duncan, M. J. (2014). Individual characteristics associated with physical activity intervention delivery mode preferences among adults. *International Journal of Behavioral Nutrition and Physical Activity, 11*(25). doi:10.1186/1479-5868-11-25

Vandelanotte, C., Caperchione, C., Ellison, M., George, E. S., Maeder, A., Kolt, G. S., ... Mummery, K. W. (2013). What kind of website and mobile phone-delivered physical activity and nutrition interventions do middle-aged men want? *Journal of Health Communication: International Perspectives, 18*(9), 1070-1083. doi:10.1080/10810730.2013.768731

Vandelanotte, C., Kirwan, M., Rebar, A., Alley, S., Short, C., Fallon, L., ... Duncan, M. J. (2014). Examining the use of evidence-based and social media supported tools in freely accessible physical activity intervention websites. *International Journal for Behavioural Nutrition and Physical Activity, 11*(1), 105. doi:10.1186/s12966-014-0105-0

Vandelanotte, C., Spathonis, K. M., Eakin, E. G., & Owen, N. (2007). Website-delivered physical activity interventions: A review of the literature. *American Journal of Preventive Medicine, 33*(1), 54-64. doi:10.1016/j.amepre.2007.02.041

Vodopivec-Jamsek, V., de Jongh, T., Gurol-Urganci, I., Atun, R., & Car, J. (2012). Mobile phone messaging for preventive health care. *Cochrane Database of Systematic Reviews, 12*. doi:10.1002/14651858.CD007457.pub2

Wong, E. Y., Jennings, C. A., Rodgers, W. M., Selzler, A.-M., Simmonds, L. G., Hamir, R., & Stickland, M. K. (2014). Peer educator vs. respiratory therapist support: Which form of support better maintains health and functional outcomes following pulmonary rehabilitation? *Patient Education and Counseling, 95*, 118-125. doi:10.1016/j.pec.2013.12.008

Wendy Rodgers
is a Professor at the Faculty of Physical Education and Recreation University of Alberta, Edmonton, Canada
wendy.rodgers@ualberta.ca

Anne-Marie Selzler
Is a PhD Student at the Faculty of Physical Education and Recreation University of Alberta, Edmonton, Canada
aselzler@ualberta.ca

Corneel Vandelanotte
is an Associate Professor at the School of Human, Health, and Social Sciences, Central Queensland University, Rockhampton, Australia
c.vandelanotte@cqu.edu.au

Michael Stickland
is an Associate Professor in the Faculty of Medicine and Dentistry and Director of the G.F. MacDonald Centre for Lung Health, Covenant Health, University of Alberta, Edmonton, Canada
michael.stickland@ualberta.ca

original article

Taking online computer-tailoring forward

The potential of tailoring the message frame and delivery mode of online health behaviour change interventions

Eline S. Smit
University of Amsterdam
Annemiek J. Linn
University of Amsterdam
Julia C. M. van Weert
University of Amsterdam

Online interventions that are tailored to the individual participant, using computer-tailoring strategies, can effectively improve health related behaviour (Lustria et al., 2013). Computer-tailoring can best be described as adjusting intervention materials to the specific characteristics of an individual person through a computerized process (de Vries & Brug, 1999). In contrast to more static online health communication (e.g. health information websites), tailored interventions provide individuals only with information that is relevant to them and their situation. As a result, this information is more likely to be considered as personally relevant and, consequently, to be read. This is expected to lead to an increased desire to use the intervention, more user engagement, more in-depth processing of information, greater recall and likely initiation or continuation of the desired health behaviour change (Kreuter, Farrell, Olevitch, & Brennan, 1999; Ritterband, Thorndike, Cox, Kovatchev, & Gonder-Frederick, 2009).

Online computer-tailoring to date

Online computer-tailored interventions have most often been matched in terms of their content to individuals' current health behaviour and/or their self-reported scores on known predictors of the desired health behaviour (change) (Rimer & Kreuter, 2006), something we refer to as content tailoring. In these content tailored interventions, information that is provided is for instance tailored to respondents' self-reported intention to change, their attitude towards changing, perceived social influences and self-efficacy levels (for an example see Smit, de Vries, & Hoving, 2012). In addition, these interventions have often been personalised (e.g. using the respondent's name; 'Dear Ms de Jong') and adapted to participants' demographic characteristics (e.g. adjusting intervention materials to the respondent's gender; providing pregnant women with information related to the consequences of smoking for their unborn child) (Dijkstra, 2005; Ritterband et al., 2009). Up to now, online computer-tailored interventions using content tailoring, personalisation and/or adaptation have been shown to be both effective and cost-effective in improving different health related behaviours (Lustria et al., 2013; Schulz et al., 2014; Smit, Evers, de Vries, & Hoving, 2013). Nonetheless, the overall effect sizes of online computer-tailoring remain small (Lustria et al., 2013), suggesting room for further improvement.

A possible explanation for the limited effects of online computer-tailoring may be that differences in personal preferences concerning *how* health related information is presented have so far been largely ignored. This, while people differ in their information processing styles and preferences for information delivery modes (Cacioppo, Petty, Feinstein, & Jarvis, 1996; Maio & Esses, 2001; Soroka et al., 2006; Wright et al., 2008). These individual differences have also been recognized by the Behaviour Change Model for Internet Interventions (Ritterband et al., 2009), that distinguishes several website areas that contain elements that can be manipulated, such as the message frame and delivery mode that are used to get the health information across. Besides, it has been

argued that novel tailoring strategies are needed to enhance the effectiveness of tailored health communication – next to the strategies mentioned above (i.e. content tailoring, personalisation and adaptation) (Rimer & Kreuter, 2006). Yet, only few previous tailoring studies have taken individual differences in information processing styles and delivery mode preferences into account when tailoring health communication interventions. This implies that, even if an intervention is personalised, adapted and provides relevant feedback only, it may remain unclear whether the intervention meets the respondent's preferences for a particular message frame and delivery mode.

In the next two sections, we will further elaborate on how the tailoring of message frame and delivery mode might increase the effectiveness of online health behaviour change interventions.

Tailoring message frame

According to Entman (1993), message framing involves the selection of some aspects of a perceived reality and making them more salient in a communicating text, to promote a particular problem definition, causal interpretation, moral evaluation and/or treatment recommendation. It refers to the taking of a certain perspective when formulating a message, highlighting some bits of information while omitting others (Entman, 1993). Based on this definition, we define message frame tailoring as adjusting this perspective based on people's individual needs. To tailor an intervention's message frame to respondents' information processing styles, particularly people's need for cognition, need for affect and need for autonomy seem promising characteristics to tailor on.

The need for cognition represents an individual's tendency to engage in and enjoy effortful cognitive endeavors (Cacioppo et al., 1996). The need for affect represents the motivation to approach or avoid emotion-inducing situations (Maio & Esses, 2001). Earlier research has shown that significant individual differences exist in individuals' need for cognition and need for affect, resulting in some individuals preferring more instrumentally and others preferring more affectively framed information (Cacioppo et al., 1996; Maio & Esses, 2001). To illustrate, in health messages for respondents with a high need for cognition the benefits of health behaviour change may be framed instrumentally (e.g. smoking cessation will result in greater physical fitness). In contrast, health messages for respondents with a high need for affect may target the same predictors of behaviour, but frame the benefits of health behaviour change rather affectively (e.g. smoking cessation will help you feel less worried about your physical fitness). Due to these individual differences, tailoring information to respondents' personally preferred message frame represents a potentially fruitful gateway for advancing online computer-tailored health communication. This idea is supported by evidence from the field of interpersonal communication. In a study that aimed to reduce patients' perceived barriers to successful medication intake, tailoring the type of information (i.e. framed instrumentally or affectively) to the patient's personal needs was associated with fewer perceived barriers to medication intake (Linn et al., 2012). Also in the context of online health communication, respondents with a high need for cognition might benefit most from instrumentally framed information, whereas respondents with a high need for affect might prefer feedback that is more affectively framed. Although the need for cognition and need for affect are theoretical constructs that have received considerable attention in relation to persuasive communication in general (Haddock, Maio, Arnold, & Huskinson, 2008) and health communication in particular (Conner, Rhodes, Morris, McEachan, & Lawton, 2011), only few previous studies have investigated whether interventions tailored to these individual needs are more effective than non-tailored interventions in changing (intentions for) health behaviour (Williams-Piehota, Schneider, Pizarro, Mowad, & Salovey, 2003).

These initial findings do, however, suggest an advantage of health communication in which the message frame is tailored to respondents' information processing styles over heatlh communication with no tailored message frame (Williams-Piehota et al., 2003).

The need for autonomy is a construct which is derived from Self-Determination Theory (Ryan & Deci, 2000). Whereas this theory suggests that every person has a basic need for autonomy, individual differences exist in the degree to which the need for autonomy is present that could form the basis for further tailoring health communication interventions (Resnicow et al., 2008; 2014). Examples of strategies that have been suggested to support people's need for autonomy are offering choice and using non-controlling language (Deci, Eghrari, Patrick, & Leone, 2004; Williams, Cox, Kouides, & Deci, 1999). To illustrate, health messages for respondents with a high need for autonomy may be framed as leaving much room to make their own choices; e.g. when providing information about smoking cessation, three possible smoking cessation aids could be described, from which the respondent could choose the option that best suits his or her own preferences. In contrast, health messages for those with a low need for autonomy may be framed using a more directive communication style; the same three smoking cessation aids could be described, but this time the online computer-tailored intervention could suggest a recommended option – based on an individual assessment preceding the tailored advice. This idea finds support in the findings from two studies that investigated the effect of printed health communication materials aimed to increase colorectal cancer screening (Resnicow et al., 2014) and fruit and vegetable intake (Resnicow et al., 2008). Both studies found that only for people with a greater need for autonomy, printed newsletters that were framed in an autonomy-supportive manner were more effective than newsletters with no tailored message frame. To our knowledge, however, no earlier research has used the need for autonomy as a basis to tailor the message frame of *online* health behaviour change interventions. Considering the individual differences found, as well as the promising results found for printed health communication (Resnicow et al., 2008; 2014) and the tailoring to other types of information processing styles (Williams-Piehota et al., 2003), it appears worthwhile to take into account respondents' needs for autonomy when we aim to advance online computer-tailoring as a health behaviour change strategy.

Tailoring mode of delivery

A second opportunity to further increase the effectiveness of online computer tailoring is to tailor interventions' delivery mode to participants' learning styles and mode preferences, i.e. adjusting whether the online health behaviour change intervention is delivered using text, audio and/or visual information. Practical examples of such (combinations of) delivery modes are animations, sound that either coincides with the screen text or that provides additional content, illustrations or graphics, video's, and vignettes or testimonials (Ritterband et al., 2009).

Previous research has identified individual differences in learning styles; whereas so-called 'verbalisers' were found to learn better from information that is presented visually, 'imaginers' performed better when offered verbal information (Ausburn & Ausburn, 1978). When communicating a health message, a lack of consistency between someone's individual learning style and the message's delivery mode can inhibit the processing of the information (Ausburn & Ausburn, 1978). In contrast, when an intervention's delivery mode is tailored based on an individual's learning style, the congruence between learning style and delivery mode is expected to enhance the motivation to attend to and process the information that is presented (Rimer & Kreuter, 2006). This enhanced processing is subsequently anticipated to facilitate learning and increase message impact in terms of information

recall and health behaviour change (Jensen, King, Carcioppolo, & Davis, 2012). Similarly, to enhance the personal relevance of an online health communication intervention, the delivery mode of this intervention could be tailored to respondents' personal preferences. Previous research has indicated that individual differences exist in delivery mode preferences. For example, among the target group of older adults, significant differences have been identified in preferences for a certain mode of delivery that make it difficult and even undesirable to provide information in a general and non-tailored way (Soroka et al., 2006; Wright et al., 2008).

Online computer-tailored health communication interventions are especially suited to adjust modalities and formats to fit individuals' personal learning styles and preferences (Lustria et al., 2013). Due to the automatic adjustment of intervention materials based on a personal assessment, these interventions could, for instance, easily present textual information with or without illustrations and provide text-based or video-based information and/or feedback (Walthouwer, Oenema, Soetens, Lechner, & de Vries, 2013). Until now, however, surprisingly little research has been conducted to determine the effectiveness of online health communication interventions tailored to respondents' learning styles or delivery mode preferences. The few studies that have been conducted within this respect, however, show promising results. In a breast cancer screening study, for example, participants provided with information tailored to their illustration preferences expressed greater breast cancer screening intentions than participants provided with standard information (Jensen et al., 2012).

Implications for future research

To determine whether the tailoring of an intervention's message frame and delivery mode is indeed able to further increase the effectiveness of existing online computer-tailored health communication interventions, two important steps should be taken in future research. First, more experimental research needs to be conducted to determine the effectiveness of a single tailoring strategy. Thus, to investigate the effectiveness of online health communication materials that are tailored to respondents' need for cognition, need for affect and need for autonomy, these materials should be compared with non-tailored materials. Similar experiments are required to investigate the effectiveness of mode tailoring, comparing the effectiveness of interventions materials that are tailored and non-tailored to respondents' learning style or delivery mode preferences. Second, studies are needed that aim to disentangle the effects of the different types of tailoring. That is, to untangle the effects of message frame and mode tailoring from each other, as well as from content and other forms of tailoring (e.g. personalisation), and to investigate whether a combination of multiple tailoring strategies outperforms a single strategy. This second step is especially important, as it will provide insight into whether the two strategies that we propose in this paper to be promising for advancing online computer-tailoring, are indeed able to further increases the effectiveness of existing online health communication interventions.

Conclusion

Although online computer-tailoring can be effective in improving different health related behaviours, overall effect sizes remain relatively small. As a result, testing strategies that might increase the effectiveness of online computer-tailored interventions should be deemed a priority. The aim of this paper was to discuss two of these strategies that have so far received relatively little attention in the field of online health communication. We propose that to advance the health behaviour change strategy of online computer-tailoring, we should move beyond content tailoring by additionally tailoring the

message frame and mode of delivery to respondents needs for cognition, affect and autonomy, and personal learning styles and delivery mode preferences, respectively. As the surprisingly few studies that have been conducted to date towards the effectiveness of these tailoring strategies show promising results, we strongly encourage more research is conducted in this area – to ultimately take online computer-tailoring forward.

References

Ausburn, L. J., & Ausburn, F. B. (1978). Cognitive styles: Some information and implications for instructional design. *Ectj, 26*(4), 337–354. doi:10.1007/BF02766370

Cacioppo, J. T., Petty, R. E., Feinstein, J. A., & Jarvis, W. B. G. (1996). Dispositional differences in cognitive motivation: The life and times of individuals varying in need for cognition. *Psychological Bulletin, 119*(2), 197-253. doi:10.1037/0033-2909.119.2.197

Conner, M., Rhodes, R. E., Morris, B., McEachan, R., & Lawton, R. (2011). Changing exercise through targeting affective or cognitive attitudes. *Psychology & Health, 26*(2), 133–149. doi:10.1080/08870446.2011.531570

de Vries, H., & Brug, J. (1999). Computer-tailored interventions motivating people to adopt health promoting behaviours: Introduction to a new approach. *Patient Education and Counseling, 36*(2), 99–105. doi:10.1016/S0738-3991(98)00127-X

Deci, E. L., Eghrari, H., Patrick, B. C., & Leone, D. R. (2004). Facilitating internalization: the self-determination theory perspective. *Journal of Personality, 62*(1), 119–142. doi:10.1111/j.1467-6494.1994.tb00797.x

Dijkstra, A. (2005). Working mechanisms of computer-tailored health education: evidence from smoking cessation. *Health Education Research, 20*(5), 527–539. doi:10.1093/her/cyh014

Entman, R. M. (1993). Framing: Toward clarification of a fractured paradigm. *Journal of Communication, 43*(4), 51–58. doi:10.1111/j.1460-2466.1993.tb01304.x

Haddock, G., Maio, G. R., Arnold, K., & Huskinson, T. (2008). Should Persuasion Be Affective or Cognitive? The Moderating Effects of Need for Affect and Need for Cognition. *Personality and Social Psychology Bulletin, 34*(6), 769–778. doi:10.1177/0146167208314871

Jensen, J. D., King, A. J., Carcioppolo, N., & Davis, L. (2012). Why are Tailored Messages More Effective? A Multiple Mediation Analysis of a Breast Cancer Screening Intervention. *Journal of Communication, 62*(5), 851–868. doi:10.1111/j.1460-2466.2012.01668.x

Kreuter, M., Farrell, D., Olevitch, L., & Brennan, L. (1999). *Tailoring Health Messages: Customizing Communication with Computer Technology*. Lawrence Erlbaum Associates.

Linn, A. J., van Weert, J. C. M., Schouten, B. C., Smit, E. G., van Dijk, L., & van Bodegraven, A. A. (2012). Words that make pills easier to swallow: A communication typology to address practical and perceptual barriers to medication intake behavior. *Patient Preference and Adherence, 6*, 871-875. doi:10.2147/PPA.S36195

Lustria, M. L. A., Noar, S. M., Cortese, J., Van Stee, S. K., Glueckauf, R. L., & Lee, J. (2013). A Meta-Analysis of Web-Delivered Tailored Health Behavior Change Interventions. *Journal of Health Communication, 18*(9), 1039–1069. doi:10.1080/10810730.2013.768727

Maio, G. R., & Esses, V. M. (2001). The need for affect: Individual differences in the motivation to approach or avoid emotions. *Journal of Personality, 69*(4), 583–614. doi:10.1111/1467-6494.694156

Resnicow, K., Davis, R. E., Zhang, G., Konkel, J., Strecher, V. J., Shaikh, A. R., et al. (2008). Tailoring a Fruit and Vegetable Intervention on Novel Motivational Constructs: Results of a Randomized Study. *Annals of Behavioral Medicine, 35*(2), 159–169. doi:10.1007/s12160-008-9028-9

Resnicow, K., Zhou, Y., Hawley, S., Jimbo, M., Ruffin, M. T., Davis, R. E., et al. (2014). Communication preference moderates the effect of a tailored

intervention to increase colorectal cancer screening among African Americans.. *Patient Education and Counseling, 97*(3), 370–375. doi:10.1016/j.pec.2014.08.013

Rimer, B. K., & Kreuter, M. W. (2006). Advancing tailored health communication: a persuasion and message effects perspective. *Journal of Communication, 56*(s1), S184–S201. doi:10.1111/j.1460-2466.2006.00289.x

Ritterband, L. M., Thorndike, F. P., Cox, D. J., Kovatchev, B. P., & Gonder-Frederick, L. A. (2009). A Behavior Change Model for Internet Interventions. *Annals of Behavioral Medicine, 38*(1), 18–27. doi:10.1007/s12160-009-9133-4

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *The American Psychologist, 55*(1), 68–78. doi:10.1037/0003-066X.55.1.68

Schulz, D. N., Smit, E. S., Stanczyk, N. E., Kremers, S. P. J., de Vries, H., & Evers, S. M. A. A. (2014). Economic evaluation of a web-based tailored lifestyle intervention for adults: findings regarding cost-effectiveness and cost-utility from a randomized controlled trial. *Journal of Medical Internet Research, 16*(3), e91. doi:10.2196/jmir.3159

Smit, E. S., de Vries, H., & Hoving, C. (2012). Effectiveness of a web-based multiple computer tailored smoking cessation program: a randomized controlled trial among Dutch adult smokers. *Journal of Medical Internet Research, 14*(3), e82. doi:10.2196/jmir.1812

Smit, E. S., Evers, S. M. A. A., de Vries, H., & Hoving, C. (2013). Cost-effectiveness and cost-utility of Internet-based computer tailoring for smoking cessation. *Journal of Medical Internet Research, 15*(3), e57. doi:10.2196/jmir.2059

Soroka, A. J., Wright, P., Belt, S., Pham, D. T., Dimov, S. S., De Roure, D., & Petrie, H. (2006). User choices for modalities of instructional information. *IEEE International Conference on Industrial Informatics*, 411–416. doi:10.1109/INDIN.2006.275835

Walthouwer, M. J. L., Oenema, A., Soetens, K., Lechner, L., & de Vries, H. (2013). Systematic development of a text-driven and a video-driven web-based computer-tailored obesity prevention intervention. *BMC Public Health, 13*(1), 1–1. doi:10.1186/1471-2458-13-978

Williams, G. C., Cox, E. M., Kouides, R., & Deci, E. L. (1999). Presenting the facts about smoking to adolescents: effects of an autonomy-supportive style. *Archives of Pediatrics & Adolescent Medicine, 153*(9), 959–964. doi:10.1001/archpedi.153.9.959

Williams-Piehota, P., Schneider, T. R., Pizarro, J., Mowad, L., & Salovey, P. (2003). Matching health messages to information-processing styles: Need for cognition and mammography utilization. *Health Communication, 15*(4), 375–392. doi:10.1207/S15327027HC1504_01

Wright, P., Soroka, A. J., Belt, S., Pham, D. T., Dimov, S., DeRoure, D. C., & Petrie, H. (2008). Modality preference and performance when seniors consult online information. *Gerontechnology, 7*(3), 293–304. doi:10.4017/gt.2008.07.03.004.00

Eline Smit
is an Assistant Professor at the Amsterdam School of Communication Research (ASCoR), Department of Communication Science, University of Amsterdam, Amsterdam, the Netherlands
E.S.Smit@uva.nl

Annemiek Linn
is an Assistant Professor at the Amsterdam School of Communication Research (ASCoR), Department of Communication Science University of Amsterdam, Amsterdam, the Netherlands
A.J.Linn@uva.nl

Julia van Weert
is an Associate Professor at the Amsterdam School of Communication Research (ASCoR), Department of Communication Science, University of Amsterdam, Amsterdam, the Netherlands
J.C.M.vanWeert@uva.nl

original article

Designing engaging online behaviour change interventions: A proposed model of user engagement

Camille E. Short
University of Adelaide
Central Queensland University
Amanda L. Rebar
Central Queensland University
Ronald C. Plotnikoff
University of Newcastle
Corneel Vandelanotte
Central Queensland University

Background

The potential of online behaviour change interventions for improving public health in both a primary and tertiary prevention setting is well recognised (Davies, Spence, Vandelanotte, Caperchione, & Mummery, 2012; Kuijpers, Groen, Aaronson, & van Harten, 2013). Due to this, and the growing popularity of the Internet, the last decade has seen a substantial increase in the number of online behaviour change interventions developed and evaluated. Several well-conducted systematic reviews and meta-analyses have synthesised the literature regarding this research, providing insight into the effectiveness of these interventions, as well as the factors associated with intervention success (e.g., Brouwer et al., 2011; Davies et al., 2012; Kuijpers et al., 2013; Webb, Joseph, Yardley & Michie, 2010). In general, these reviews have shown that online interventions can be effective (albeit effect sizes are in general small), and that effectiveness is mediated by factors related to health behaviour change (e.g., the use of behaviour change theory and the type and number of behaviour change techniques employed) as well as intervention characteristics related to user engagement in the intervention (e.g., whether intervention content is tailored to match individual characteristics, website interactivity, frequency of website updates and reminders and the use of supplementary delivery modes).

Engagement in this context refers to a quality of user experience, characterised by increased attention, positive affect, sensory and intellectual satisfaction and mastery (O'Brien & Toms, 2008). Whilst there have been calls as early as 2009 (Ritterband & Tate, 2009) to consider determinants of user engagement when designing online interventions, very few studies have incorporated this into their conceptual framework. Rather, the development of online interventions has been guided predominantly by theories of behaviour change, which focus on the psychosocial determinants of behaviour (e.g., self-efficacy, intentions). Theories offering insight into how to foster user engagement in online interventions have been largely ignored, an oversight which may explain why issues with user engagement, such as low use of intervention features, few logins, and poor retention rates are consistently reported in the literature (Davies et al., 2012; Kelders, Kok, Ossebaard, & Van Gemert-Pijnen, 2012).

A notable exception is research investigating the efficacy of computer-tailored interventions. Computer-tailoring is a technique that utilises expert-system technology and individual assessments to provide individuals with customised health behaviour advice and feedback via an automated process (Kreuter, Farrell, & Olevitch, 2000). The Elaboration Likelihood Model (ELM; Petty, Barden, & Wheeler, 2009), an information processing theory, is often cited as the theoretical rationale for computer-tailoring (Kreuter et al., 2000; Short, James, & Plotnikoff, 2013). According to the ELM, people process information elaborately (i.e., in an active and deliberate manner) if they are motivated and have the resources (e.g., time), tendency and capabilities

to do so. Otherwise, information is processed with little or no consideration of central information and attitudes are formed or reinforced based on simple periphery cues (e.g., number of arguments made, credibility of the source) and heuristics (e.g., presumptions that experts are generally correct) rather than thoughtful consideration of the message content. Information processed in either way can lead to persuasion, however for long-lasting effects, thoughtful processing of the message is necessary (Petty et al., 2009). In a behaviour change context, this means that intervention strategies that increase an individual's motivation, tendency and ability to elaborately process intervention content are more likely to result in actual and sustained attitudinal changes (Petty et al., 2009). According to the ELM, a key factor that influences motivation to process information elaborately is the perceived personal relevance of the message (Petty et al., 2009). Whereby, motivation is heightened when the message is perceived as personally relevant. Since computer-tailored interventions provide customised advice, likely to be perceived as personally relevant, pioneers in this technique asserted that individual's receiving computer-tailored interventions would be more motivated to process them elaborately than if they received a generic 'one size-fits all' intervention.

Previous evaluations of computer-tailored interventions have provided support for this, showing that computer-tailored intervention materials are more likely to be read, remembered, discussed, and perceived by the reader as interesting compared to non-tailored (i.e. generic) intervention materials (Kreuter et al., 2000). Furthermore, personal relevance has been found to enhance the persuasiveness of messages when perceived personal relevance is high (Dijkstra & Ballast, 2012) and at least partially mediate intervention effects on behaviour (Oenema, Tan, & Brug, 2005; Jensen, King, Carcioppolo & Davis, 2012).

Taken together, these studies support the notion that intervention techniques directed at influencing user engagement have an impact on intervention efficacy and should therefore be considered when designing and evaluating online interventions. In line with best practice, these factors should be considered within a conceptual framework that is both evidence-based and guided by theory (Michie, Johnston, Francis, Hardeman & Eccles, 2008). While this has been done to some extent in computer-tailoring studies, it should be noted that even in these studies the ELM has not been operationalized in full. Other factors thought to impact on whether information is processed elaborately, such as an individual's resources (e.g., time), tendency and capability to process information have not yet been considered. Nor have factors that may influence motivation (e.g., expectations and goals of the program) or the role of peripheral cues (e.g., aesthetic appeal) that may help to enhance engagement in the initial stages of the intervention. The purpose of this paper is to propose a new model that can be used to guide the consideration of these factors when developing and evaluating online behaviour change interventions.

Model of user engagement in online interventions

Research stemming from multiple disciplines, including social psychology, information science and marketing, suggests that factors relating to the individual's environment, the individual and the intervention interact to influence how users engage with the intervention program and how persuasive it is (Petty, Wheeler & Tormala, 2003; O'Brien & Toms, 2008; Petty et al., 2009; Ritterband & Tate, 2009; Kelders et al., 2012; Short et al., 2014; Crutzen, Ruiter & de Vries, 2014). Our model based on this research is presented in Figure 1. The pathways of influence depicted for each hypothesised determinant of user engagement are based on information drawn from existing models, including the ELM (Petty et al., 2009), Obrien and Toms' conceptual model of user engagement with technology (O'Brien & Toms, 2008),

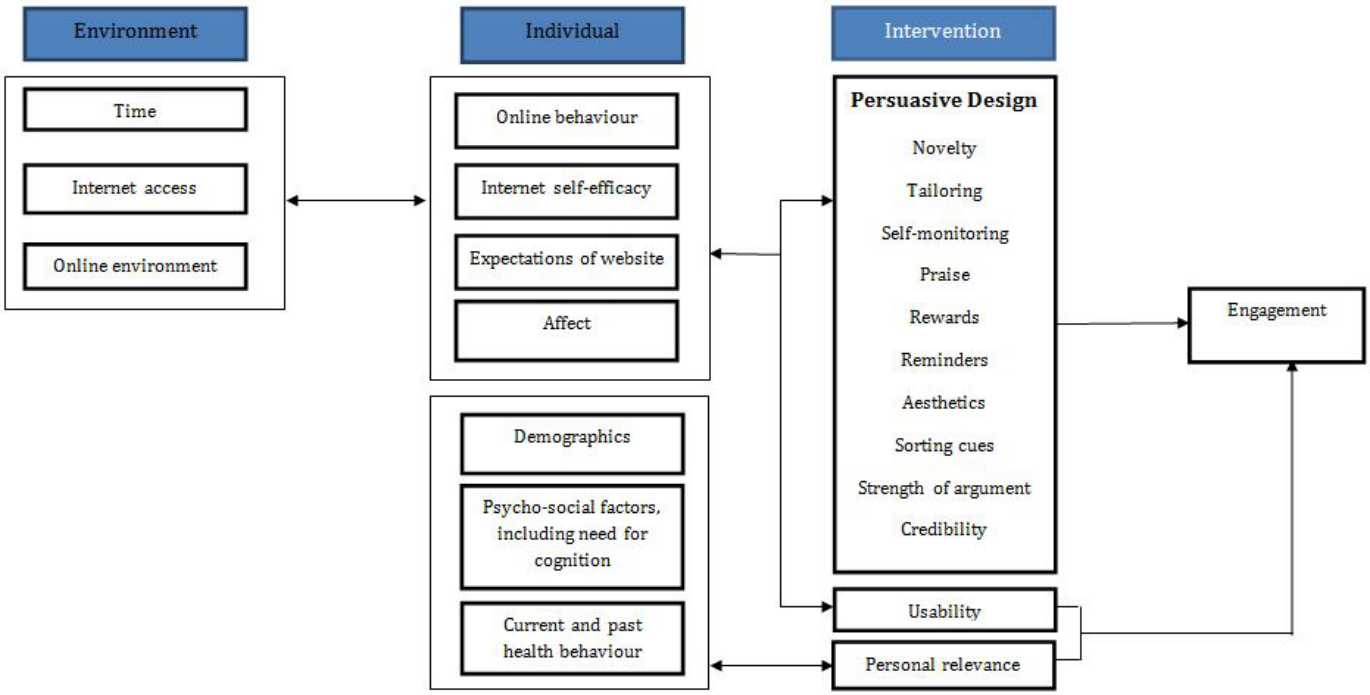

Figure 1. Model of user engagement in online interventions.

Ritterband and Tate's (2009) model of internet interventions, as well as the Persuasive Systems Design Model (Oinas-Kukkonen & Harjumaa, 2009) as applied by Kelders and colleagues (Kelders et al., 2012).

In this model, the environment is composed of external factors that impede or facilitate intervention use, such as the length of time available to the user and the user's access to the Internet. The online environment, relating to the tone, feel and function of what is currently accessible online, also fits within this domain. These environmental determinants influence engagement indirectly by shaping a user's expectations of the intervention, internet self-efficacy and internet behaviour, which in turn influences the user's perception of intervention usability and how persuasive it is to them (Ritterband et al., 2009).

The user's individual characteristics are related to perceived personal relevance of the intervention, the tendency to process information elaborately (need for cognition), user expectations and the perceived usability of the intervention (Crutzen et al., 2014; O'Brien &Toms, 2008; Petty et al., 2003; Petty et al., 2009). When intervention content is matched to the user's demographic, psychosocial and behavioural characteristics the intervention content is perceived as personally relevant by the user, who is then motivated to consider the intervention content elaborately and engage in the intervention (Petty et al., 2003; Petty et al., 2009). Increased motivation to engage in the intervention also occurs when intervention content and the way information is presented is matched to the participants need for cognition (i.e., the extent to which people enjoy in depth thinking) and encourages a positive affect. For individuals with low need for cognition, the presence of motivating periphery cues (e.g., several arguments presented, the website is published by a credible source) and information presented in an accessible

and visual manner (e.g., via video or graphics) is likely to initiate engagement in the intervention. For individuals with a high need for cognition, in depth information that can be read at the users' own pace may be more appreciated (Petty et al.,2003; Petty et al., 2009). Disengagement can be motivated by the experience of negative emotions, resulting from incongruence between the user's expectations of the website and the website itself (Crutzen et al., 2014) or the intervention being perceived as irrelevant, cumbersome (i.e. low usability) or unlikely to be effective in terms of the user's personal goals (O'Brien &Toms, 2008). Importantly, disengagement in the intervention can also occur due to the experience of positive emotions, such as satisfaction with the program due to the achievement of personal goals (O'Brien & Toms, 2008).

Intervention features, such as the aesthetics, interactivity, intended frequency of use, delivery mode of intervention content (e.g., video or text) and the content itself, exert a strong influence on user engagement. Engagement is most likely to be initiated when the intervention is perceived as relevant, novel, and aesthetically appealing. Sustained engagement is likely when the intervention proves usable and offers ongoing learning and interacting opportunities that are relevant and motivating to the user (O'Brien & Toms, 2008). This can be achieved using persuasive design features, such as interaction with a counsellor and by frequently updating content (Kelders et al., 2012). Disengagement occurs when the user experiences negative emotions relating to intervention features, such as frustration or boredom.

Importantly, these factors operate within a feedback loop, whereby they influence each other and engagement reciprocally (Figure 1).

Operationalization of the proposed model alongside health behaviour change theory

The proposed model is congruent with current psycho-social and ecological models of health behaviour change. As in these models, multiple and interacting levels of influence on the individual are recognised, including individual, social and environmental factors. Indeed, intervention developers may wish to utilise health behaviour change models to determine which psycho-social and environmental factors may be important to consider in the context of engagement as well as behaviour change. Overall, these models can be operationalised alongside each other to inform a more comprehensive approach to intervention development. That is, one that focuses not only on what psychosocial and ecological factors to target in order to influence behaviour, but on how these factors are likely to influence engagement and which intervention features are likely to be effective in the target population. As is recommended for the operationalization of behaviour change theory, the proposed model should be operationalised by mapping the proposed determinants of engagement to intervention strategies, preferably with known efficacy (Michie, Fixsen, Grimshaw & Eccles, 2009). To inform this process, experimental studies focusing on the impact of intervention strategies on determinants of user engagement and engagement itself are needed (Crutzen et al., 2014). While little work has been done in this area within the behaviour change field, there are some notable exceptions. For example, Crutzen and colleagues (2014) have recently conducted experiments investigating user perceptions as determinants of engagement in online interventions. These studies show that altering the users affect (by arousing interest) is a promising intervention strategy for enhancing engagement in online interventions and provide important insights into how to manipulate intervention features to

achieve this aim.

Implications for Future research

Overall, the presented model suggests that online interventions are likely to be most engaging when they are well matched to the user's characteristics (demographics, behaviour, psycho-social profile), needs (need for cognition), skill level (internet self-efficacy) and expectations (related to goals and previous internet experience). The use of persuasive design characteristics helps to sustain engagement, especially when techniques promote patterns of use that reflect the users' available resources (in terms of time and internet access), meet or exceed the users' expectations for the program, and create a positive user experience.

While this model may be an oversimplification of the processes involved with engagement in online interventions (Ritterband et al., 2009), it provides a useful foundation to help intervention developers identify and map their assumptions about how the intervention will work against each of the model's domains. In doing so, intervention developers can identify which environmental, individual and intervention features related to engagement have not yet been considered, and which should be addressed, examined and measured in the context of their intervention.

As the model is utilised and tested by researchers in the future, it can be adapted to better explain and predict engagement in online interventions. To this end, key steps for future research are to test whether the relationship between the proposed determinants and engagement are causal, if the determinants interact with each other as suggested and what moderating and/or mediating effects these determinants have on behaviour change. This will need to be done with the same rigor that is applied for tests of behaviour change theory. This means that experimental designs must allow for causal inferences, reliable and valid measures must be used to assess both determinants and outcomes, and clear links between the determinants of engagement targeted and the techniques selected to address them must be made (Michie et al., 2009). Furthermore, in accordance with Crutzen and colleagues (2014), we agree that experimental studies examining the impact of specific intervention features on user engagement is an essential next step for building 'a science of user engagement' in our field.

Conclusion

Evidence from systematic reviews and meta-analyses suggests that the effectiveness of online interventions is mediated by factors associated with user engagement in interventions and psychosocial health behaviour change determinants. However, current intervention approaches strongly focus on influencing determinants of health behaviour change and fail to address determinants of engagement. This is due to a reliance on behaviour change theories to guide the development and evaluation of online interventions, which provide little or no insight into how to deliver intervention content in an engaging way. If we are to fully understand the active mechanisms of online interventions, future studies need to consider both sets of determinants and their interactive effects. The model presented in this paper can be operationalised alongside behaviour change theory to help guide this research.

References

Brouwer, W., Kroeze, W., Crutzen, R., de Nooijer, J., de Vries, N. K., Brug, J., & Oenema, A. (2011). Which intervention characteristics are related to more exposure to Internet-delivered healthy lifestyle promotion interventions? A systematic review. *Journal of Medical Internet Research, 13*(1), e2. doi:10.2196/jmir.1639

Crutzen, R. (2014). The Behavioral Intervention

Technology Model and Intervention Mapping: The best of both worlds. *Journal of Medical Internet Research, 16*(8), e188. doi:10.2196/jmir.3620

Crutzen, R., Ruiter, R. A. C., & de Vries, N. K. (2014). Can interest and enjoyment help to increase use of Internet-delivered interventions? *Psychology & Health, 29*(11), 1227-1244. doi:10.1080/08870446.2014.921300

Davies, C., Spence, J., Vandelanotte, C., Caperchione, C., & Mummery, W. (2012). Meta-analysis of internet-delivered interventions to increase physical activity levels. *International Journal of Behavioral Nutrition and Physical Activity, 9*(1), 52. doi:10.1186/1479-5868-9-52

Dijkstra, A., & Ballast, K. (2012). Personalization and perceived personal relevance in computer-tailored persuasion in smoking cessation. *British Journal of Health Psychology, 17*(1), 60-73. doi: 10.1111/j.2044-8287.2011.02029.x

Jensen, J. D., King, A. J., Carcioppolo, N., & Davis, L. (2012). Why are tailored messages more effective? A multiple mediation analysis of a breast cancer screening intervention. *Journal of Communication, 62*(5), 851-868. doi:10.1111/j.1460-2466.2012.01668.x

Joseph, R. P., Durant, N. H., Benitez, T. J., & Pekmezi, D. W. (2014). Internet-based physical activity interventions. *American Journal of Lifestyle Medicine, 8*(1), 42-68. doi:10.1177/1559827613498059

Kelders, S. M., Kok, R. N., Ossebaard, H. C., & Van Gemert-Pijnen, J. E. (2012). Persuasive system design does matter: A systematic review of adherence to web-based interventions. *Journal of Medical Internet Research, 14*(6), e152. doi:10.2196/jmir.2104

Kreuter, M., Farrell, D., Olevitch L., & L. Brennan (2000). *Tailoring health messages: Customizing communication with computer technology*. Mahwah, New Jersey: Lawrence Erlbaum Associates

Kuijpers, W., Groen, W. G., Aaronson, N. K., & van Harten, W. H. (2013). A systematic review of web-based interventions for patient empowerment and physical activity in chronic diseases: Relevance for cancer survivors. *Journal of Medical Internet Research, 15*(2), e37. doi:10.2196/jmir.2281

Michie, S., Fixsen, D., Grimshaw, J., & Eccles, M. (2009). Specifying and reporting complex behaviour change interventions: The need for a scientific method. *Implementation Science, 4*(1), 40. doi:10.1186/1748-5908-4-40

Michie, S., Johnston, M., Francis, J., Hardeman, W., & Eccles, M. (2008). From theory to intervention: Mapping theoretically derived behavioural determinants to behaviour change techniques. *Applied Psychology, 57*(4), 660-680. doi:10.1111/j.1464-0597.2008.00341.x

O'Brien, H. L., & Toms, E. G. (2008). What is user engagement? A conceptual framework for defining user engagement with technology. *Journal of The American Society for Information Science and Technology, 59*(6), 938-955. doi:10.1002/asi.v59:6

Oenema, A., Tan, F., & Brug, J. (2005). Short-term efficacy of a web-based computer-tailored nutrition intervention: Main Effects and Mediators. *Annals of Behavioral Medicine, 29*(1), 54-63. doi: 10.1207/s15324796abm2901_8

Oinas-Kukkonen H & Harjumaa M. (2009). Persuasive Systems Design: Key Issues, Process Model, and System Features. *Communication of the Association for Information System, 24*, 28. Retrieved from http://aisel.aisnet.org/cais/vol24/iss1/28

Petty, R. E., Barden, J., & Wheeler, S. C. (2009). The elaboration liklihood model of persuasion: Health promptions that yield sustainable behavioral change. In R. J. DiClemente, R. A. Crosby, & M. C. Kegler (Eds), *Emerging theories in health promotion pratice and research* (pp. 185-214). San Francisco: Josey-Bass.

Petty, R. E., S. C. Wheeler and Z. L. Tormala (2003). Persuasion and attitude change. In T. Mellon, & M. J. Learner (Eds), *Handbook of psychology: Vol. 5: Personality and social psychology* (pp.282-353). Hoboken, NJ: Wiley.

Ritterband, L. M., & Tate, D. F. (2009). The science of internet interventions. *Annals of Behavioral Medicine, 38*(1), 1-3. doi:10.1007/s12160-009-9132-5

Short, C. E., James, E. L., & Plotnikoff, R. C. (2013). Theory-and evidence-based development and process evaluation of the Move More for Life program: A tailored-print intervention designed to promote physical activity among post-treatment breast cancer survivors. *International Journal of Behavioral Nutrition and Physical Activity, 10*, 124. doi:10.1186/1479-5868-10-124

Short, C. E., Vandelanotte, C., Dixon, M. W., Rosenkranz, R., Caperchione, C., Hooker, C., . . . Duncan, M. J. (2014). Examining participant engagement in an information technology-based physical activity and nutrition intervention for men: the manup randomized controlled trial. *JMIR Research Protocols, 3*(1), e2. doi:10.2196/resprot.2776

Webb, T. L., Joseph, J., Yardley, L., & Michie, S. (2010). Using the internet to promote health behavior change: A systematic review and meta-analysis of the impact of theoretical basis, use of behavior change techniques, and mode of delivery on efficacy. *Journal of Medical Internet Research, 12*(1), e4. doi: 10.2196/jmir.1376

Camille E. Short
is a National Health and Medical Research Early Career Fellow at the School of Medicine, University of Adelaide, Australia
camille.short@adelaide.edu.au

Amanda L. Rebar
Is a Post-Doctoral Research Fellow at the School of Human, Health, and Social Sciences Central Queensland University, Rockhampton, Australia
a.rebar@cqu.edu.au

Ronald C. Plotnikoff
Professor and founding director of the Priority Research Centre for Physical Activity and Nutrition, University of Newcastle, Newcastle, Australia
Ron.plotnikoff@newcastle.edu.au

Corneel Vandelanotte
is an Associate Professor at the School of Human, Health, and Social Sciences, Central Queensland University, Rockhampton, Australia
c.vandelanotte@cqu.edu.au

original article

Easier said than done: Overcoming challenges in the economic evaluation of Internet-based lifestyle interventions

Eline S. Smit
University of Amsterdam
Hein de Vries
Maastricht University
Edwin J. M. Oberjé
University of Amsterdam
Silvia M. A. A. Evers
Maastricht University
Netherlands Institute of Mental Health and Addiction

An unhealthy lifestyle is often represented by a variety of health behaviours like physical inactivity, an unhealthy diet, excessive drinking and smoking. As a consequence, it is a major cause of chronic diseases and related to reduced quality of life, productivity losses and substantial health care costs. Interventions that can effectively stimulate a healthy lifestyle will thus yield important societal benefits.

A landmark systematic review has shown that Internet-based health behaviour change interventions can effectively promote a healthy lifestyle (Webb, Joseph, Yardley, & Michie, 2010). In particular Internet-based interventions that are tailored to the specific characteristics of the individual participant – using online computer-tailoring strategies – have been found to be effective in enhancing various health behaviours (Lustria et al., 2013). Compared to more static health communication tools, computer-tailored interventions provide individuals with more personally relevant information. Consequently, this information is more likely to be read, thoroughly processed and remembered (de Vries & Brug, 1999; Kreuter, Farrell, Olevitch, & Brennan, 1999). Besides, using the Internet to deliver these interventions has several advantages: it is highly accessible for people with different backgrounds, it offers participants the possibility to use it at any convenient time, and it has the potential to reach a large audience at minimal cost – an attribute making it likely to result in favourable cost-effectiveness (Griffiths, Lindenmeyer, Powell, Lowe, & Thorogood, 2006).

In healthcare, especially given the current economic climate, limited resources are generally available to implement effective lifestyle interventions on a large scale. Therefore, health care decision-makers should prioritize interventions that produce most value for money and should make evidence-based decisions about which interventions to implement. Valid and reliable information regarding the cost-effectiveness of Internet-based lifestyle interventions is therefore crucial.

Economic evaluations to date

In economic evaluations, the costs and effects of an intervention are determined and compared with the costs and effects of current practice and/or other interventions (Drummond, O'Brien, Sculpher, Thorrance, & Stoddart, 2005). Economic evaluations usually consist of 5 steps: 1) Identification of relevant costs and effects based on a chosen perspective (e.g. the health care or societal perspective); 2) Measurement of costs and effects; 3) Valuation of measured costs and effects; 4) Calculation of an incremental cost-effectiveness ratio (ICER) to indicate the additional costs required for an additional measure of effect, based on the formula ICER = $(Cost_{intervention} - Cost_{control}) / (Effect_{intervention} - Effect_{control})$; and 5) Uncertainty analysis to test the robustness of the results. These steps can easily be embedded within the context of a randomised controlled trial. Whereas step 1 requires some thought before the initiation of the trial, step 2 can take place during regular measurements of the trial

and mainly entails including a resource use measurement instrument, such as a cost questionnaire (Thorn et al., 2013), and a generic health-related quality of life instrument, such as the EuroQol (EuroQol Group, 1990). Steps 3 to 5 could be conducted in collaboration with a health economics expert once data have been collected – similar to analyses to investigate an intervention's effectiveness. The five steps are described in more detail elsewhere (Smit, Evers, de Vries, & Hoving, 2013, multimedia appendix 1).

In 2006, a call was published to more regularly investigate the cost-effectiveness of Internet-based interventions aimed to improve health (Ahern, Kreslake, & Phalen, 2006). Since then, a number of cost-effectiveness studies have been conducted of Internet-based interventions aimed at, for example, alcohol reduction (Smit et al., 2011), decreasing depressive symptoms (Warmerdam, Smit, van Straten, Riper, & Cuijpers, 2010), smoking cessation (Smit et al., 2013; Stanczyk et al., 2014), and reducing lifestyle associated risk factors (Schulz et al., 2014). Without exception, these economic evaluations showed a high probability of Internet-based interventions being cost-effective in improving lifestyle related outcomes when compared to current practice (Smit et al., 2013; Smit et al., 2011), brief and/or non-tailored interventions (Schulz et al., 2014; Stanczyk et al., 2014) or a waiting list control group (Warmerdam et al., 2010). Together, these findings thus suggest that Internet-based lifestyle interventions are not only effective, but also cost-effective.

Challenges in the economic evaluation of Internet-based lifestyle interventions

We highly recommend economic evaluations to be conducted to enable evidence-based decision-making. To facilitate this, we would like to address some of the major challenges in economically evaluating Internet-based lifestyle interventions that need to be anticipated upon, and provide suggestions to overcome these challenges (for an overview, see table 1).

The first challenge in performing economic evaluations is how to choose an outcome measure that can compare interventions across health behaviours, but is also sensitive to behaviour-specific changes resulting from the intervention. Health care decision-makers often need to compare the cost-effectiveness of interventions targeting different health behaviours; the use of a generic measure like quality adjusted life years (QALYs) as a study outcome facilitates this comparison. A recommended QALY measure that has been used frequently is the EuroQol (EuroQol Group, 1990). Although the EuroQol is able to compare interventions aimed at different health behaviours, the EuroQol has also been criticized for assessing quality of life from a limited health perspective. The majority of Internet-based lifestyle interventions aims to prevent the development of chronic diseases, rather than treating them. Consequently, most participants do not (yet) suffer from any health related complaints (i.e. they do not experience any limitations in daily life resulting from impaired health) and will not experience any major improvements in health due to their participation in the intervention. In fact, people may initially experience adverse effects of their lifestyle change, such as withdrawal symptoms (i.e. when quitting smoking) and aching muscles (i.e. when increasing physical activity levels). Recent research has therefore suggested to take a broader perspective in the economic evaluation of lifestyle interventions and to additionally focus on non-health related outcomes (Weatherly et al., 2009). In line with this suggestion, next to health related quality of life measures, we recommend using outcome measures that go beyond health, such as the ICECAP questionnaire measuring quality of life by assessing capabilities that are non-health related, such as achievement (Keeley, Al-Janabi, Lorgelly, & Coast, 2013).

Table 1

Overview of the challenges in the economic evaluation of Internet-based lifestyle interventions and their possible solutions

Challenge	Possible solution(s)
#1 How to choose an outcome measure that can compare interventions across health behaviours, but is also sensitive to behaviour-specific changes	Use measures of non-health related quality of life as (additional) outcome measures
#2 How to determine whether the effects of an intervention on lifestyle related outcomes outweigh its costs – taking into account society's willingness to pay	Transform changes in lifestyle improvements into metrics that are comparable across health behaviours
#3 How to predict long-term costs and effects accurately	Use data from trials and longitudinal research to inform modelling techniques to predict long-term costs and effects
#4 How to value the leisure time people spend on participation	Value leisure time using several methods (i.e. as paid and unpaid labour time) in a sensitivity analysis
#5 How to finance Internet-based lifestyle interventions – also in the long run – to ensure their financial sustainability	Mobilize governmental bodies to ensure long-term financial possibilities

A second challenge is how to determine whether the effects of an intervention on lifestyle outweigh its costs. New interventions often bring about additional effects, but also additional costs, which is reflected in the ICER calculated in step 3 of an economic evaluation. Whether the ICER is acceptable, however, depends on society's willingness to pay (WTP) per additional measure of effect. The ICER should be lower than the WTP for the intervention to be considered as having sufficient value for money. Often €18,000/QALY has been set as the Dutch WTP for preventive interventions, though this cut-off point is still contested (Raad voor de Volksgezondheid en Zorg, 2006). Besides, no information on the WTP for lifestyle improvements, e.g. for each additional non-smoker or health norm met, is available. This hinders the interpretation of the results from economic evaluations using lifestyle related outcomes. This became especially apparent in three studies in which the cost-effectiveness (i.e. using lifestyle related outcome measures) and cost-utility (i.e. using QALYs as outcome measure) of three different Internet-based interventions were determined. In all three studies, both types of analyses suggested different treatments to be most efficient (Schulz et al., 2014; Smit et al., 2013; Stanczyk et al., 2014). To overcome this problem, WTP cut-off points could be defined for improvements in different lifestyle related outcomes. However, given the range of lifestyle related health behaviors, a better alternative might be to transform lifestyle improvements into metrics that can be compared across behaviours and for which WTP cut-off points are known (e.g. transforming lifestyle improvements into QALYs) (Schulz et al., 2014; Tate, Finkelstein, Khavjou, & Gustafson, 2009). Yet, recent research efforts indicate the potential but also the challenges that accompany the development of such metrics (Versteegh, Leunis, Groot, & Stolk, 2012), indicating that more research is needed before reliable metrics can be recommended.

A third challenge is how to predict long-term costs and effects accurately. Many economic evaluations are trial-based, i.e. conducted using data collected

alongside a randomised controlled trial (e.g. Schulz et al., 2014; Smit et al., 2013; Stanczyk et al., 2014; Warmerdam et al., 2010). This often implies that follow-up periods are relatively short and limited to 12 or 24 months. However, assessing the effects of lifestyle interventions on health related outcomes (e.g. a reduced risk of cardiovascular diseases due to smoking cessation) often requires a longer follow-up period. A potential solution to this problem may be to complement trial-based economic evaluations with modelling techniques to predict long-term costs and effects. A major drawback of modelling though is that a model is only as good as the available evidence. If the evidence-base is limited, it is hard to model long-term costs and consequences accurately, resulting in uncertainty in the results presented (Drummond et al., 2005). To optimise model-based economic evaluations, longitudinal research is required in which long-term costs and effects associated with lifestyle related risk factors are investigated. Moreover, for model-based economic evaluations of Internet-based lifestyle interventions, the choice of a discount rate is particularly important as these interventions often generate benefits in the distant future, while costs have to be invested in the short-term. This poses additional challenges, as we know that the use of a certain discount rate will have an influence on the results (Evers, Hiligsmann, & Adarkwah, 2014) and there has been considerable methodological debate about the most appropriate discount rate that should be applied to costs and health benefits being modelled (Weatherly et al., 2009).

The fourth challenge is how to value participant time. Whereas the costs associated with the time spent by a health professional are often well documented in guidelines (Tan, Bouwmans, Rutten, & Hakkaart-van Roijen, 2012), in many Internet-based lifestyle interventions no health professional is involved (Webb et al., 2010). Consequently, the only time that needs to be valued in terms of costs is the time people spend participating in these interventions. However, people often participate in their leisure time and the question remains how this should be valued. It has been suggested to value it as labour time, using wages, or to value it as unpaid work (Tan et al., 2012). Yet, a comparison of the different methods to value patient time revealed that the method of valuation greatly influenced economic evaluation results (Guerriere, Tranmer, Ungar, Manoharan, & Coyte, 2008). To deal with this uncertainty, we recommend that patient time is valued using different methods in a sensitivity analysis (see also step 5 of economic evaluations as described in Smit et al., 2013).

A final challenge concerns how Internet-based lifestyle interventions can be financed – also in the long run – to ensure their financial sustainability. When published on the Internet, many Internet-based interventions become publicly accessible. Yet, not everything that is publicly accessible is for free and often there are costs associated with the permanent availability of these interventions (e.g. costs associated with hosting a website or keeping an intervention up-to-date). However, after an Internet-based intervention has been studied for its (cost-)effectiveness, research funds are often no longer available and new funding needs to be found for the intervention's dissemination. Although this is not in the heart of the economic evaluation itself, financial and organisational sustainability of these interventions is a major challenge. While some intervention developers or researchers might have the resources and/or enthusiasm to pursue long-term funding, a more sustainable option might be for governmental bodies to play a role in this respect.

Conclusion

Given the current economic climate and resulting limited resources for large-scale implementation, economic evaluations of Internet-based lifestyle interventions are becoming increasingly important. The few economic evaluations carried out to date show a great potential for these types of

interventions in terms of value for money. Nonetheless, many challenges remain for conducting rigorous economic evaluations, as well as for the interpretation and the use of their results. We therefore encourage researchers in the field not only to conduct economic evaluations alongside their randomised controlled trials, but also to investigate novel ways of overcoming the challenges presented in this paper.

References

Ahern, D. K., Kreslake, J. M., & Phalen, J. M. (2006). What is eHealth (6): Perspectives on the evolution of eHealth research. *Journal of Medical Internet Research, 8*(1), e4. doi:10.2196/jmir.8.1.e4

de Vries, H., & Brug, J. (1999). Computer-tailored interventions motivating people to adopt health promoting behaviours: Introduction to a new approach. *Patient Education and Counseling, 36*(2), 99–105. doi:10.1016/S0738-3991(98)00127-X

Drummond, M. F., O'Brien, B. J., Sculpher, M. J., Thorrance, G. W., & Stoddart, G. L. (2005). *Methods for the economic evaluation of health care programmes. Oxford medical publications* (3rd ed.). Oxford: Oxford University Press.

EuroQol Group. (1990). EuroQol--a new facility for the measurement of health-related quality of life. *Health Policy, 16*(3), 199–208.

Evers, S. M. A. A., Hiligsmann, M., & Adarkwah, C.C. (2015). Risk of bias in trial-based economic evaluations: Identification of sources and bias-reducing strategies. *Psychology & Health, 30*(1), 52-71. doi:10.1080/08870446.2014.953532

Griffiths, F., Lindenmeyer, A., Powell, J., Lowe, P., & Thorogood, M. (2006). Why are health care interventionsd delivered over the Internet? A systematic review of the published literature. *Journal of Medical Internet Research, 8*(2), e10. doi:10.2196/jmir.8.2.e10

Guerriere, D. N., Tranmer, J. E., Ungar, W. J., Manoharan, V., & Coyte, P. C. (2008). Valuing care recipient and family caregiver time: A comparison of methods. *International Journal of Technology Assessment in Health Care, 24*(1), 52-59. doi:10.1017/S0266462307080075

Keeley, T., Al-Janabi, H., Lorgelly, P., & Coast, J. (2013). A qualitative assessment of the content validity of the ICECAP-A and EQ-5D-5L and their appropriateness for use in health research. *PLoS ONE, 8*(12), e85287. doi:10.1371/journal.pone.0085287.t001

Kreuter, M., Farrell, D., Olevitch, L., & Brennan, L. (1999). *Tailoring health messages: Customizing communication with computer technology*. NY: Lawrence Erlbaum Associates.

Lustria, M. L. A., Noar, S. M., Cortese, J., Van Stee, S. K., Glueckauf, R. L., & Lee, J. (2013). A meta-analysis of web-delivered tailored health behavior change interventions. *Journal of Health Communication, 18*(9), 1039–1069. doi:10.1080/10810730.2013.768727

Raad voor de Volksgezondheid en Zorg. (2006). *Zinnige en duurzame zorg*. Zoetermeer. Retrieved from http://www.webcitation.org/6D3RQDL1Z

Schulz, D. N., Smit, E. S., Stanczyk, N. E., Kremers, S. P. J., de Vries, H., & Evers, S. M. A. A. (2014). Economic evaluation of a web-based tailored lifestyle intervention for adults: Findings regarding cost-effectiveness and cost-utility from a randomized controlled trial. *Journal of Medical Internet Research, 16*(3), e91. doi:10.2196/jmir.3159

Smit, E. S., Evers, S. M. A. A., de Vries, H., & Hoving, C. (2013). Cost-effectiveness and cost-utility of Internet-based computer tailoring for smoking cessation. *Journal of Medical Internet Research, 15*(3), e57. doi:10.2196/jmir.2059

Smit, F., Lokkerbol, J., Riper, H., Majo, M. C., Boon, B., & Blankers, M. (2011). Modeling the cost-effectiveness of health care systems for alcohol use disorders: How implementation of eHealth interventions improves cost-effectiveness. *Journal of Medical Internet Research, 13*(3), e56. doi:10.2196/jmir.1694

Stanczyk, N. E., Smit, E. S., Schulz, D. N., de Vries, H., Bolman, C., Muris, J. W. M., & Evers, S. M. A.

A. (2014). An economic evaluation of a video- and text-based computer-tailored intervention for smoking cessation: A cost-effectiveness and cost-utility analysis of a randomized controlled trial. *PlosOne, 9*(10), e110117. doi:10.1371/journal.pone.0110117

Tan, S. S., Bouwmans, C. A. M., Rutten, F. F. H., & Hakkaart-van Roijen, L. (2012). Update of the Dutch manual for costing in economic evaluations. *International Journal of Technology Assessment in Health Care, 28*(02), 152–158. doi:10.1017/S0266462312000062

Tate, D. F., Finkelstein, E. A., Khavjou, O., & Gustafson, A. (2009). Cost effectiveness of internet interventions: Review and recommendations. *Annals of Behavioral Medicine, 38*(1), 40–45. doi:10.1007/s12160-009-9131-6

Thorn, J. C., Coast, J., Cohen, D., Hollingworth, W., Knapp, M., Noble, S. M. … Hughes, D. (2013). Resource-use measurement based on patient recall: Issues and challenges for economic evaluation. *Applied Health Economics and Health Policy, 11*(3), 155–161. doi:10.1007/s40258-013-0022-4

Versteegh, M. M., Leunis, A., Groot, C. A. U.-D., & Stolk, E. A. (2012). Condition-specific preference-based measures: Benefit or burden? *Value in Health, 15*(3), 504–513. doi:10.1016/j.jval.2011.12.003

Warmerdam, L., Smit, F., van Straten, A., Riper, H., & Cuijpers, P. (2010). Cost-utility and cost-effectiveness of internet-based treatment for adults with depressive symptoms: Randomized trial. *Journal of Medical Internet Research, 12*(5), e53. doi:10.2196/jmir.1436

Weatherly, H., Drummond, M., Claxton, K., Cookson, R., Ferguson, B., Godfrey, C. … Sowden, A. (2009). Methods for assessing the cost-effectiveness of public health interventions: Key challenges and recommendations. *Health Policy, 93*(2-3), 85–92. doi:10.1016/j.healthpol.2009.07.012

Webb, T. L., Joseph, J., Yardley, L., & Michie, S. (2010). Using the internet to promote health behavior change: A systematic review and meta-analysis of the impact of theoretical basis, use of behavior change techniques, and mode of delivery on efficacy. *Journal of Medical Internet Research, 12*(1), e4. doi:10.2196/jmir.1376

Eline Smit
is an Assistant Professor at the Amsterdam School of Communication Research (ASCoR), Department of Communication Science, University of Amsterdam, Amsterdam, the Netherlands
E.S.Smit@uva.nl

Hein de Vries
is a Professor at the department of Health Promotion, CAPHRI School for Public Health and Primary Care, Maastricht University, Maastricht, the Netherlands
hein.devries@maastrichtuniversity.nl

Edwin Oberjé
is a PhD student at the Amsterdam School of Communication Research (ASCoR), Department of Communication Science, University of Amsterdam, Amsterdam, the Netherlands
E.J.M.Oberje@uva.nl

Silvia Evers
is a Professor at the department of Health Services Research, CAPHRI School for Public Health and Primary Care, Maastricht University and the Trimbos Institute, the Netherlands Institute of Mental Health and Addiction, the Netherlands
s.evers@maastrichtuniversity.nl

original article

Wild West eHealth: Time to hold our horses?

Jeroen Ruwaard
VU University Amsterdam
Robin N. Kok
VU University Amsterdam
The Australian National University

Dutch eHealth rocks. After years of rather disappointing eMental Health dissemination efforts - with uptake estimates varying between just 1% to 5% - the tide seems to be turning. In the media, the number of people receiving Internet-based help are reported to have tripled in a period of just three years. Mental health organisations issue press releases boasting that up to 50% of their patients will be treated using eHealth soon (van Dorresteijn, 2014). Implementation projects thrive. In a recent inventory among 101 Dutch mental health organizations, 73% showed active eHealth projects (Metselaar, 2013). Official uptake statistics are hard to come by and our contacts in the field still warn us for the gap between intentions and results. What is clear, however, is that mental health organizations have become much more eager to implement eMental health care. What happened?

There is a sobering explanation for the growing interest in eMental Health implementation. Money. Primed by promised benefits of eMental health care (of which cost-savings are not the least important), insurance companies award bonuses to mental health organisations which implement eHealth. In the coming years, these bonuses will be contingent on increasing percentages of clients treated with eHealth. Given the number of implementation projects, the strategy of the insurance companies appears to be successful. A key problem with this "success", however, is that it is unclear what this uptake will mean for the quality of care, since we are blind to the effects of many of the interventions that are implemented.

We fear that the eHealth bonuses of the insurance companies are not used to implement evidence-based treatment. Available validated programmes such as online self-help and guided self-help are shelved. They are judged to be outdated or incompatible with routine clinical practice. The new 'killer application' of Dutch eMental health care is blended treatment – interventions that combine face-to-face sessions with online contacts. Many organisations base their implementation projects on this new type of treatment, presumably because it is less disruptive to the organization than the 'established' types of eMental health. The choice is remarkable though, as research into the safety, efficacy and efficiency of blended treatment has only recently begun (e.g., see Kooistra et al, 2014). What was tested remains unimplemented and what is being implemented has not been tested.

One may wonder how it is possible that patients are exposed to unvalidated eHealth interventions. One answer is: a history of lenient regulation. The quality of implemented eHealth in Dutch mental health care has been allowed to be unclear for some time. Riper et al. surveyed the Dutch eMental Health landscape in 2007 and 2013. In both surveys, it was found that a majority of publicly available programmes had not been validated in terms of effectiveness. Perfunctory attempts have been made to regulate the field towards a more evidence-based practice, but these initiatives have been largely ignored. For example, the Dutch Trimbos Institute and the Dutch ministry of health developed the 'online hallmark' - a quality seal geared towards consumers. More than two years after its inception, in November 2012, the hallmark has been earned by just

two programmes. Given that reimbursements of eMental health care are not tied to the quality seal in any way, we don't expect this number to rise soon.

There is a double standard in mental health care. Pharmaceutical companies largely adhere – as they should – to the rules of evidence-based care: new antidepressants cannot be introduced until their safety, tolerability and efficacy have been extensively documented. In eMental health, these rules do not seem to apply - as often in the psychotherapeutic realm (Coyne & Kok, 2014). We rely on our collective good intentions and try to implement as quickly and as widely as possible. Effectiveness research comes later - if at all. Shoot first, ask questions later.

This is unsettling. What arguments are so convincing that we accept this double standard? In the following paragraphs, we present - and refute - a number of the arguments that we encountered in the field.

Four Arguments to Implement Unvalidated Ehealth (and Why They are Wrong)

1. "EMental health is Effective and Ready for Implementation"

Internet intervention research has been underway for more than 15 years. We learned that guided online treatment can be as effective as face-to-face psychotherapy (Cuijpers, Donker, van Straten, Li, & Andersson, 2010). There are clear indications that it is safe and cost-effective. There is no need, we heard people argue, to replicate this research in routine practice, even if the implemented programmes are untested. The current challenge is to implement eMental health, and that is a large enough task on hand as it is.

To imply that all eMental health is effective and ready for implementation is a misleading blanket statement. The argument holds for some eMental health, but the assumption that similar programmes are also similar in terms of (cost)effectiveness is open to debate and empirical investigation, because we still know very little about the key characteristics of effective eHealth. In reality, the effectiveness of blended eHealth – by now the dominant model in the Netherlands – is simply unknown. From this, it follows that blended eHealth isn't ready for unquestioned implementation yet.

2. "The Medium is Not the Message"

A second argument to implement unvalidated e-health is to claim that applications can be assumed to be effective because they are based on clinical strategies that have proven their value in research and practice. Adherents adapt and adopt a validated protocol for face-to-face cognitive behavioural therapy to an interactive website and then assert that the quality of the programme is guaranteed. In this argument, eMental health is a transparent, ineffectual carrier of an effective message - the medium is not the message. Proponents argue that there is no need to test the effectiveness of the intervention because we know that it transparently delivers effective content.

This "let-the-content-do-the-talking" argument ignores everything we know about effective computer systems and human-computer interaction. The use of effective clinical strategies is a necessary, but insufficient condition for effective eHealth. If even the appearance of a pill can moderate its effects, it is easy to see why the e in eHealth is much more than an ineffective delivery capsule. E-mental health joins computer science with clinical psychology and requires the integration of knowledge from both disciplines, amalgamating clinically effective content with, e.g., persuasive design elements (Kelders, Kok, Ossebaard & van Gemert-Pijnen, 2012). E-health may enhance the effectiveness of clinical strategies or weaken it. It can be a catalyst but also a filter. Since the medium is inseparable from the message, thorough validation of individual programmes should

be a prerequisite for implementation.

3. "Absence of Evidence is Not Evidence of Absence"

The adoption of blended treatment is a prime example of a practice-based health policy. Given its wide acceptance by the mental health care sector, blended care seems to be more representative of routine daily practice. If 'blended' will bring mental health care the process optimisation that is so direly needed, validation research will temporarily have to take a back seat to implementation. When effects of a specific program have not been demonstrated, it is argued, this does not imply that these effects may not be there.

Rose-coloured glasses are fine, but when they obfuscate fundamental concerns and basic science, corrective glasses should be worn. E-health programs often aim for more efficient care, in which the same quality is offered at lower costs. Savings are often integral to the programs, e.g., by reducing the number of face-to-face sessions or the amount of therapist guidance. The programme is developed around desired savings that are stipulated from the start. When the effects of these savings on the quality of care are not assessed, one cannot claim that the quality is maintained. E-health can have both positive and negative effects. We cannot assume the former and ignore the latter (Rozental et al., 2014). The premise and promise of blended e-health is that it combines the advantages of face-to-face and online treatment, but it might also combine the disadvantages of both (e.g., when online components are not used by many patients, reductions in the number of face-to-face sessions might harm treatment outcomes). Anyone who does not take this into account, runs the risk to confuse simple budget cuts for effective care. When all you see is positive effects, you can always keep cutting budgets.

4. "Science is Too Slow for eHealth"

A thorough validation study, for instance in the form of a randomised controlled trial, usually takes years. The field does not have this time. In the Netherlands, the pressure to introduce eHealth is enormous. Government officials publicly complain about the slow uptake of eHealth and increasingly demand tangible upscaling results. National mental health associations have adopted the implementation of eMental health as a key policy theme. Organizations that tarry with the introduction of eMental health are financially pressured by contracting reimbursement partners. Available validated programmes are outdated, it is claimed. Current scientific validation methods are too slow to keep up with eHealth developments (Baker, Gustafson & Shah, 2014). To meet upscaling demands, mental health organizations are therefore forced to use interventions that lack evidence of efficacy.

Any healthcare organisation embracing the principles of evidence-based care should assess the impact of treatment programmes that are introduced, especially when the effectiveness of these programmes is controversial. Dutch mental health care organisations probably already have the basic tools to do so, as they are also pressed by insurance companies to evaluate their treatments through Routine Outcome Monitoring (ROM; see De Beurs et al, 2011). Science doesn't necessarily have to travel from the lab to daily practice. It can - and should be - an integral characteristic of evidence-based routine care. By combining ROM with a controlled roll-out of a new eMental health programme such as blended care, good indications of the effects of the new programmes in comparison to the current practice can be obtained. This need not take years - see, for instance, the stepped wedge cluster design (Keriel-Gascou, Buchet-Poyau, Rabilloud, Duclos, & Colin, 2014). Scientists would love to contribute to such projects. We really would. With joint efforts, there is no need for a tug-of-war between academia and societal uptake demands, with patients stuck in the middle. Yes, these implementation studies would require additional investments, but we are sure that insurance companies would understand if part of their eHealth / ROM bonuses is used to set up a research-

driven quality-assuring infrastructure in the field.

Time to Hold Our Horses

The dissemination of eMental health is not progressing too slowly, as policy makers sometimes complain. Current developments in the field suggest that we are moving too fast, and that the Dutch approach may not be the best model for the rest of the EU to adopt. In the UK, previous overzealous implementation of computerised CBT has backfired, resulting in recent eMental Health efforts being met with distrust and discontentment (Lina Gega, personal communication, 2014). What is claimed to be evidence-based on closer scrutiny turns out to be either evidence-assumed or eminence-based, e.g., because an intervention is loosely based on CBT or because an intervention has been around for some time or made by a reputable party. If unvalidated e-health becomes entrenched in routine care, the so-called 'sunk cost effect' will make this practically irreversible.

Scientific validation is a fundamental and critical step in the development process of any new treatment. Signs that this step is postponed or even skipped to force the dissemination of eHealth should raise red flags. EHealth can enrich mental health care. The political, social and economic tide for eMental health has never been better. Let us use this to do the right thing. Adopters of blended care: start your implementation trials!

References

Baker, T. B., Gustafson, D. H., & Shah, D. (2014). How can research keep up with eHealth? Ten strategies for increasing the timeliness and usefulness of eHealth research. *Journal of Medical Internet Research, 16*(2), e36. doi:10.2196/jmir.2925

Coyne, J. C. & Kok, R. N. (2014). Salvaging psychotherapy research: A manifesto. *Journal of Evidence-Based Psychotherapies, 14*(2), 105-124. Retrieved from http://jebp.psychotherapy.ro/

Cuijpers, P., Donker, T., van Straten, A., Li, J., & Andersson, G. (2010). Is guided self-help as effective as face-to-face psychotherapy for depression and anxiety disorders? A systematic review and meta-analysis of comparative outcome studies. *Psychological Medicine, 40*(12), 1943–57. doi:10.1017/S0033291710000772

De Beurs E., Den Hollander-Gijsman M. E., Van Rood Y. R., Van der Wee N. J., Giltay E. J., Van Noorden, M. S., … Zitman, F. G. (2011). Routine outcome monitoring in the Netherlands: Practical experiences with a web-based strategy for the assessment of treatment outcome in clinical practice. *Clinical Psychology & Psychotherapy, 18*(1), 1-12. doi:10.1002/cpp.696

van Dorresteijn, M. (2014, September 8). *E-health in minimaal helft ggz-behandelingen*. [E-health in at least half of mental health treatments]. Retrieved from http://www.zorgvisie.nl/ICT/Nieuws/2014/9/Minimaal-helft-ggz-behandelingen-wordt-blended-1592483W/

Kelders, S. M., Kok, R. N., Ossebaard, H. C., & Van Gemert-Pijnen, J. E. W. C. (2012). Persuasive system design does matter: A systematic review of adherence to web-based interventions. *Journal of Medical Internet Research, 14*(6), e152. doi:10.2196/jmir.2104

Keriel-Gascou, M., Buchet-Poyau, K., Rabilloud, M., Duclos, A., & Colin, C. (2014). A stepped wedge cluster randomized trial is preferable for assessing complex health interventions. *Journal of Clinical Epidemiology, 67*(7), 831–3. doi:10.1016/j.jclinepi.2014.02.016

Kooistra, L., Wiersma, J., Ruwaard, J., van Oppen, P., Smit, F., Lokkerbol, J. … Riper, H. (2014). Blended vs. face-to-face cognitive behavioural treatment for major depression in specialized mental health care: study protocol of a randomized

controlled cost-effectiveness trial. *BMC Psychiatry, 14*, 290, doi:10.1186/s12888-014-0290-z

Metselaar, S. (2013). *Werken aan vraagsturing: Grip op ontwikkelingen in eHealth* [Working on demand basis: Getting a grip on eHealth development]. Utrecht: LPGGz. Retrieved from http://www.platformggz.nl/

Riper, H., Smit, F., van der Zanden, R., Conijn, B., Kramer, J., & Mutsaers, K. (2007). *E-mental health. High tech, high touch, high trust*. Utrecht: Trimbos-instituut.

Riper, H., van Ballegooijen, W., Kooistra, L., de Wit, J., & Donker, T. (2013). *Preventie & eMental-health. Onderzoek dat leidt, technologie die verleidt, preventie die bereikt en beklijft. Kennissynthese 2013 in opdracht van ZonMw*. Amsterdam: Vrije Universiteit Amsterdam. Retrieved from http://www.zonmw.nl/

Rozental, A., Andersson, G., Boettcher, J., Daniel, D., Cuijpers, P., & Knaevelsrud, C. (2014). Consensus statement on defining and measuring negative effects of Internet interventions. *Internet Interventions, 1*(1), 12-19. doi:10.1016/j.invent.2014.02.001

Note

An abridged version of this paper was previously published as Ruwaard, J. (2014). Wild West in de e-health: eerst invoeren, dan pas valideren. Kind en Adolescent praktijk, 13, 1.

Jeroen Ruwaard
is postdoctoral researcher at the Department of Clinical Psychology, VU University Amsterdam, The Netherlands
j.j.ruwaard@vu.nl

Robin Kok
is PhD-candidate at the Department of Clinical Psychology, VU University Amsterdam, The Netherlands
r.n.kok@vu.nl

spotlight

Dr. Kristine Martinsone – an Academic Pioneer

The story of Health Psychology in Latvia is the story of Kristine Martinsone

Efrat Neter
EHPS National Delegate Officer

Dr. Martinsone is the first national delegate from Latvia in the EHPS (since 2012). Currently, she is an associate professor at Riga Stradins University and Head of Department of Health Psychology and Pedagogy (DHPP) at the Faculty of Public Health and Social Welfare. The department offers undergraduate and graduate courses for psychology students as well as for students in related fields of health and social studies.

Kristine has a rich educational background: beside a bachelor, master's and doctoral degrees in psychology with qualification as psychologist, she studied pedagogical education (master's degree and teacher qualification), and education in the field of medicine (professional master's degree in health as well as an art therapist qualification).

Dr. Martinsone is an academic pioneer. She started to work at Riga Stradins University in 2006. The university has long been the only medical school in Latvia, and started broadening its curriculum in the 1990s. Together with colleagues, Kristine has created a bachelor's program in psychology and has established, and for several years led, the master's program in arts therapy (which is a regulated by the medical profession in Latvia). Furthermore, she assembled a group of psychology lecturers at the Faculty of Rehabilitation to develop and license the first (and so far the only) Latvian masters in "Health Psychology", in which the first students were admitted in 2013. At present 25 students are enrolled. Indeed, Kristine received a Letter of Acknowledgement from the Ministry of Education and Science of the Republic of Latvia for the development of health psychology in Latvia in 2014.

Kristine realized the need to create a professional association for the health psychologists graduating from the master's program. Hence, the Latvian Health Psychology Association (LHPA) was established in 2012, uniting specialists, researchers and stakeholders in health psychology, and Dr. Martinsone became its chairperson. The goal of the LHPA is to position health psychology in the fields of health and psychology, to develop its legal regulations, and to introduce EHPS activities in Latvia. One of the first activities was a conference "Psychology in Healthcare", organized in collaboration with the Latvian Association of Clinical Psychologists (LACP) in 2013. Paul Norman gave the keynote address (his presence was partly supported by EHPS funds) and a lively discussion and debate was held on the role of psychologists in healthcare. In order to promote public awareness of health psychology, LKPA actively participated in the organization and implementation of Latvian Psychology Days in 2013 and 2014 (over 1,000 visitors), thus promoting recognition of health psychology.

Dr. Martinsone is active in public-professional domains: she is a member of the board of the Latvian Association of Psychologists, a member in the board of Union of Professional Organizations of Rehabilitation, and a member of LACP and Latvian Test Commission, and represents psychology in the Latvian Science Council. She has participated in the drafting of the Law on Psychologists, the current initiative that is intended to strengthen psychologists' professional scope, including the strengthening of health psychology.

Dr. Martinsone has participated in several EU-funded projects and has worked on international accreditation commissions. She has been the leader

and member of the organizing committee at more than 10 international scientific conferences, and she is an editorial board member of several scientific journals. She has participated in more than 50 international conferences, and has authored/co-authored more than 200 scientific publications, including her work as a compiler and scientific editor of collective monographs, collections of articles, and textbooks.

In the research domain, Kristine was the leading researcher in several grants financed by the Latvian Science Council (2001-2006). Currently, Dr. Martinsone is involved in two National Research Programes (2014-2017), the first focusing on clinical multidimensional personality test development, and the second on societal transformation in terms of values and action models in periods of social and economic changes.

Kristine has three grown children, two daughters and a son. She loves to travel, especially to exotic countries and locations to explore the world's cultural and spiritual heritage and meet different people. Her motto is: *The journey of a thousand miles begins with one step*.

Kristine Martinsone
Riga Stradins University
Kristine.Martinsone@rsu.lv

Disclaimer: The views expressed within the European Health Psychologist are those of the authors and do not necessarily represent those of the European Health Psychology Society (EHPS) or the European Health Psychologist's (EHP) editorial board.