Appendix A: Definitions and Discussion by Intervention Type

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Each of these appendices and supplementary documents was less thoroughly edited than Sentience Institute's usual standard, in order to reduce the time required to summarize the extensive health behavior literature. The main report is available at: http://sentienceinstitute.org/health-behavior

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Individual and small group educational and supportive behavioral interventions

Education or information only

In health behavior interventions, educational content is often integrated with behavioral support or advice. For example, the authors of one Cochrane review note that, "[i]n school settings, universal prevention [of alcohol use] typically takes the form of alcohol awareness education, social and peer resistance skills, normative feedback, or development of behavioural norms and positive peer affiliations."[1] However, some reviews evaluate interventions that are primarily focused on enhancing knowledge and affecting the "rational determinants" of behavior, rather than trying to provide behavioral support. This section focuses on such interventions, though separating educational from behavioral interventions for analysis can be an arbitrary process at times.[2]

Overall there is moderate evidence from the health behavior literature that educational interventions are likely to be effective at changing behavior in the farmed animal movement.[3] Where behavioral outcomes are measured in meta-analyses, there are some wide confidence intervals (CIs), but point estimates tend to suggest small effect sizes.[4]

Sometimes the control groups in educational intervention trials are provided with some information or education, of a level which seems more comparable with interventions currently used in the farmed animal movement, such as leafleting or online ads, and the intervention group receives content uncommon in activism, such as telephone or face-to-face counseling.[5] In this sense, the results of education intervention

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[1] David R. Foxcroft and Alexander Tsertsvadze, "Universal family-based prevention programs for alcohol misuse in young people," *Cochrane Database of Systematic Reviews* 9 (September 2011).

[2] For example, this section includes a review of "dietary advice" that may sometimes have included some behavioral advice—but since so much of the farmed animal movement's resources are directed towards education, analysis seemed worth attempting. This section therefore may include some interventions that predominantly but not exclusively focused on education. Many other interventions included in this literature review also had some informational components but have not been included in this section.

[3] See the spreadsheet "Strength of Evidence Assessments."

[4] See the spreadsheet "Effect Size Estimates."

[5] For example, in William Tuong, Elizabeth R. Larsen, and April W. Armstrong, "Videos to influence: a systematic review of effectiveness of videobased education in modifying health behaviors," *Journal of Behavioral Medicine* 37, no. 2 (November 2012), 218-33, 7 studies used "usual care" as a control arm, 13 had some form of written leaflet or guide, 1 had telephone counseling and 7 had some kind of face-to-face education or counseling.

Eric Stice, Heather Shaw, and C. Nathan Marti, "A Meta-Analytic Review of Obesity Prevention Programs for Children and Adolescents: The Skinny on Interventions That Work," *Psychological Bulletin* 132, no. 5 (2006), 681 found an average of 40 hours of intervention time for the interventions that produced weight gain prevention effects. They add that the range was 3 to 120 hours and that, "the average r per hour of interventions for those that produced significant weight gain prevention effects ranged from .001 (Robinson et al., 2003) to .063 (Stice, Shaw, et al., 2006)." In comparison, "the average number of intervention hours was 46 for the programs that did not produce weight gain prevention effects (range 5–280 hr)." Many of the interventions evaluated contained psychoeducational components but review was not limited exclusively to education interventions.

trials sometimes compare resource-intensive educational interventions to lower-cost educational interventions, rather than directly testing for the overall effects of educational interventions. There is little evidence for the effectiveness of lower-cost education interventions compared to zero intervention.

Sometimes, reviews report that resource-intensive educational interventions improved knowledge outcomes but not behavioral outcomes;[6] the effects on behavioral outcomes, if any, might only have been detected with longer follow-up, or if combined with other intervention types. In this sense, knowledge may be an important moderator of behavioral change, but the evidence of long-term effects of educational interventions is very weak.[7]

Three meta-analyses with behavioral outcomes at long-term follow-up suggested that small or very small effects were most likely; in one of these, the CI included no effect. Indirect comparisons in these meta-analyses found that short-term effects were very slightly larger than long-term effects, though the CIs suggest a wide range of possible differences in either direction.[8]

Brief interventions (BIs)

Brief Interventions (BIs) do not have a strict definition, and the term can include educational or behavioral interventions varying from the single provision of a leaflet through to comparatively lengthy educational sessions; one review notes that BIs "typically comprise a conversation of anywhere between 5 and 45 minutes."[9] They can incorporate a range of techniques, from information provision to behavioral advice, and often include motivational interviewing (MI) components. Despite this heterogeneity, in many ways, BIs are the interventions most comparable to the individual outreach often currently pursued by the farmed animal movement through leafleting, humane education, and one-on-one conversations during street activism. In the

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Additionally, Jessica Kaufman, Rebecca Ryan, Louisa Walsh, Dell Horey, Julie Leask, Priscilla Robinson, and Sophie Hill, "Face-to-face interventions for informing or educating parents about early childhood vaccination," *Cochrane Database of Systematic Reviews* 5 (May 2018; first published 2013) notes that one study reported that, "the estimated additional cost per fully immunised child" for a case management intervention "was approximately eight times higher than usual care (low-certainty evidence)."

John G. Lawrenson, Ella Graham-Rowe, Fabiana Lorencatto, Jennifer Burr, Catey Bunce, Jillian J. Francis, Patricia Aluko, Stephen Rice, Luke Vale, Tunde Peto, Justin Presseau, Noah Ivers, and Jeremy M. Grimshaw, "Interventions to increase attendance for diabetic retinopathy screening," *Cochrane Database of Systematic Reviews* 1 (January 2018) notes that for one patient education intervention, "Physician cost = GBP 48.76/hour," "Community health worker = GBP 12.91/hour," "Cost of intervention over 20 years = GBP 3646.10 per patient."

[6] Information about knowledge outcomes has not been consistently included where reviews mention this, but as one example, see Rebecca Ryan, Nancy Santesso, Dianne Lowe, Sophie Hill, Jeremy M. Grimshaw, Megan Prictor, Caroline Kaufman, Genevieve Cowie, and Michael Taylor, "Interventions to improve safe and effective medicines use by consumers: an overview of systematic reviews," *Cochrane Database of Systematic Reviews* 4 (April 2014; first published 2011).

[7] See the spreadsheet "Strength of Evidence Assessments."

[8] See the spreadsheet "Effect Size Estimates."

[9] Eileen F. S. Kaner, Fiona R. Beyer, Claire Garnett, David Crane, Jamie Brown, Colin Muirhead, James Redmore, Amy O'Donnell, James J. Newham, Frank de Vocht, Matthew Hickman, Heather Brown, Gregory Maniatopoulos, and Susan Michie, "Personalised digital interventions for reducing hazardous and harmful alcohol consumption in community-dwelling populations," *Cochrane Database of Systematic Reviews* 9 (September 2017).

review focused on BIs for dietary behaviors, print materials and internet interventions were included,[10] although this did not seem to be the case in most of the included reviews of BIs.

There is strong evidence from the health behavior literature that BIs are likely to be effective at changing behavior in the farmed animal movement.[11] Meta-analyses evaluating BIs tend to find small effects on behavioral outcomes, and CIs mostly focus around small or very small effect sizes, with a few exceptions.[12] There is very weak evidence of long-term effects from BIs.[13] Meta-analyses found small effects on long-term behavioral outcomes, with CIs ranging from no effect through to small effects. Indirect comparison in two meta-analyses focused on alcohol found that short-term effects were moderately or substantially larger than long-term effects, though the CIs suggest a wide range of possible differences in either direction.[14]

One review argues that the identified effects were so small that they were unlikely to be cost-effective, though this claim does not seem to hold much weight without a cost-benefit analysis.[15]

One review found that BIs had significant effects compared to assessment-only controls (i.e. participants only saw assessments after signing up), but insignificant effects compared to information-provision controls (i.e. participants saw basic information on the health issue, but no further advice was given), which weakly suggests that both information-provision-only and face-to-face BIs may have some effects, though the effects of both may be small or very small.[16]

There are differences between the BIs evaluated in the health behavior literature and the most comparable interventions currently carried out in the farmed animal movement. For example, health professionals carrying out BIs face-to-face have usually been trained in techniques such as motivational interviewing, and the specific components of BIs for health behavior have been honed through decades of research into SCMs.[17] Additionally, health behavior BIs are usually aligned with the recipient's explicit goals, more so than farmed animal movement audiences, who may see messages like "eat less meat" as confrontational. Also, BIs are often administered based on the results of individual screening processes. They are therefore often

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[10] Megan C. Whatnall, Amanda J. Patterson, Lee M. Ashton, and Melinda J. Hutchesson, "Effectiveness of brief nutrition interventions on dietary behaviours in adults: A systematic review," *Appetite* 120 (2018), 338 explain that, "[t]he total number of study arms was 119, of which 98 were active brief intervention groups. Most interventions were delivered using print materials (n = 58), followed by internet (n = 15)."

[11] See the spreadsheet "Strength of Evidence Assessments."

[12] See the spreadsheet "Effect Size Estimates."

[13] See the spreadsheet "Strength of Evidence Assessments."

[14] See the spreadsheet "Effect Size Estimates."

[15] Leslie A. Sim, Jocelyn Lebow, Zhen Wang, Afton Koball, M. Hassan Murad, "Brief Primary Care Obesity Interventions: A Meta-analysis," *Pediatrics* 138, no. 4 (October 2016) note that, "[i]n light of the substantial financial cost of these interventions to the family and to the society, the lack of a meaningful effect of these primary care efforts in reducing a child's BMI trajectory suggests that resources may be better devoted to other public health agendas and to the development and testing of novel approaches to address this problem in primary care."

[16] Tara Carney, Bronwyn J Myers, Johann Louw, Charles I. Okwundu, "Brief school-based interventions and behavioural outcomes for substance-using adolescents," *Cochrane Database of Systematic Reviews* 1 (January 2016; first published 2014). The implications of other reviews focusing on BIs for print-based materials and their comparability to leafleting will be discussed in the section on "Explicit consideration of print-based materials."

[17] See for example, "WHO alcohol brief intervention training manual for primary care," World Health Organization (2017), http://www.euro.who.int/__data/assets/pdf_file/0006/351294/Alcohol-training-manual-final-edit-LSJB-290917-new-cover.pdf?ua=1.

targeted towards only those who need them and sometimes provide tailored information.[18] The effects of these differences on the overall effect size are difficult to predict.

Motivational Interviewing (MI)

Motivational interviewing (MI) is a specific form of counseling that helps individuals explore and resolve their ambivalence towards behavior change. In several reviews, MI is described as a form of BI, although not all BIs involve motivational interviewing, and it is possible for MIs to be repeated over many sessions. In some reviews of MI, BIs are treated as controls. Therefore, the sections are separated, categorized according to the phrasing used in the original reviews. Note also that MI is sometimes coded as a behavior change technique in BCT analysis (see the section below on "Behavior change techniques (BCTs)"). This section only includes reviews referring explicitly to either MI or motivational enhancement therapy (MET), which is a variation of MI.

There is moderate evidence from the health behavior literature that MI is likely to be effective at changing behavior in the farmed animal movement.[19] Where behavioral outcomes are measured, meta-analyses tended to find very small effects, with CIs narrowly within this range, although some reviews found evidence of small effects.[20] There was a lack of evidence or of clear reporting regarding the effects at longer-term follow-up (and no reportable effect sizes from meta-analyses with behavioral outcomes), so the evidence of long-term effects of MI is very weak.[21] Indirect comparison in one meta-analysis suggest that short-term effects were substantially larger than long-term effects, though the CIs suggest a wide range of possible differences in either direction.[22]

Tests of MI against various forms of "active control" (that is, other active interventions), provide very weak evidence that MI is more effective.[23] Results from three included meta-analyses suggest, in aggregate, very small or small differences in effectiveness in favor of MI.[24]

Some forms of MI included in the reviews here are much more intensive than would likely be considered by the farmed animal movement, with one review noting that "the included studies utilised multiple MI sessions,

[18] Eileen F. S. Kaner, Fiona R. Beyer, Claire Garnett, David Crane, Jamie Brown, Colin Muirhead, James Redmore, Amy O'Donnell, James J. Newham, Frank de Vocht, Matthew Hickman, Heather Brown, Gregory Maniatopoulos, and Susan Michie, "Personalised digital interventions for reducing hazardous and harmful alcohol consumption in community-dwelling populations," *Cochrane Database of Systematic Reviews* 9 (September 2017) explain that BIs for alcohol typically "include an initial screening process to identify people who are experiencing alcohol-related risk or harm, provide personalised feedback on alcohol use and harms, identify high-risk situations for drinking and coping strategies, suggest strategies to increase motivation for positive behaviour change, and develop a personal plan to reduce drinking."

[19] See the spreadsheet "Strength of Evidence Assessments."

[20] See the spreadsheet "Effect Size Estimates."

[21] See the spreadsheet "Strength of Evidence Assessments."

[22] See the spreadsheet "Effect Size Estimates."

[23] See the spreadsheet "Strength of Evidence Assessments." The author would guess that most of the "active controls" evaluated are more intensive than the likely alternative interventions that the farmed animal movement would use, so insignificant differences between MI and active controls could be interpreted as evidence that MI is likely to be more effective than alternative interventions in the farmed animal movement.

[24] See the spreadsheet "Strength of Evidence Assessments."

with total exposure time ranging from 90 minutes up to 960."[25] Several reviews specifically considered the effectiveness of MI as a form of BI.[26]

MI seems to be more focused on support and less focused on persuasion than many of the methods of encouraging behavior change that are used in the farmed animal movement.[27] Since it relies on eliciting an individual's own motivations for change, it will not be an appropriate tool for individuals who do not yet agree that animal product reduction is the desirable course of action for them.[28] The success of MI as an intervention is therefore possibly reliant on successful use of educational or persuasive interventions.

Counseling or therapy

There are a variety of types of counseling and therapy beyond MI, such as cognitive behavioral therapy (CBT).[29] Many counseling interventions are multi-session and resource intensive and so are not very comparable to likely interventions in the farmed animal movement.

Effects tend to be significant when compared to no intervention, with large or moderate effect sizes in meta-analyses with behavioral outcomes (with CIs ranging from insignificant to very large).[30] Effects are also sometimes significant when compared to other active control groups. Overall, there is strong evidence from the health behavior literature that counseling interventions are likely to be effective at changing behavior in

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[25] Ana Palacio, Desiree Garay, Benjamin Langer, Janielle Taylor, Barbara A. Wood, and Leonardo Tamariz, "Motivational Interviewing Improves Medication Adherence: a Systematic Review and Meta-analysis," *Journal of General Internal Medicine* 31, no. 8 (August 2016), 929-40.

[26] These included:

Nicola Lindson-Hawley, Tom P. Thompson, and Rachna Begh, "Motivational interviewing for smoking cessation," *Cochrane Database of Systematic Reviews* 3 (March 2015; first published 2010). On the specifics, they found that, "[w]hen we compared MI interventions conducted through shorter sessions (less than 20 minutes per session) to controls, this resulted in an RR of 1.69 (95% CI 1.34 to 2.12; 9 trials; N = 3651),

L. A. Gayes, R. G. Steele, "A meta-analysis of motivational interviewing interventions for pediatric health behavior change," *Journal of Consulting and Clinical Psychology* 82, no. 3 (June 2014), and

C. C. DiClemente, C. M. Corno, M. M. Graydon, A. E. Wiprovnick, D. J. Knoblach, "Motivational interviewing, enhancement, and brief interventions over the last decade: A review of reviews of efficacy and effectiveness," *Psychology of Addictive Behaviors* 31, no. 8 (December 2017), 862-887.

[27] Geir Smedslund, Rigmor C. Berg, Karianne T. Hammerstrøm, Asbjørn Steiro, Kari A. Leiknes, Helene M. Dahl, Kjetil Karlsen, "Motivational interviewing for substance abuse," *Cochrane Database of Systematic Reviews* 5 (May 2011) summarizes that during MI, "The drug abuser and counsellor typically meet between one and four times for about one hour each time. The counsellor expresses that he or she understands how the clients feel about their problem and supports the clients in making their own decisions. He or she does not try to convince the client to change anything, but discusses with the client possible consequences of changing or staying the same."

[28] This is based on the author's own shallow understanding of how MI works, rather than on a search of the evidence for moderators of the effectiveness of MI.

[29] Note that some of the reviews in this section include MI as part of the wider counseling interventions tested. For example, Tim Lancaster, Lindsay F. Stead, "Individual behavioural counselling for smoking cessation," *Cochrane Database of Systematic Reviews* 3 (March 2017; first published 2002) notes that 5 studies compared between counseling types and "[o]nly one of them detected a significant difference between different types of counselling, where number of contacts and general intensity were similar." This study found evidence in favor of "a health education approach" over MI (RR 0.51, 95% CI 0.34 to 0.76; 755 participants).

[30] See the spreadsheet "Effect Size Estimates."

the farmed animal movement.[31] However, there is only very weak evidence of long-term effects.[32] The only meta-analysis with data on long-term effects had CIs ranging from no effect to moderate effects. Indirect comparison in the same meta-analysis found that short-term effects were substantially larger than long-term effects, though the CIs suggest a range of possible differences in either direction.[33]

Self-help, self-monitoring, and self-management

As well as there being promising results for self-monitoring and other self-regulatory skills in BCT analyses (see the section below on "Behavior change techniques (BCTs)"), interventions that focus on self-monitoring or related skills like self-help and self-management are sometimes tested specifically for their effectiveness. The reviews included in this section have a wide range of included interventions; some include any studies that measure interventions that are primarily self-directed, while others focus on more specific practices, such as goal setting.

There is moderate direct evidence from the health behavior literature (i.e. not including the correlational evidence from BCT analysis) that self-help, self-monitoring, and self-management interventions in the farmed animal movement are likely to be effective at changing behavior.[34] Behavioral outcomes were only measured in 3 included meta-analyses and CIs ranged from very small to moderate effects; small effect sizes seem most typical.[35] The health behavior literature provides very weak evidence of long-term effects.[36]

Two overviews suggest that self-management programs improve confidence and self-efficacy of participants, which may help to explain the effectiveness of self-help, self-monitoring, and self-management interventions. Both overviews emphasize the importance of including some professional support.[37]

There was a surprising lack of evidence of the effects of activity monitors or pedometers on PA levels.[38]

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[31] See the spreadsheet "Strength of Evidence Assessments."
[32] See the spreadsheet "Strength of Evidence Assessments."
[33] See the spreadsheet "Effect Size Estimates."
[34] See the spreadsheet "Strength of Evidence Assessments."
[35] See the spreadsheet "Effect Size Estimates."
[36] See the spreadsheet "Strength of Evidence Assessments."
[37] Orjola Shahaj, Diarmuid Denneny, Anna Schwappach, Gemma Pearce, Eleni Epiphaniou, Hannah L. Parke, Stephanie J.C. Taylor, and Hilary Pinnock, "Supporting self-management for people with hypertension: a meta-review of quantitative and qualitative systematic reviews," *Journal of Hypertension* 37, no. 2 (February 2019), 264-79 notes that home blood pressure monitoring, "in the context of a supportive patient-professional relationship, changed perceptions of the significance of symptoms and fostered confidence in ability to self-manage hypertension."

S. J. C. Taylor, H. Pinnock, E. Epiphaniou et al., "Chapter 15, Additional meta-review: self-management support for people with hypertension," *A rapid synthesis of the evidence on interventions supporting self-management for people with long-term conditions: PRISMS – Practical systematic Review of Self-Management Support for long-term conditions*, (Southampton: NIHR Journals Library, 2014) similarly found that "self-management was not a substitute for professional care. Far from feeling abandoned and left to look after themselves, supported self-management empowered patients to access best care and support, though potentially (and paradoxically) reducing health-care resource use, especially in asthma and COPD." They note that they included "30 qualitative systematic reviews (including 515 unique studies), 102 quantitative systematic reviews."
[38] Elizabeth A. Lynch, Taryn M. Jones, Dawn B. Simpson, Natalie A. Fini, Suzanne S. Kuys, Karen Borschmann, Sharon Kramer, Liam Johnson, Michele L. Callisaya, Niruthikha Mahendran, Heidi Janssen, and Coralie English, "Activity monitors for increasing physical activity in adult stroke survivors," *Cochrane Database of Systematic Reviews* 7 (July

Several papers review literature from health behavior and other academic fields to develop recommendations on the variations of goal setting interventions that are most likely to lead to effectiveness in achieving behavioral change.[39]

Action planning, coping planning, problem solving, and implementation intentions

One review summarizes that, "[i]mplementation intentions are specified action plans on how one will act in certain situations (e.g. 'If I am watching TV and craving a snack, I will eat an apple') that aim to install

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2018) found "four small RCTs with 274 participants" of relevance, only one of which had significant effects. The significant effect was only on one of the measured outcomes in this trial; "this study reported that an activity monitor in addition to usual inpatient rehabilitation increased the time spent on moderate intensity physical activity by 4.4 minutes per day (95% CI 0.28 to 8.52; 1 RCT, 48 participants; low-quality evidence) compared with usual rehabilitation alone."

Charles Foster, Justin Richards, Margaret Thorogood, and Melvyn Hillsdon, "Remote and web 2.0 interventions for promoting physical activity," *Cochrane Database of Systematic Reviews* 9 (September 2013) found "no difference between studies that included pedometers as part of their intervention and those that did not. Three studies included pedometers as part of their intervention." The results were SMD 0.16; 95% CI 0.05 to 0.27 for 3 studies that used pedometers, and SMD 0.23; 95% CI 0.11 to 0.35 for those that did not.

Rosanne L. A. Freak-Poli, Miranda Cumpston, Anna Peeters, and Stacy A. Clemes, "Workplace pedometer interventions for increasing physical activity," Cochrane Database of Systematic Reviews 4 (April 2013) found "insufficient evidence to assess the effectiveness of pedometer interventions in the workplace," with only three studies being included in the review, only one of which found a significant effect on behavioral outcomes.

In contrast, Elizabeth J. Lyons, Zakkoyya H. Lewis, Brian G. Mayrsohn, and Jennifer L. Rowland, "Behavior Change Techniques Implemented in Electronic Lifestyle Activity Monitors: A Systematic Content Analysis," *Journal of Medical Internet Research* 16, no. 8 (August 2014), e192 note that "Electronic activity monitors (such as those manufactured by Fitbit, Jawbone, and Nike) improve on standard pedometers by providing automated feedback and interactive behavior change tools via mobile device or personal computer" and summarize results from 4 trials using these monitors as "very promising, showing increases in physical activity and decreases in weight for two monitor brands."

[39] See, for example:

Traci Mann, Denise de Ridder, and Kentaro Fujita, "Self-Regulation of Health Behavior: Social Psychological Approaches to Goal Setting and Goal Striving," *Health Psychology* 32, no. 5 (2013), 487-98,

Erin S. Pearson, "Goal setting as a health behavior change strategy in overweight and obese adults: A systematic literature review examining intervention components," *Patient Education and Counseling* 87, no. 1 (2012), 32-42,

Milou Fredrix, Jenny McSharry, Caragh Flannery, Sean Dinneen, and Molly Byrne, "Goal-setting in diabetes self-management: A systematic review and meta-analysis examining content and effectiveness of goal-setting interventions," *Psychology and Health* 33, no. 8 (2018),

L. Blaine Kyllo and Daniel M. Landers, "Goal Setting in Sport and Exercise: A Research Synthesis to Resolve the Controversy," *Journal of Sport and Exercise Psychology* 17, no. 2 (1995), 117-37, and

Desmond McEwan, Samantha M. Harden, Bruno D. Zumbo, Benjamin D. Sylvester, Megan Kaulius, Geralyn R. Ruissen, A. Justine Dowd, and Mark R. Beauchamp, "The effectiveness of multi-component goal setting interventions for changing physical activity behaviour: A systematic review and meta-analysis," *Health Psychology Review* 10, no. 1 (November 2015), 67-88.

habitual behaviour."[40] Another review explains that, "[a]ction planning (AP) involves specifying the details of when, where, and how to act in the service of one's intentions. Coping planning (CP) involves identifying how one will cope with potential barriers or obstacles that could get in the way of the goal striving process."[41] These interventions seem similar in that they involve making specific plans in order to increase the chances that intentions are translated into behavioral change. There was some evidence in favor of use of these sorts of intervention components in BCT analyses,[42] and they have been evaluated more directly in some reviews.

There is weak direct evidence from the health behavior literature (i.e. not including the correlational evidence from BCT analysis) that action planning, coping planning, problem solving, and implementation intention interventions are likely to be effective at changing behavior in the farmed animal movement.[43] Behavioral outcomes were only measured in 3 included meta-analyses and CIs ranged from very small to very large effects; small effect sizes seem most typical.[44] Interestingly, there was evidence from one meta-analysis that implementation intentions are more effective at increasing health promoting dietary behaviors like fruit consumption (d = .51, 14 studies) than decreasing dietary health risk behaviors like consumption of unhealthy snacks (d = .29, 8 studies)."[45] There is very weak evidence (from four studies included in one review) of long-term effects.[46]

One paper provides a useful summary of previous literature and discusses potential variations in format and delivery that could be harnessed in intervention design. It summarizes the previous literature on a variety of

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[40] Denise de Ridder, Floor Kroese, Catherine Evers, Marieke Adriaanse, and Marleen Gillebaart, "Healthy diet: Health impact, prevalence, correlates, and interventions," *Psychology & Health* 32 (April 2017), 20-21.

Agoro Toli, Thomas L. Webb, and Gillian E. Hardy, "Does forming implementation intentions help people with mental health problems to achieve goals? A meta-analysis of experimental studies with clinical and analogue samples," *British Journal of Clinical Psychology* 55, no. 1 (March 2016), 70 note that, "[a] number of reviews point to the features of effective goal setting. However, goal setting is not the same as goal striving – the process of moving towards the desired goal once set."

A fuller review of definitions is included in Martin S. Hagger and Aleksandra Luszczynska, "Implementation Intention and Action Planning Interventions in Health Contexts: State of the Research and Proposals for the Way Forward," *Applied Psychology and Well-being* 6, no. 1 (2014), 5-11.

[41] Natasha Carraro and Patrick Gaudreau, "Spontaneous and experimentally induced action planning and coping planning for physical activity: A meta-analysis," *Psychology of Sport and Exercise* 14, no. 2 (March 2013), 229.

[42] See the paragraph beginning "The overlapping groups…" in the section on "Behavior Change Techniques (BCTs)."

[43] See the spreadsheet "Strength of Evidence Assessments."

[44] See the spreadsheet "Effect Size Estimates."

[45] Marieke A. Adriaanse, Charlotte D. W. Vinkers, Denise T. D. De Ridder, Joop J. Hox, and John B. F. De Wit, "Do implementation intentions help to eat a healthy diet? A systematic review and meta-analysis of the empirical evidence," *Appetite* 56, no. 1 (February 2011), 183-93. They note that "the difference in effect size between the two categories was marginally significant, p = .09. As only a limited number of studies are available in each category (N = 15 and N = 9), and the average sample size in each study is relatively small (median = 126), the power to detect even such a relatively large difference in effect size is low." They add that, "[r]esults for diminishing unhealthy eating also appear to be less consistent: Although several studies showed promising effects of implementation intentions in reducing unhealthy eating behaviors... two thirds of the studies did not find such positive effects."

[46] See the spreadsheet "Strength of Evidence Assessments." The review is Martin S. Hagger and Aleksandra Luszczynska, "Implementation Intention and Action Planning Interventions in Health Contexts: State of the Research and Proposals for the Way Forward," *Applied Psychology and Well-being* 6, no. 1 (2014), 1-47.

issues, including definitions, the use of theory in design of implementation intention interventions, and moderators of effectiveness.[47]

Given that the interventions included in this section work by overcoming the gap between intention and behavior, it seems intuitive that they would work best for individuals that have been identified as (or are suspected of) having already decided to make a behavioral change, much like motivational interviewing.[48] One meta-analysis of AP interventions for PA found that, "intention was a significant moderator of the AP to PA relation; as intention scores increased, the strength of the observed relation decreased."[49]

Social norms

Though information on social norms as a determinant of health behaviors is readily available[50] and BCTs that reflect social influences or include comparisons to peers are included as part of BCT analyses, this section only includes reviews that explicitly evaluate the effectiveness of interventions using social norms components. These interventions can utilize descriptive norms information — which "reflect what most group members do (e.g., 'most young people eat less than the recommended amount of fruit')" — or injunctive social norms — which reflect what other group members would consider appropriate behaviour (e.g., 'most young people think their peers should eat sufficient fruit')."[51]

There is moderate direct evidence from the health behavior literature (i.e. not including the correlational evidence from BCT analysis) that social norms interventions are likely to be effective at changing behavior in the farmed animal movement.[52] Meta-analyses mostly found small behavioral effects, with CIs ranging from very small to moderate.[53] Interestingly, one meta-analysis found evidence that, "small and moderate sized changes in social influence-related constructs correspond with a change in alcohol intake that is roughly half

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[47] Martin S. Hagger and Aleksandra Luszczynska, "Implementation Intention and Action Planning Interventions in Health Contexts: State of the Research and Proposals for the Way Forward," *Applied Psychology and Well-being* 6, no. 1 (2014), 1-47.

[48] See the paragraph beginning "MI seems to be…" in the section on "Motivational Interviewing (MI)."

[49] Natasha Carraro and Patrick Gaudreau, "Spontaneous and experimentally induced action planning and coping planning for physical activity: A meta-analysis," *Psychology of Sport and Exercise* 14, no. 2 (March 2013), 241 summarize that "[w]eighted regression (i.e., weighted by the sample size of each sample) was performed using intention as a predictor and the fully corrected effect size of the AP to PA relation using the average time delay. Results revealed that intention was a significant moderator of the AP to PA relation; as intention scores increased, the strength of the observed relation decreased ($\beta = 5.02$, $p < .05$, $R^2 = .52$). Further, results showed that the moderating influence of intention was best modeled in quadratic terms ($\beta = 4.30$, $p < .05$, $R^2 = .07$). This result indicates that the strength of the AP to PA relation was stronger for samples with lower levels of behavioral intention compared to samples with moderately high levels of behavioral intention (90th point on the percent scale). The relation between AP and PA was nonetheless stronger from samples with highest values of behavioral intention compared to those with moderately high values of behavioral intention."

[50] See, for example, C. E. Draper, L. Grobler, L. K. Micklesfield, and S. A. Norris, "Impact of social norms and social support on diet, physical activity and sedentary behaviour of adolescents: a scoping review," *Child: care, health and development* 41, no. 5 (February 2015), 654-67.

[51] F. Marijn Stok, Emely de Vet, Denise T. D. de Ridder, and John B. F. de Wit, "The potential of peer social norms to shape food intake in adolescents and young adults: A systematic review of effects and moderators," *Health Psychology Review* 10, no. 3 (2016), 326-40.

[52] See the spreadsheet "Strength of Evidence Assessments."

[53] See the spreadsheet "Effect Size Estimates."

in size. When changes in social influence are greater (moderate-to-large), there was little additional change in alcohol intake."[54]

Reviews of direct comparisons between social norms messaging and alternative messaging strategies were not identified, nor were reviews of whether social norms interventions had long-term effects.

Some reviews of the effects of social norms on dietary behaviors include analysis of the potential moderators of effects. Although the conclusions are only tentative, some may be particularly important, such as the evidence suggesting that the consumption of foods such as meat and vegetables may only be susceptible to social norms intervention influences if they are consumed in the presence of peers.[55]

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[54] Andrew Prestwich, Ian Kellar, Mark Conner, Rebecca Lawton, Peter Gardner, and Liz Turgu, "Does changing social influence engender changes in alcohol intake? A meta-analysis," *Journal of Consulting and Clinical Psychology* 84, no. 10 (March 2016), 845-60. They note that, "[b]ased on all 36 studies, a change of g = .29 in social influence corresponded with a change of g = .18 in alcohol intake. Repeating these analyses only on the studies that detected a significant effect of the intervention on at least 50% of the social influence follow-up measures (k = 17), a change of g = .51 in social influence corresponded with a change of g = .26 in drinking behavior. Selecting only the studies that produced at least a moderate sized effect change in the social influence measures (d =.5 to 1 decimal place, k = 11), a change of g = .66 in social influence corresponded with a change of g = .22 in drinking behavior." Differentiating between social influences and norms, they also note that "small sized changes in norm-related constructs correspond with a change in alcohol intake that is roughly half that magnitude in size. Moderate sized change in norm-related constructs corresponded with a change in alcohol intake that is roughly two and a half to three times smaller. When changes in norms are greater (moderate-to-large), changes in norm-related constructs correspond with a change in alcohol intake that is roughly a third of this magnitude."

[55] Eric Robinson, Jason Thomas, Paul Aveyard, and Suzanne Higgs, "What Everyone Else Is Eating: A Systematic Review and Meta-Analysis of the Effect of Informational Eating Norms on Eating Behavior," *Journal of the Academy of Nutrition and Dietetics* 114, no. 3 (2014), 425 summarize that in one study, "follow-up analysis indicated a significant increase in intake as a result of high intake norm effect vs control ($P<0.05$), but only for the palatable food. A second study found no significant influence of a social norm on choice of unpalatable food." As another example, they note that, "[i]n one study, a high intake norm did not significantly increase consumption when the experimenter was present but did so when participants were alone ($P<0.05$), and this interaction between condition and presence of experimenter was statistically significant at $P<0.05$." A similar effect was found in another study, but not in another study where "participants were led to believe that their food intake would or would not be observed by another person."

Additionally, on 426-7, they note that, "[t]here was some evidence that identification with the norm reference group moderated the influence of norms on eating behavior. In one study, significant effects were reported when the food intake norm came from an in-group that participants identified with, but not when it came from an out-group. These findings are in line with other reviewed studies that showed participants would eat less of a food if they believed that it was the norm for an undesirable social group."

F. Marijn Stok, Emely de Vet, Denise T. D. de Ridder, and John B. F. de Wit, "The potential of peer social norms to shape food intake in adolescents and young adults: A systematic review of effects and moderators," *Health Psychology Review* 10, no. 3 (2016), 326-40 evaluated a variety of moderators, such as "identification with the norm referent group," "habit strength," and "forcefulness" of injunctive norm communication. Though not yet tested directly, there was some tentative evidence from two studies to suggest that snack foods ("typically consumed in situations in which peers are present") might be more readily influenced by social norms than foods usually consumed in a formal meal context, "such as vegetables and meats." Furthermore, studies investigating consumption of vegetables in school or college cafeterias (in the presence of peers) had more consistent effects than those outside such settings.

There seems to be stronger evidence for the effectiveness of descriptive norms than injunctive norms[56] and for modifying the quantity of food consumed than for modifying the type of food consumed.[57]

There is also evidence that social norms interventions may sometimes have counterproductive effects, a conclusion that is also found in several BCT analyses.[58]

Peer-led interventions and mentoring

Some reviews explicitly focus on interventions delivered to individuals by their peers or by mentors. Some reviews specify that these are predominantly educational interventions, although others do no; some studies included in these reviews presumably have supportive or behavioral components.

Although several meta-analyses of the effectiveness of peer-support and mentoring interventions were identified, most of these included only a small number of studies. In general, the findings were mixed across

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[56] F. Marijn Stok, Emely de Vet, Denise T. D. de Ridder, and John B. F. de Wit, "The potential of peer social norms to shape food intake in adolescents and young adults: A systematic review of effects and moderators," *Health Psychology Review* 10, no. 3 (2016), 326-40 which "focuses on how much young people eat, rather than on what they choose to eat," found that all 16 experimental studies "investigating the influence of peer social norm manipulations on food intake found (at least some) significant effects." The two studies that also tested injunctive social norms manipulations found that this "did not significantly affect young people's food intake."

In addition, most reviews in the health behavior literature seem to refer to descriptive norms when they discuss social norms interventions.

[57] Eric Robinson, Jason Thomas, Paul Aveyard, and Suzanne Higgs, "What Everyone Else Is Eating: A Systematic Review and Meta-Analysis of the Effect of Informational Eating Norms on Eating Behavior," *Journal of the Academy of Nutrition and Dietetics* 114, no. 3 (2014) conducted a meta-analysis of 15 experimental studies reviewing "whether providing information about other people's eating habits influences food intake or choices." They found significant effects from both high intake norms (SMD 0.41, 95% CI 0.20 to 0.63, 6 studies) and low intake norms (SMD –0.35, 95% CI –0.59 to –0.10) on the quantities of food eaten. The review also qualitatively reported results for studies where type of food was the chosen outcome, noting that of four that "tested whether information about others choosing a food influenced actual or intended choice," none found significant differences between a norms intervention and the control, although significant differences were found between high norms and low norms conditions in some. In another three, "the effect of providing information that a socially undesirable group ate a lot of junk food," produced significant effects.

[58] F. Marijn Stok, Emely de Vet, Denise T. D. de Ridder, and John B. F. de Wit, "The potential of peer social norms to shape food intake in adolescents and young adults: A systematic review of effects and moderators," *Health Psychology Review* 10, no. 3 (2016), 326-40 summarize that two previous reviews "suggest there is a relation between social norms and eating behaviour… However, the potential for social norms to improve health behaviour, including food intake, is by no means ubiquitous, with various studies also showing null effects or even negative results." F. Marijn Stok, Saar Mollen, Kirsten T. Verkooijen, and Britta Renner, "Editorial: Unravelling Social Norm Effects: How and When Social Norms Affect Eating Behavior," *Frontiers in Psychology* (May 2018) similarly notes that "the outcomes of social norm interventions for health promotion have been mixed, with positive effects, no effects, and even counterproductive effects being reported." The authors summarize the extent of research focusing on moderators and mediators of the effectiveness of social norms information.

See the paragraph beginning "The BCT 'provide normative information about others' behavior'" in the section "Behavior Change Techniques (BCTs)."

This seems intuitively plausible. Individuals may have inaccurate perceptions about the behavior and attitudes of others that may actually increase the likelihood that they adhere to the preferred behavior. For example, consumers may have the impression that veganism is more common or more rapidly growing than is the case, and providing them with more accurate information might reduce the social pressure that they experience.

health behaviors. Overall, there is weak evidence from the health behavior literature that peer-led interventions and mentoring are likely to be effective at changing behavior in the farmed animal movement.[59] Meta-analyses mostly found very small or small behavioral effects, with CIs ranging from very small negative effects to moderate positive effects.[60]

Two reviews focusing on sexual health found that these interventions did not affect behavior but improved knowledge outcomes,[61] so there may be indirect benefits of peer-led and mentoring interventions. Again, the evidence (from only one review) of long-term effects was very weak.[62]

There was very little identified information on how cost-effective these interventions are likely to be. A review notes that one included study found insignificant effects of training peer-supporters on the likelihood that participants quit smoking.[63]

Reminders

Some reviews consider reminders or prompts for a health behavior. These reviews can include a variety of forms of reminder, from text messages to in-person visits. It is possible that other interventions covered by reviews in the section on "Effectiveness across different modes of delivery" also include various forms of prompts, though they are not included in this section unless they refer explicitly to reminders or prompts in their inclusion criteria, or explicitly note that a large majority of included studies evaluated such interventions.

There is moderate direct evidence from the health behavior literature that reminder interventions are likely to be effective at changing behavior in the farmed animal movement.[64] Behavioral outcomes were only

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[59] See the spreadsheet "Strength of Evidence Assessments."

[60] See the spreadsheet "Effect Size Estimates."

[61] Rehana A. Salam, Anadil Faqqah, Nida Sajjad, Zohra S. Lassi, Jai K. Das, Miriam Kaufman, and Zulfiqar A. Bhutta, "Improving Adolescent Sexual and Reproductive Health: A Systematic Review of Potential Interventions," *Journal of Adolescent Health* 59, no. 4 (October 2016), S11-S28 found in subgroup analysis that two trials of "peer-led counseling significantly improved mean knowledge score [SMD 0.67, 95% CI 0.33 to 1.01, 5 studies] however did not significantly impact use of contraception" (RR 1.15, 95% CI 0.87 to 1.51, 2 studies).

Similarly, Wai Han Sun, Heidi Yin Hai Miu, Carlos King Ho Wong, Joseph D. Tucker, and William Chi Wai Wong, "Assessing Participation and Effectiveness of the Peer-Led Approach in Youth Sexual Health Education: Systematic Review and Meta-Analysis in More Developed Countries," *The Journal of Sex Research* 55, no. 1 (November 2016), a review of 15 articles, concluded that peer-led sexual health education "is effective in changing knowledge and attitudes but not behaviors." They summarize that, "[t]he majority of articles found improvements in sexual health knowledge (13 of 14) and attitudes (11 of 15) at postintervention stages. Two studies showed improved self-efficacy, and three showed behavioral changes. A preliminary synthesis of effectiveness and level of participation was done. Meta-analysis revealed a large effect on knowledge change (Hedges' g = 0.84, 95% confidence interval [CI]: 0.43 to 1.25) and a medium effect on attitude change (Hedges' g = 0.49, 95% CI: 0.19 to 0.80)." For those studies measuring sexual behaviors, "[t]hree studies found improvements, six found no difference, one showed mixed results," and meta-analysis of 4 RCTs found that, "the odds ratio of the change in condom use was 1.007 (95% CI: 0.88 to 1.15)."

[62] See the spreadsheet "Strength of Evidence Assessments."

[63] Pauline Ford, Anton Clifford, Kim Gussy, and Coral Gartner, "A Systematic Review of Peer-Support Programs for Smoking Cessation in Disadvantaged Groups," *International Journal of Environmental Research and Public Health* 10, no. 11 (2013).

[64] See the spreadsheet "Strength of Evidence Assessments."

measured in 3 included meta-analyses; effects seem likely to be very small, though CIs suggest that small effects are possible.[65]

There is stronger evidence for the effectiveness of reminders for increasing vaccination uptake, appointment attendance, and medication adherence than there is for other health behaviors. However, behavior in these areas may be more determined by forgetfulness than is the case in other health behavior areas or in the farmed animal movement; the success of reminder interventions may not reliably transfer across to other types of behavior change.[66]

One review across health behaviors found evidence that prompts were effective at promoting engagement with other (digital) interventions.[67] There is very weak evidence that reminder interventions have no long-term effects.[68]

Some reminder interventions could plausibly be delivered cheaply or for free, such as through emails at pre-set times,[69] though there may still be costs from staff time or programming of software.

Educational or behavioral interventions as additions to pharmacological interventions

Combining individual educational or behavioral interventions with pharmacological (drug-based) interventions may improve efforts to stop smoking or use of illegal drugs when compared to pharmacological interventions alone. However, some of the most directly relevant reviews came to opposite conclusions.[70] The CIs on included meta-analyses vary from small negative effects to moderate positive effects, with very

[65] See the spreadsheet "Effect Size Estimates."

[66] Many people eat around three meals a day. A decision to consume or avoid animal products is therefore made very frequently. This decision may be faced in the home, when shopping for (or otherwise acquiring) food products, or when eating out. By comparison, medication needs could vary from an occasional pill to multiple usages daily. Individuals may be less in the habit of taking regular medication (which is only required when they have particular illnesses) than eating regular food (which they will have done throughout their life), so this seems likely to be easier to forget. Vaccinations, immunizations, and appointments are one-off or infrequent events, which may also be easy to forget.

[67] Ghadah Alkhaldi, Fiona L. Hamilton, Rosa Lau, Rosie Webster, Susan Michie, and Elizabeth Murray, "The Effectiveness of Prompts to Promote Engagement With Digital Interventions: A Systematic Review," *Journal of Medical Internet Research* 18, no. 1 (January 2016) found a statistically significant result from a meta-analysis of 9 studies (RR 1.27, 95% CI 1.01 to 1.60). With an outlier removed, heterogeneity and the confidence interval decreased, but it seems likely that the effect size is very small (RR 1.16, 95% CI 1.01 to 1.33). They explain that, "[e]xamples of interventions that were included were a computerized treatment program with mobile phone text messages that reminded the user to visit the program, and a blood pressure self-monitoring website that sent email prompts to users to enter their pressure readings on the website."

[68] See the spreadsheet "Strength of Evidence Assessments."

[69] Although the reviews included in this section did not seem to discuss this explicitly, many of the reviews focusing on specific formats amenable to reminder interventions—such as internet or text interventions—did comment on this benefit (see the section below on "Effectiveness across different modes of delivery).

[70] See the spreadsheet "Strength of Evidence Assessments."

small positive effects seeming most likely overall, though this is unclear.[71] This suggests that the additive or interactive effects between interventions may sometimes be smaller than expected.[72]

Effectiveness across different modes of delivery

Interventions of similar content can be delivered through a variety of different media and contexts. For example, counseling can be delivered in person to an individual, in person to a group, by telephone calls, or via the internet. The following sections consider specific modes of delivery across intervention types; sometimes the included interventions are directly comparable to face-to-face equivalents and sometimes they differ in that they are used as an additional component for a predominantly face-to-face intervention (such as a text message prompt) rather than as a replacement. Where possible, this section has been limited to individual and small group educational and supportive behavioral interventions.

Telephone

A variety of interventions can be delivered by telephone. Some reviews include any form of telephone-delivered intervention, while others are limited to reminder or support calls. Some reviews focus on automated systems, others on phone calls by medical staff.

In all of these variations, there was some evidence of effectiveness of telephone-delivered interventions. Although the evidence was not consistently positive across reviews, there was no significant evidence of negative effects and, overall, there is strong evidence from the health behavior literature that interventions delivered by telephone are likely to be effective at changing behavior in the farmed animal movement.[73] Where behavioral outcomes were measured in meta-analyses, CIs were sometimes narrowly around very small to small effect sizes, though other meta-analyses had much wider CIs and higher point estimates. Small or very small effects seem most likely.[74] Very few reviews considered long-term effects; the evidence that telephone interventions have no long-term effects is very weak.[75]

There is very weak evidence from the health behavior literature that face-to-face interventions in the farmed animal movement are similarly effective to comparable telephone-delivered interventions.[76] One review focused on PA found high quality evidence that face-to-face interventions were more effective,[77] but on

[71] See the spreadsheet "Effect Size Estimates."

[72] It is tempting to interpret this as weak evidence that animal-free food products will be more effective at replacing animal-based foods if they are supported by educational or behavioral interventions. This seems to be an especially indirect and unhelpful comparison however, given the importance of addiction in determining whether individuals are able to cease smoking or drug use.

[73] See the spreadsheet "Strength of Evidence Assessments."

[74] See the spreadsheet "Effect Size Estimates."

[75] See the spreadsheet "Strength of Evidence Assessments."

[76] See the spreadsheet "Strength of Evidence Assessments."

[77] Juliana S. Oliveira, Catherine Sherrington, Anita B. Amorim, Amabile B. Dario, and Anne Tiedemann, "What is the effect of health coaching on physical activity participation in people aged 60 years and over? A systematic review of randomised controlled trials," *Br J Sports Med* (March 2017) found significant effects for both telephone-delivered (SMD 0.21, 95% CI 0.11 to 0.32, 18 trials) and face-to-face coaching (SMD 0.41, 95% CI 0.25 to 0.58, 9 trials) but found statistically significant effects in favor of the face-to-face group ($p = 0.047$). By GRADE criteria, the overall quality of

aggregate, the evidence for smoking and medication adherence did not seem to support this. One review even found evidence that telephone-delivered interventions were significantly more effective than face-to-face interventions.[78] In indirect comparison, CIs from four meta-analyses from smoking and PA suggested that anything from small differences in effectiveness for behavioral outcomes in favor of telephone delivery to moderate differences in favor of face-to-face delivery were possible.[79]

Text messaging

Although reviews rarely specify what the content of evaluated text messages is, text messaging interventions evaluated in the health behavior literature seem to vary from short reminders through to informative, motivational, or persuasive content.

There is strong evidence from the health behavior literature that text messaging interventions are likely to be effective at changing behavior in the farmed animal movement.[80] Where behavioral outcomes were measured in meta-analyses, CIs ranged from very small to large effects. Small effects seem most typical.[81]

Though some included trials measured results at 12 months' follow up or more, these results were not compared to shorter-follow-up periods in any of the included reviews. Some evidence suggests that the effects of text interventions may decrease with time.[82]

Several meta-analyses for smoking cessation found significant effects despite the included studies having used fairly intensive additional interventions in both the control and intervention groups, such as counseling or additional tailored materials. Other comparisons to no intervention controls also found significant effects.[83]

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evidence is likely to be high, though there was no information on heterogeneity for the subgroup using primarily telephones.

[78] Lindsay F. Stead, Priya Koilpillai, and Tim Lancaster, "Additional behavioural support as an adjunct to pharmacotherapy for smoking cessation," *Cochrane Database of Systematic Reviews* 10 (October 2015; first published 2012).

Jacob Crawshaw, Vivian Auyeung, Lucy Ashworth, Sam Norton, and John Weinman, "Healthcare provider-led interventions to support medication adherence following ACS: a meta-analysis," *Open Heart* 4 (2017) and James Machoki M'Imunya, Tamara Kredo, and Jimmy Volmink, "Patient education and counselling for promoting adherence to treatment for tuberculosis," *Cochrane Database of Systematic Reviews* 5 (May 2012) also noted evidence that telephone-delivered interventions may be more effective than face-to-face interventions.

[79] See the spreadsheet "Effect Size Estimates."

[80] See the spreadsheet "Strength of Evidence Assessments."

[81] See the spreadsheet "Effect Size Estimates."

[82] Stephanie A. Spohr, M. A. Rajesh Nandy, Deepthi Gandhiraj, Abhilash Vemulapalli, Sruthi Anne, Scott T. Walters, "Efficacy of SMS Text Message Interventions for Smoking Cessation: A Meta-Analysis," *Journal of Substance Abuse Treatment* 56 (September 2015), 1-10 found that, "[t]here were no significant differences between intervention efficacy over time (QB = 0.56, df = 1, p = .46); however, studies with a 3 month follow-up period showed a slightly higher efficacy compared to studies with 6 month follow-up data."

Ashleigh A. Armanasco, Yvette D. Miller, Brianna S. Fjeldsoe, and Alison L. Marshall, "Preventive Health Behavior Change Text Message Interventions: A Meta-analysis," *American Journal of Preventive Medicine* 52, no. 3 (March 2017), 391-402 found that for the data from 7 studies, "following a no-intervention maintenance period," the results remained significant but the confidence interval is much closer to 0, suggesting that the effect size is likely to be smaller (d=0.17, 95% CI=0.03, 0.31, p=0.017).

[83] See the spreadsheet "Strength of Evidence Assessments."

These findings suggest that text messaging interventions can be effective both independently and as an adjunct to other intervention types.

One trial in an included review explicitly suggested that text interventions might be cost-saving for healthcare services.[84] One review notes the lack of cost-effectiveness evaluations for mobile phone interventions in the health behavior literature.[85]

Given that text messages are too short to implement interventions like counseling, there is also a lack of direct comparison to face-to-face equivalents. There is some evidence that increasing the number of messages received in text messaging interventions has no significant impact on the intervention's effectiveness (see the section on "Intensity of intervention" below).

Broader mobile phone interventions (mHealth)

Some reviews limit their inclusion criteria to smartphone applications while others include mobile phone interventions more broadly, such as including a mixture of text messaging, smartphone apps, and voicemail messages. Where the reviews appeared to be exclusively focused on text messaging, or where subgroup analysis showed the results to be unaffected by the inclusion of non-text message-based intervention methods, they are included in the section on "Text messaging" interventions above. Otherwise they are included in this section. The use of wider functions of mobile phones, such as voicemail messages and smartphone apps, allows lengthier and more complex intervention types than are possible with text message only interventions.

Most analyses of broad, non-text-messaging-focused mHealth interventions were qualitative in nature (only one meta-analysis was included in this section) and many emphasized the methodological weaknesses of the studies that they reviewed.[86] Many of the reviews report that only slightly more or slightly fewer than half of the included studies found statistically significant effects, making the results difficult to interpret.

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[84] Robyn Whittaker, Hayden McRobbie, Chris Bullen, Anthony Rodgers, Yulong Gu, "Mobile phone-based interventions for smoking cessation," *Cochrane Database of Systematic Reviews* 4 (April 2016; first published 2009) note that, "[a] cost-effectiveness analysis was also conducted as part of the Free 2011 trial (Guerriero 2013). This showed that the cost of text-based support per 1000 enrolled smokers was GBP278 per quitter. When the future health service costs saved (as a result of reduced smoking) were included, text-based support was considered to be cost saving, with 0.5 quality-adjusted life years (QALYs) gained per quitter."

Other primary studies may have made similar suggestions, but, given that this literature review focused on other reviews, rather than primary studies, a systematic search for such comments was not conducted.

[85] Sherif M. Badawy and Lisa M. Kuhns, "Economic Evaluation of Text-Messaging and Smartphone-Based Interventions to Improve Medication Adherence in Adolescents with Chronic Health Conditions: A Systematic Review," *JMIR Mhealth Uhealth* 4, no. 4 (October 2016) concluded that, "[t]he evidence to support the cost effectiveness of text-messaging and smartphone-based interventions in improving medication adherence in adolescents with CHCs is insufficient" because the reviewers could not find a single article which met their pre-defined criteria for inclusion.

[86] For example, Fiona H. McKay, Christina Cheng, Annemarie Wright, Jane Shill, Hugh Stephens, and Mary Uccellini, "Evaluating mobile phone applications for health behaviour change: A systematic review," *Journal of Telemedicine and Telecare* 24, no. 1 (October 2018; first published October 2016) conclude that, "[t]his review is unable to suggest a single best practice approach to evaluate mobile health apps. Few measures identified in this review included sufficient information or evaluation, leading to potentially incomplete and inaccurate information for consumers seeking the best app for their situation. This is further complicated by a lack of regulation in health promotion generally. For those seeking to complete a review of behaviour change and health promoting apps, we suggests the inclusion of three

Overall, there is weak evidence from the health behavior literature that either mobile health interventions broadly (incorporating text messaging, voicemail messages, and smartphone apps) or smartphone apps specifically are likely to be effective at changing behavior in the farmed animal movement.[87] There was no available information on behavioral effect sizes. Recall, however, that there is stronger evidence for the effectiveness of text messaging interventions (see the section above).

Two reviews of mHealth interventions for vaccination or immunization in low- and middle-income countries (LMIC) had positive findings.[88] However, it is unclear why the included trials tended to be successful and therefore whether mHealth interventions by the farmed animal movement in LMIC could be expected to be similarly successful. An overview across health behaviors also notes that 17 of the 23 included mHealth reviews "included studies performed in low- and middle-income countries"[89]; the proportion of reviews including information from LMIC is unusually large in comparison to other aspects of the health behavior literature.

Two reviews note that engagement with smartphone apps declines with time.[90] This may be important, since another review notes that, "[e]leven studies reported app usage statistics, and three of them demonstrated that

components: (a) a review of usability and functionality, (b) some critique of the apps potential to promote behaviour change, and (c) the quality of the health-related content within the apps. We were unable to find a single study or evaluation tool incorporating these three components."

Jing Zhao, Becky Freeman, and Mu Li, "Can Mobile Phone Apps Influence People's Health Behavior Change? An Evidence Review," *Journal of Medical Internet Research* 18, no. 11 (November 2016) note that only 6 of 23 articles used sample sizes of over 100 per intervention group, that "[a]ll 23 studies had some kind of risk of bias according to the Cochrane Risk of Bias Assessment Tool," and that "the long-term sustainability of effects is largely unknown."

[87] See the spreadsheet "Strength of Evidence Assessments."

[88] Clare Oliver-Williams, Elizabeth Brown, Sara Devereux, Cassandra Fairhead, and Isaac Holeman, "Using Mobile Phones to Improve Vaccination Uptake in 21 Low- and Middle-Income Countries: Systematic Review," *JMIR Mhealth Uhealth* 5, no. 10 (October 2017) found that, "[t]en [out of 10] peer-reviewed studies and 7 [out of 11] white or gray studies demonstrated improved vaccination uptake after interventions, including appointment reminders, mobile phone apps, and prerecorded messages." For example, in the study with low risk of bias, sending just 3 reminder texts for each of 3 appointments resulted in greater vaccination coverage in the intervention group at each time point (P<.001 for all): "6 weeks: 96.7% (147/152) versus 82.2% (125/152); 10 weeks: 96.1% (146/152) versus 80.3% (122/152); 14 weeks: 94.7% (144/152) versus 75.0% (114/152)."

Jessica L. Watterson, Julia Walsh, and Isheeta Madeka, "Using mHealth to Improve Usage of Antenatal Care, Postnatal Care, and Immunization: A Systematic Review of the Literature," *BioMed Research International* (2015) reviewed 10 studies, eight of which were conducted in African countries. They note that, "[t]he majority of studies used text or voice message reminders to influence patient behavior change (80%, n = 8)." They found that all included studies "showed at least some evidence of effectiveness at changing behavior to improve antenatal care attendance, postnatal care attendance, or childhood immunization rates," though "many of the studies were observational and further rigorous evaluation of mHealth programs is needed in a broader variety of settings."

[89] Milena Soriano Marcolino, João Antonio Queiroz Oliveira, Marcelo D'Agostino, Antonio Luiz Ribeiro, Maria Beatriz Moreira Alkmim, and David Novillo-Ortiz, "The Impact of mHealth Interventions: Systematic Review of Systematic Reviews," *JMIR Mhealth Uhealth* 6, no. 1 (January 2018), e23.

[90] Oyungerel Byambasuren, Sharon Sanders, Elaine Beller, and Paul Glasziou, "Prescribable mHealth apps identified from an overview of systematic reviews," *Digital Medicine* 1 (May 2018) notes that, "[f]our of the RCTs from this review [Gemma Flores Mateo, Esther Granado-Font, Carme Ferré-Grau, and Xavier Montaña-Carreras, "Mobile Phone Apps to Promote Weight Loss and Increase Physical Activity: A Systematic Review and Meta-Analysis," *Journal of Medical Internet Research* 17, no. 11 (November 2015), e253] used calorie counting apps as interventions… This study also provided an insight on the usage of the apps during the trial, which showed that the logins to the app dropped sharply to

higher app usage was associated with improved health outcomes."[91] Recall that one review across health behaviors found evidence that prompts were effective at promoting engagement with other (digital) interventions[92]; it seems plausible that prompt systems (either internal or external to the app) could help to address low app usage.

No included reviews offered comparisons to face-to-face interventions or included analyses of intervention effects at long-term follow-up.

Online and computer-based interventions

This section includes reviews that focus on computer-based or online interventions. Reviews that include broader categories of "digital" interventions are included in the section below on "Broader consideration of non face-to-face modes of delivery," though many of these deal primarily with computer-based or online interventions. Although not always as portable or convenient as mobile-based interventions, online and computer-based interventions may offer similar advantages and disadvantages. It is also possible to use computers or the internet for relatively lengthy or intensive interventions. In the health behavior literature, they are sometimes used for their ability to automatically tailor advice.

There is strong evidence from the health behavior literature that online and computer-based interventions are likely to be effective at changing behavior in the farmed animal movement.[93] Included meta-analyses suggest that small or very small effects are most typical. Mostly, the CIs focused narrowly within that range, although some suggested that large effects were possible.[94]

There was more evidence on long-term effectiveness and on comparisons to face-to-face interventions for online and computer-based interventions than for some of the other evaluated modes of delivery. Nevertheless, the evidence that these interventions do not have long-term effects is very weak.[95] Behavioral outcomes were only measured in 1 included meta-analysis at long-term follow-up; the CI included no effect or a very small positive effect. Indirect comparison in the same meta-analysis found that short-term effects

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nearly zero after 1 month from acquiring it. These three studies also suffered from a high overall attrition rate of more than 30% and the intervention groups lost more participants than the control groups."

Donna M. Kazemi, Brian Borsari, Maureen J. Levine, Shaoyu Li, Katie A. Lamberson, and Laura A. Matta, "A Systematic Review of the mHealth Interventions to Prevent Alcohol and Substance Abuse," *Journal of Health Communication* 22, no. 5 (April 2017), 16 note that, "[a]ll 12 studies indicated feasibility/accessibility of the interventions, except Suffoletto et al. (2012) mentioned a relatively high "not responding" rate at 11th week (20%)... it appears that mHealth interventions are used less and less as time passes unless there is regular contact and prompts with the participant, if the information is static, or relies on the participants' initiative to access, use declines within a week or two (e.g., Gonazales et al., 2015)."

[91] Stephanie Schoeppe, Stephanie Alley, Wendy Van Lippevelde, Nicola A. Bray, Susan L. Williams, Mitch J. Duncan, and Corneel Vandelanotte, "Efficacy of interventions that use apps to improve diet, physical activity and sedentary behaviour: a systematic review," *International Journal of Behavioral Nutrition and Physical Activity* 13, no. 127 (December 2016).

[92] See footnote 67 on this appendix.

[93] See the spreadsheet "Strength of Evidence Assessments."

[94] See the spreadsheet "Effect Size Estimates."

[95] See the spreadsheet "Strength of Evidence Assessments."

were moderately greater than long-term effects, with CIs suggesting a fairly narrow set of possibilities around moderate or substantial differences.[96]

There is very weak evidence from the health behavior literature that face-to-face interventions are more effective than computer-based or web-based interventions.[97] Two meta-analyses with relevant behavioral outcomes suggest that there could be very small differences in favor of either face-to-face or computer and internet-based interventions. Indirect comparison in a third review found moderate differences in favor of face-to-face, with CIs suggesting anything from very large differences in favor of face-to-face to large diffefences in favor of internet-based interventions.[98]
Some reviews note the low costs of online and computer-based interventions.[99] One review for smoking provides cost information that suggests that internet-based interventions may be more cost-effective than face-to-face or telephone interventions.[100]

A review focused on alcohol notes several reasons to expect that low-intensity internet-based interventions may reach different individuals to face-to-face BIs, some of which could plausibly transfer to the farmed animal movement.[101] Additionally, there is surprisingly consistent evidence that increasing the intensity of

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[96] See the spreadsheet "Effect Size Estimates."

[97] See the spreadsheet "Strength of Evidence Assessments."

[98] See the spreadsheet "Effect Size Estimates."

[99] S. Kodama, K. Saito, S. Tanaka, C. Horikawa, K. Fujiwara, R. Hirasawa, Y. Yachi, K. T. Iida, H. Shimano, Y. Ohashi, N. Yamada, and H. Sone, "Effect of web-based lifestyle modification on weight control: a meta-analysis," *International Journal of Obesity* 36 (2012), 675-85, citing an old study, note that, "[a]long with the growing penetration of Internet use worldwide, [internet-delivered] programs have the ability to provide information to numerous individuals at a relatively low cost and with high anonymity."

[100] Gemma M. J. Taylor, Michael N. Dalili, Monika Semwal, Marta Civljak, Aziz Sheikh, Josip Car, "Internet-based interventions for smoking cessation," *Cochrane Database of Systematic Reviews* 9 (September 2017; first published 2010) summarize that 8 studies "reported information about the cost of their intervention." It might be tempting to assume that internet interventions will always be cheaper than more intensive direct interventions, but once labor and programming costs are included, these interventions can become quite expensive. For example, they summarize that "Harrington 2016 reported the average cost per quitter at six-month follow-up was USD 283 for their web intervention (n = 190) and USD 20 for usual care (n = 198), but noted that the cost of the intervention decreases to USD 57 per quit without programmer costs."

For the three studies that compared costs directly with the costs of other intervention types, results seem very favorable, given the findings overall from the meta-analysis that internet-based interventions are more effective than non-active controls and similarly effective to active controls, although the reviewers note that only one included trial actually demonstrated cost-effectiveness for its intervention. They note that, "Skov-Ettrup 2016 reported that the cost per user of their Internet intervention 'e-quit' was GBP 4.30 (n = 225), while the cost of the self-help booklet was GBP 1.80 (n = 451), and the cost of proactive and reactive telephone counselling was GBP 48 (n = 245) and GBP 39 (n = 30), respectively. Etter 2005 estimated that the total cost of implementing the website, for a reach of 8000 participants in computer-tailored programmes and for 600,000 visitors a year to the website, is comparable to the cost of running a small smoking cessation clinic which would treat about 50 smokers a month. Rabius 2008 suggested Internet assistance for smoking cessation was cost-effective, since four days of programming at a cost of less than USD 2000 allowed approximately 5000 additional users for services from the five tailored interactive service providers, compared with the much higher cost of serving 1000 new clients with telephone counselling (approximately USD 100,000)."

[101] Heleen Riper, Matthijs Blankers, Hana Hadiwijaya, John Cunningham, Stella Clarke, Reinout Wiers, David Ebert, and Pim Cuijpers, "Effectiveness of Guided and Unguided Low-Intensity Internet Interventions for Adult Alcohol Misuse: A Meta-Analysis," *PLoS ONE* (June 2014) notes that, "[s]tudies on web-based self-help interventions for adult problem drinking show that (1) the interventions are mostly of an unguided nature and are delivered as stand-alone procedures directly to participants in the community, and to a far lesser extent via primary care, clinical or employment settings; (2) they largely reach first-time help seekers (with rates varying from 80% to 90%); (3) people who misuse

online and computer-based interventions does not increase their effectiveness and some evidence that this actually reduces their effectiveness (see the section on "Intensity of intervention" below).

Explicit consideration of print-based materials

Some reviews directly test the effectiveness of print-based materials. There is weak evidence from the health behavior literature that interventions using print-based materials are likely to be effective at changing behavior in the farmed animal movement.[102] Behavioral outcomes in two included meta-analyses had CIs suggesting that very small effect sizes were likely, though a third meta-analysis found that either very small or small effect sizes were posible.[103]

The reviewed interventions using print-based materials have features that make them less comparable to the leafleting interventions used by the farmed animal movement,[104] such as the use of tailoring of the materials

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alcohol take up these services on a much wider scale than the available brief, low-intensity face-to-face interventions in primary care settings; and (4) people differ in whether they desire additional help from professionals. Studies have also shown such unguided interventions to be effective in reducing adult alcohol misuse as compared to no-intervention control conditions."

[102] See the spreadsheet "Strength of Evidence Assessments."

[103] See the spreadsheet "Effect Size Estimates."

[104] Jamie Hartmann-Boyce, Tim Lancaster, and Lindsay F. Stead, "Print-based self-help interventions for smoking cessation," *Cochrane Database of Systematic Reviews* 6 (June 2014; first published 2002) note that they "defined self-help interventions as any manual or programme to be used by individuals to assist a quit attempt" but that "[b]rief leaflets on the health effects of smoking were not included - they were considered to be a control intervention if compared to a more substantial manual." The authors measured abstinence, rather than amount of cigarettes smoked; from an animal advocacy point of view, reductions in the amount of animal products consumed would also be a valuable outcome. This therefore does not account for a potential a backfire effect amongst recipients, who view the materials as an unwanted challenge to their behavior or beliefs and slightly increase the amount of cigarettes that they smoke. The authors note that "studies in this review tended to include participants regardless of whether or not they wanted to quit smoking (only three of the 20 studies in our primary analyses focused on smokers who wished to stop." However, 11 of the 20 studies of non-tailored materials involved participants who "responded to promotion of smoking cessation programmes or volunteered for a trial."

Camille E. Short, Erica L. James, Ronald C. Plotnikoff, and Afaf Girgis, "Efficacy of tailored-print interventions to promote physical activity: a systematic review of randomised trials," *International Journal of Behavioral Nutrition and Physical Activity* 8, no. 113 (October 2011) note that six of their included studies "compared tailored print materials to other non-tailored print materials on the same topic (ie generic materials or targeted materials). Five studies tested the relative effectiveness of different tailored interventions against a control group… Finally, one study compared a single tailored-print group to a control group."

Seth M. Noar, Melissa S. Harris, and Christina Anderson, "Does Tailoring Matter? Meta-Analytic Review of Tailored Print Health Behavior Change Interventions," *Psychological Bulletin* 133, no. 4 (August 2007), 681 note that, "[a]lthough most studies included a single intervention contact (k = 44, 77%), contacts ranged from 2 to 12 (median = 3) among the remaining k = 13 studies. Studies with a single intervention contact were compared with those with more than one intervention contact (see Table 4). Results indicated that interventions with more than one contact (r = .092) had significantly larger effect sizes than those with only one point of contact (r = .068), Z = 2.46, p = .007."

L. Wolfenden, N. Nathan, and C. M. Williams, "Computer-tailored interventions to facilitate health behavioural Change," *British Journal of Sports Medicine* 49, no. 22 (November 2015), 1478-9 explain that, "[c]omparison groups typically received assessments only, generic information brochure or no intervention." However, "[t]he median number of computer-generated intervention contacts was 3 (range 1–15)," which is more than is typically tested in the farmed animal movement. They add that "the median months from baseline in which follow-up data collection occurred was 8 months (range 1–30 months)," suggesting that these interventions reflect medium term outcomes.

to an individual's personal interests or to their stage of change in the Transtheoretical model.[105] An additional concern is that these results may be especially susceptible to publication bias, given the very small effect sizes or, in qualitative reviews, relatively similar ratios of studies reporting significant effects compared to those reporting insignificant effects.[106] However, the experimenters in one trial which found significant positive effects were able to use seemingly superior objective measures of behavior change than those used by the leafleting studies included in Animal Charity Evaluators' meta-analysis, which rely on self-reported dietary change.[107]

One review focused on PA found that interventions delivered via postal mail had significant negative effects on two out of three outcome measures of motivation.[108]

The evidence of long-term effects of print-based materials is very weak, with only one identified study providing relevant evidence.[109]

Reviews do not usually directly compare print-based materials to other modes of delivery, but several reviews provide indirect evidence for this comparison, such as through subanalyses. Additionally, some reviews of BIs included print-based materials as part of the control conditions and so the strong evidence of the effectiveness of BIs (some of which include face-to-face components) also constitutes indirect evidence that (more intensive) face-to-face interventions are more effective than (less intensive) print-based materials.

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[105] The author's impression is that leaflets in the farmed animal movement are not usually tailored (though they may be targeted to specific audiences) and are usually intended as resources that introduce people to ideas about veganism, seeking to persuade them that removing animal products from their diet is preferable. See for example "Booklet PDFs," Vegan Outreach, accessed May 24, 2019, https://veganoutreach.org/booklet-pdfs/, where leaflets come with taglines like: "If you care about animals, please consider not eating them" and "Becoming vegan is a powerful way to oppose cruelty to animals." Even the leaflet called "Compassionate Athlete and Guide to Cruelty-Free Eating" has several pages focusing on the suffering endured by animals, accompanied by graphic images.

However, print-based materials in the health behavior literature that tailor their materials according to an individual's stage of change are presumably not limited in this way to moving individuals from the "precontemplation" to the "contemplation" stages of the *Transtheoretical model*. Plausibly, even if tailoring is not viable, leaflets could be more impactful on average if they focus on providing support for those in the "contemplation" or "preparation" stages.

[106] Three of the four reviews with positive findings compared to no intervention controls did not use graphical or statistical tests of publication bias. L. Wolfenden, N. Nathan, C. M. Williams, "Computer-tailored interventions to facilitate health behavioural Change," *British Journal of Sports Medicine* 49, no. 22 (November 2015), 1478-9 note that, "[t]here was no evidence of publication bias," though the method used to assess this is unclear from the abstract.

[107] "Leafleting," Animal Charity Evaluators (November 2017), https://animalcharityevaluators.org/advocacy-interventions/interventions/leafleting/#report.

Pamela M. Meharry, Regina M. Cusson, Robert Stiller, and Marietta Vázquez, "Maternal Influenza Vaccination: Evaluation of a Patient-Centered Pamphlet Designed to Increase Uptake in Pregnancy," *Maternal and Child Health Journal* 18, no. 5 (July 2014), 1205-14 note that, "[p]roof of vaccination was obtained by the clinic RN or prenatal instructor outside the research team and therefore unaware of the random assignment. Prenatal class participants provided a self-report of vaccination."

[108] Keegan Knittle, Johanna Nurmi, Rik Crutzen, Nelli Hankonen, Marguerite Beattie, and Stephan U. Dombrowski, "How can interventions increase motivation for physical activity? A systematic review and meta-analysis," *Health Psychology Review* 12, no. 3 (February 2018). For intention, they found d = -0.24 (95% CI -0.43 to -0.04), from 9 interventions; for stage of change, they found d = -0.10 (95% CI -0.35 to 0.14) from 9 interventions; for autonomous motivation, they found d = -0.27 (95% CI -0.48 to -0.06) from 3 interventions.

[109] See the spreadsheet "Strength of Evidence Assessments."

Overall, this constitutes weak evidence that interventions using print-based materials are less effective at changing behavior in the farmed animal movement than face-to-face equivalents.[110]

There is also very weak evidence from the health behavior literature that interventions using print-based materials are likely to be similarly effective at changing behavior in the farmed animal movement to other interventions using non face-to-face modes of delivery.[111] One meta-analysis had CIs suggesting that differences on behavioral outcomes could be very small in either direction, or that there could be no difference.[112] However, some of the studies evaluated in reviews included in the sections on "Telephone," "Text messaging," "Broader mobile phone interventions (mHealth)," and "Online and computer-based interventions" used information only groups as comparators to test the effectiveness of the main intervention type, and many of these reviews found significant effects.

Three reviews of print-based interventions found larger effects for multiple points of contact than single points of contact (see the section on "Intensity of intervention" below). Additionally, it seems plausible that the significant effects of a pamphlet to encourage flu shots in one RCT may have been dependent on their interaction with face-to-face counseling.[113] One review found that non-tailored print-based interventions had significant effects compared to no controls but insignificant effects when used as an adjunct to face-to-face interventions.[114] This suggests that the effects from print-based materials are small enough that they are imperceptible compared to more intensive interventions and provides weak evidence against the hypothesis that leaflets may have important effects by interacting with other interventions types.[115]
One review included information from a trial that suggested that a print-based intervention may be more cost-effective than a telephone intervention or (if small numbers of participants are involved) a computer-based intervention.[116]

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[110] See the spreadsheet "Strength of Evidence Assessments."

[111] See the spreadsheet "Strength of Evidence Assessments."

[112] See the spreadsheet "Effect Size Estimates."

[113] Pamela M. Meharry, Regina M. Cusson, Robert Stiller, and Marietta Vázquez, "Maternal Influenza Vaccination: Evaluation of a Patient-Centered Pamphlet Designed to Increase Uptake in Pregnancy," *Maternal and Child Health Journal* 18, no. 5 (July 2014), 1205-14 compared a theoretically-based pamphlet to a group with both the pamphlet and an additional verbalized benefit statement ("If you have the flu shot during pregnancy, you will also help protect your baby against influenza from birth to 6 months") and to a no-intervention control. They found statistically significant results on vaccination within 2 months of receiving the intervention (or just the pre-test). Though the study is not clear on this, it seems likely that all participants received some counseling or had face-to-face conversations about vaccination; it is plausible that the leaflet was only effective through an interactive effect with the counseling interventions.

[114] Jamie Hartmann-Boyce, Tim Lancaster, and Lindsay F. Stead, "Print-based self-help interventions for smoking cessation," *Cochrane Database of Systematic Reviews* 6 (June 2014; first published 2002) found from 11 studies that standard, non-tailored print-based self-help materials were effective compared to no intervention at increasing smoking abstinence (RR 1.19, 95% CI 1.03 to 1.37). In another analysis of 11 studies, they note that print-based self-help materials did not have a statistically significant effect when combined with face-to-face advice when the control also included face-to-face advice (RR 0.99, 95% CI 0.76 to 1.28).

[115] However, if leaflets do have important interactive effects with other intervention types, it seems plausible that they would not become immediately apparent. For example, someone may take a leaflet, consider it briefly and therefore become more open to further information provided to them at a later point. Given that, in this review, the print-based materials were provided at the same time as a brief face-to-face intervention, the potential interactive effects of the materials may not have been maximized.

[116] Camille E. Short, Erica L. James, Ronald C. Plotnikoff, and Afaf Girgis, "Efficacy of tailored-print interventions to promote physical activity: a systematic review of randomised trials," *International Journal of Behavioral Nutrition and Physical Activity* 8, no. 113 (October 2011) note that 2 studies contained information on cost effectiveness; "[i]n the study comparing tailored print to tailored telephone calls, print was found to be more cost-effective at 12 months in terms of

The evidence on "Mass media" and "Social marketing" is also relevant to the consideration of leafleting interventions.

Broader consideration of non face-to-face modes of delivery

The term "digital" is sometimes used to include computer-based, mobile phone-based, and other non face-to-face interventions. Other reviews compare face-to-face interventions with broad categories of non face-to-face modes of delivery. All such reviews are included here where the findings could not be separated into more specific categories. Findings from the reviews included in this section specifically and commentary on the combined evidence of all six sections on non face-to-face modes of delivery ("Telephone," "Text messaging," "Broader mobile phone interventions," "Online and computer-based interventions," "Explicit consideration of print-based materials," and "Broader consideration of non face-to-face modes of delivery") are reported separately.

There is strong evidence from the health behavior literature that "digital" interventions are likely to be effective at changing behavior in the farmed animal movement.[117] Included meta-analyses suggest small or very small behavioral effects. In some, the CIs had a wide range, but most were focused on small or very small effects. Overall, there is very strong evidence from the health behavior literature that non face-to-face interventions are likely to be effective at changing behavior in the farmed animal movement. The evidence on non face-to-face modes of delivery seems to be quite consistent in suggesting small or very small effects.[118]

The included reviews on "digital" interventions to increase PA and to decrease alcohol use conflict as to whether effects are likely to last into the long term. Since neither health behavior area seems obviously more comparable to the farmed animal movement, overall, the evidence is very weak that effects are not likely to last into the long term.[119] The CIs in included meta-analyses with long-term follow-up range from small negative behavioral effects through to small positive behavioral effects. Indirect comparisons suggest large or moderate differences in favor of short-term outcomes.[120] Taken as a whole, the six sections here on non face-to-face modes of delivery provide a disappointing lack of evidence on long-term effects. Where evidence exists, findings are often mixed. Overall, there is very weak evidence that, in general, non face-to-face interventions in the farmed animal movement are not likely to have long-term behavioral effects. Meta-analyses on both "digital" and "online and computer-based interventions" suggest very small effects or no effects in the long term.[121]

There is very weak evidence that digital interventions are likely to be similarly effective to face-to-face equivalents. Taken as a whole, the evidence very weakly suggests that interventions that are not delivered

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the cost of moving one person out of sedentary behaviour ($955 for the print group and $3,967 for the telephone group)." They add that, "it was noted that the internet intervention may be less costly per participant if the number of participants was increased (i.e. assuming the same additional costs for each added participant the internet intervention would be less costly than the print condition when N > 352). Of note for intervention developers, the tailored print and tailored-internet interventions cost $10, 742 and $109, 564 (USD) respectively, to develop."

[117] See the spreadsheet "Strength of Evidence Assessments."

[118] See the spreadsheet "Effect Size Estimates."

[119] See the spreadsheet "Strength of Evidence Assessments."

[120] See the spreadsheet "Effect Size Estimates."

[121] See the spreadsheet "Effect Size Estimates."

face-to-face are likely to be similarly effective to equivalent face-to-face interventions.[122] However, only two reviews found significant differences in favor of non face-to-face interventions for behavioral outcomes, compared to thirteen finding significant differences in favor of face-to-face interventions.[123] It therefore seems highly likely that if there is a significant difference between the effectiveness of face-to-face and non face-to-face interventions for behavioral outcomes, the former will be more effective. Indirect comparisons from meta-analyses on digital interventions suggest that there is likely a moderate or small difference in favor of face-to-face interventions, though CIs are wide. Including the meta-analyses in the sections on online and computer-based interventions and telephone-based interventions, indirect comparisons in the health behavior literature fairly consistently point towards small to large differences in behavioral effects in favor of face-to-face interventions. A combined average across all individual included indirect comparisons between face-to-face and non face-to-face methods suggests overall a small difference in effectiveness in favor of the former.[124]

Although this literature review focuses on behavioral outcomes, three included reviews found significant evidence in favor of non face-to-face interventions for indirect outcome measures such as knowledge.[125]

However, the interventions evaluated here are not very comparable to the leafleting or online advertising methods common in the farmed animal movement, since they are often more intensive (such as telephone counseling or an ongoing program of text messages and website use to address a specific behavior) or directed towards patients who are aware of the personal need to maintain specific behaviors (such as with follow up calls or reminder text messages). The evidence considered in the sections on "Mass media" and "Social marketing" are perhaps more comparable.

Group interventions

Some reviews evaluate interventions delivered in groups and compare these to interventions delivered individually. Usually this is done by subanalysis, rather than being the primary goal of the review. A small number of reviews evaluate dyadic interventions (that is, delivered to pairs of individuals).

Though it seems intuitively plausible that interventions using group delivery would be less effective at changing behavior in the farmed animal movement than individual equivalents, the health behavior literature provides moderate evidence against this hypothesis.[126] Included meta-analyses with direct comparisons find that behavioral effects could be slightly larger for either group-based or individual-based delivery. Indirect comparisons in included meta-analyses suggest very small differences in favor of group delivery, though the CIs suggest a wide range of possible differences in either direction.[127] There is some evidence from included meta-analyses that group-delivered interventions have moderate sized behavioral effects, which is larger than many of the effect sizes found for other intervention types in this literature review. However, the included meta-analyses had wide CIs, ranging from very small negative effects to very large positive effects.[128]

[122] See the spreadsheet "Strength of Evidence Assessments."
[123] See the tab "GRADE individual reviews" in the spreadsheet "Strength of Evidence Assessments."
[124] See the spreadsheet "Effect Size Estimates."
[125] See the tab "GRADE individual reviews" in the spreadsheet "Strength of Evidence Assessments."
[126] See the spreadsheet "Strength of Evidence Assessments."
[127] See the spreadsheet "Effect Size Estimates."
[128] See the spreadsheet "Effect Size Estimates."

A review focused on PA and a review across multiple health behaviors found larger effect sizes for interventions focusing on pairs of people than interventions on individuals[129]; the available evidence suggests that interventions delivered either to pairs or larger groups are likely to be similarly or more effective than interventions delivered to individuals.

No identified reviews provided evidence on the effectiveness of group interventions for altering dietary behaviors and the two health behavior areas with the strongest evidence on this question (PA and smoking) seem especially incomparable to plausible group interventions that could be used by the farmed animal movement to alter dietary behavior.[130] The reviews evaluated here tended to focus on counseling, feedback, or support.

There was very weak evidence for long-term effects of group interventions[131]

The section on "Behavior Change Techniques (BCTs)" provides evidence relevant to the use of social support in interventions.

Effectiveness across different settings

Interventions of similar content can be delivered in a variety of settings. For example, a brief advice intervention could be conducted in a school-based setting or in a clinical setting (often the default in clinical trials). The following sections consider specific settings across intervention types. Where possible, this section has been limited to individual and small group educational and supportive behavioral interventions. This means that interventions such as incentives or bans of risk behaviors are considered separately, in later sections. However, many of the reviews in the section on "Workplace-based interventions" also evaluate environmental components, while many of the reviews in the section on "Community-based interventions" evaluate multi-component, population-wide interventions, not restricted to components involving individuals or small groups.

School-based interventions

There is weak evidence from the health behavior literature that school-based interventions are likely to be effective at changing behavior in the farmed animal movement and weak evidence of long-term effects.[132] Included meta-analyses have wide CIs, from very small negative behavioral effects to large positive behavioral effects. Overall, small positive behavioral effects seem most typical. There was quite a wide range for long-

[129] R. M. Carr, A. Prestwich, D. Kwasnicka, C. Thøgersen-Ntoumani, D. F. Gucciardi, E. Quested, L. H. Hall, and N. Ntoumanis, "Dyadic interventions to promote physical activity and reduce sedentary behaviour: systematic review and meta-analysis," *Health Psychology Review* (October 2018) and Emily Arden-Close and Nuala McGrath, "Health behaviour change interventions for couples: A systematic review," *British Journal of Health Psychology* 22, no. 2 (May 2017), 215-37.

[130] For smoking, the social support element of group-based interventions could be important, given the addictiveness of nicotine. For PA, the demonstration of the behavior might be more important than would be the case for dietary behaviors, and this could be delivered easily in a group setting. See "BCT analysis" for some inconclusive evidence relating to these moderators of effectiveness.

[131] See the spreadsheet "Strength of Evidence Assessments."

[132] See the spreadsheet "Strength of Evidence Assessments."

term effects, with small or very small behavioral effects seeming most typical. Surprisingly, indirect comparisons found that long-term effects were very slightly larger than short-term effects, though the CIs suggest a wide range of possible differences in either direction.[133]

There are several aspects of the school-based interventions in the health behavior literature that reduce their comparability with the farmed animal movement. Many of the school-based interventions cannot truly compare to "no intervention" controls, since schools often have some form of education or intervention in place as usual practice.[134] In this sense, many of the comparisons are actually between different types or intensities of intervention. This is a distinct difference from the farmed animal movement, where the interventions that animal advocates would like to introduce are often very different from existing programs. I'd also guess that there is greater existing awareness of the basic principles of health behavior in schools than there is of the outcomes of interest to the farmed animal movement; whereas school children might shut down to another adult telling them about the dangers of drug and alcohol use, they might be more attentive to the novelty of an educator telling them about farmed animal welfare, or the moral consequences of animal product consumption. However, the interventions included in this section are often far more time- and resource-intensive than school-based interventions would likely be in the farmed animal movement.[135] Once these factors are taken into account, the health behavior literature seems to provide very weak evidence that school-based interventions are likely to be effective at changing behavior in the farmed animal movement and very weak evidence of long-term effects.[136]

A rapid review concludes that alcohol education interventions in schools "are not cost-effective."[137]

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[133] See the spreadsheet "Effect Size Estimates."

[134] See the tab "GRADE individual reviews" in the spreadsheet "Strength of Evidence Assessments" and note that several reviews include usual curricula as the comparator. In other cases, where the comparator is listed as "mixed," the reviewers did not use control group type as part of their exclusion criteria, but it seems likely that many of the comparators involve some form of education on the topic too.

[135] For example, H. K. Strøm, F. Adolfsen, S. Fossum, S. Kaiser, and M. Martinussen, "Effectiveness of school-based preventive interventions on adolescent alcohol use: a meta-analysis of randomized controlled trials," *Substance abuse treatment, prevention, and policy* 9, no. 48 (December 2014) found "no significant differences between medium intensity (6 to 10 hours) or high intensity programs (11 to >15 hours)" in either continuous or categorical outcomes." Susan T. Ennett, Nancy S. Tobler, Christopher L. Ringwalt, and Robert L. Flewelling, "How effective is drug abuse resistance education? A meta-analysis of Project DARE outcome evaluations," *American Journal of Public Health* 84, no. 9 (September 1994), 1394–401 note that Project DARE (Drug Abuse Resistance Education) comprises "17 lessons, usually offered once a week for 45 to 60 minutes."

In contrast, opportunities for the farmed animal movement to support school-based educational and behavioral interventions would probably be limited to a single session in many cases. There may be exceptions to this, such as if content related to farmed animals can be integrated into existing curricula and delivered directly by students' current teachers. This situation may also change as societal attitudes towards farmed animals change.

[136] See the spreadsheet "Strength of Evidence Assessments."

[137] Robyn Burton, Clive Henn, Don Lavoie, Rosanna O'Connor, Clare Perkins, Kate Sweeney, Felix Greaves, Brian Ferguson, Caryl Beynon, Annalisa Belloni, Virginia Musto, John Marsden, and Nick Sheron, "A rapid evidence review of the effectiveness and cost-effectiveness of alcohol control policies: an English perspective," *The Lancet* 389, no. 10078 (April 2017), 8.

Family-based interventions

This section includes reviews that explicitly refer to family-based, parent-based, or home-based interventions. These reviews are mostly focused on children and adolescents, though some of the included studies aimed to change the behavior of parents, either as outcomes in their own right or as ways to influence outcomes for their children.

There is moderate evidence that family- and parent-based interventions are likely to be effective at changing behavior in the farmed animal movement and weak evidence of long-term effects.[138] Included meta-analyses suggest that small behavioral effects are most typical in both the short and long term, with CIs mostly focused around very small to moderate sized behavioral effects. Indirect comparison in one meta-analysis found that short-term effects were slightly larger than long-term effects, though the CIs suggest a wide range of possible differences in either direction.[139]

Two meta-analyses found that parental involvement had no significant effect on obesity interventions for children,[140] though one review of "behavioural interventions for preventing caries" found that MI was more effective when both parents and children were involved.[141] This provides very weak evidence that focusing on parents is not important for the success of home- or family-based interventions.[142] Indirect comparison in the meta-analysis focused on caries suggests substantial differences in effectiveness in favor of interventions that involve both parents and children.[143]

Interventions working with parents or families in their homes will likely be much more resource intensive than the sorts of interventions commonly used by the farmed animal movement. One review focusing on substance abuse notes concerns about implementation difficulties.[144]

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[138] See the spreadsheet "Strength of Evidence Assessments."

[139] See the spreadsheet "Effect Size Estimates."

[140] Emma Loveman, Lena Al-Khudairy, Rebecca E. Johnson, Wendy Robertson, Jill L. Colquitt, Emma L. Mead, Louisa J. Ells, Maria-Inti Metzendorf, and Karen Rees, "Parent-only interventions for childhood overweight or obesity in children aged 5 to 11 years," *Cochrane Database of Systematic Reviews* 12 (December 2015) found that "[p]arent-only interventions had similar effects compared with parent-child interventions" for obesity in children aged 5 to 11 (BMI z score lower by 0.04, 95% CI 0.15 lower to 0.08 higher).

Eric Stice, Heather Shaw, and C. Nathan Marti, "A Meta-Analytic Review of Obesity Prevention Programs for Children and Adolescents: The Skinny on Interventions That Work," *Psychological Bulletin* 132, no. 5 (2006), 677 found that parental attendance of sessions and parental involvement were not statistically significant predictors of the effect size of obesity prevention programs for children and adolescents. However, this review gains an AMSTAR 2 rating of "critically low" and the quality of evidence is probably very low by GRADE criteria.

[141] Anna M. Cooper, Lucy A. O'Malley, Sarah N. Elison, Rosemary Armstrong, Girvan Burnside, Pauline Adair, Lindsey Dugdill, and Cynthia Pine, "Primary school-based behavioural interventions for preventing caries," *Cochrane Database of Systematic Reviews* 5 (May 2013) fond that the effect sizes for "child" (g = 0.26, 95% CI 0.19 to 0.37, 23 studies) and "parent" (g = 0.27, 95% CI 0.22 to 0.32, 11 studies) interventions were similar, but for both combined, effect sizes were higher and the CIs did not overlap (g = 0.59, 95% CI 0.42 to 0.75, 3 studies).

[142] See the spreadsheet "Strength of Evidence Assessments."

[143] See footnote 141 on this appendix.

[144] Michele L. Allen, Diego Garcia-Huidobro, Carolyn Porta, Dorothy Curran, Roma Patel, Jonathan Miller, and Iris Borowsky, "Effective Parenting Interventions to Reduce Youth Substance Use: A Systematic Review," *Pediatrics* 138, no. 2 (August 2016) note that, "[f]or the 21 studies reporting illicit substance use outcomes, 86% reported the intervention dosage… most effective interventions

Workplace-based interventions

Some reviews focus specifically on workplace settings. These reviews usually include a mixture of environmental components (see the section on "Nudges and environmental interventions" for more on this) and educational or behavioral components.

Little relevant evidence was identified. Most reviews were qualitative and had mixed or unclear findings, and the inclusion of environmental components makes focused evaluation of educational and behavioral interventions in these settings difficult. The health behavior literature provides weak evidence that workplace-based interventions are likely to be effective at changing behavior in the farmed animal movement.[145] Three included meta-analyses had CIs suggesting a possible range from no behavioral effects through to large behavioral effects. Small effects seem most typical.[146] There is very weak evidence that workplace-based interventions have no long-term effects, though only one review provided relevant evidence for this question.[147]

One Cochrane review focused on smoking explicitly notes that the findings for workplace interventions are similar to equivalent interventions outside the workplace.[148] The reviewed evidence does not suggest that interventions in the workplace are likely to be either especially effective or especially ineffective.

One review focused on diet and PA used an intervention quality assessment tool that encouraged greater integration of interventions into the routine and systems of the workplace; the reviewed studies scoring higher on this metric all had significant effects on behavior.[149] The quality criteria offered may be a useful starting point for the development of workplace interventions.[150]

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included ≤24 hours of training." They also conclude that "relatively low-intensity interventions with a dosage of a manageable ≥12 parent contact hours achieve outcomes." However, 12 hours seems likely to be a much longer intervention intensity than is commonly used in the farmed animal movement. They also note that, "[a]lthough the dosage is manageable, the delivery modality may be problematic. The finding that group sessions were the most common means for delivering these interventions to parents and youth may pose barriers for some community settings. When implemented well, in-person group sessions may be powerful because of social support and shared learning among the participants; however, high-quality sessions require dedicated staff with content expertise, strong facilitation skills, and high-intensity training on intervention implementation. The costs and staff requirements may be beyond the means of community organizations, particularly those in resource-limited settings where highest at-risk youth are often served and reside."

[145] See the spreadsheet "Strength of Evidence Assessments."

[146] See the spreadsheet "Effect Size Estimates."

[147] See the spreadsheet "Strength of Evidence Assessments."

[148] Kate Cahill and Tim Lancaster, "Workplace interventions for smoking cessation," *Cochrane Database of Systematic Reviews* 2 (February 2014; first published 2003).

[149] Lea Maes, Eveline Van Cauwenberghe, Wendy Van Lippevelde, Heleen Spittaels, Ellen De Pauw, Jean-Michel Oppert, Frank J. Van Lenthe, Johannes Brug, and Ilse De Bourdeaudhuij, "Effectiveness of workplace interventions in Europe promoting healthy eating: a systematic review," *European Journal of Public Health* 22, no. 5 (October 2012), 677-83.

[150] European Network For Workplace Health Promotion, "Quality Criteria," accessed December 17, 2019, http://www.enwhp.org/good-whp-practice/methods-tools-mogp/quality-criteria.html.

One review noted that, compared to large businesses, fewer small businesses adopt worksite health promotion programs and suggested some explanations for this.[151]

Community-based interventions and population-level interventions

Several reviews refer to interventions as being community-based, but this does not always mean a specific type of setting. Often, this term is used to differentiate from primary care or medical contexts and can include settings varying from schools to family homes to churches. The interventions evaluated by the reviews included in this section are therefore highly varied, although many focus on interventions that are multi-component (including components that go beyond individual education) and aimed at the entire population in an area, rather than targeted at specific groups. In some ways, this section is more comparable to the interventions in the section on "Population-level and large group interventions." However, this section does not include the effects of mass media, legislation, or the direct effects of adding additional components to an intervention, which are evaluated in subsequent sections on "Mass media," "Other legislation," and "Complexity of intervention."

From the included reviews there is a surprising lack of evidence that interventions using a variety of components could be effective. For example, one Cochrane review found "no clear evidence that structural interventions at the community level to increase condom use prevent the transmission of HIV and other STIs," despite the reviewed interventions including handing out free condoms.[152]

There is very weak evidence from the health behavior literature (counting only those reviews included directly in this section) that community-based or population-level interventions in the farmed animal movement are likely to be effective.[153] In meta-analyses, CIs were mostly focused around very small negative to small positive behavioral effects, except for one outlier review with much wider CIs and a much larger effect. Small effects seem most typical.[154]

Given the high resource costs that are likely to be involved with many of the whole-of-community and multicomponent interventions evaluated by the reviews in this section,[155] such interventions seem unlikely to be cost-effective.

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[151] Kira McCoy, Kaylan Stinson, Kenneth Scott, Liliana Tenney, and Lee S. Newman, "Health Promotion in Small Business: A Systematic Review of Factors Influencing Adoption and Effectiveness of Worksite Wellness Programs," *Journal of Occupational and Environmental Medicine* 56, no. 6 (June 2014), 579-87. Their hypotheses include cost, lack of space, lower incentives, employee privacy, lack of expertise and time, and higher concern about paternalism.

[152] For example, David R. Foxcroft and Alexander Tsertsvadze, "Universal family-based prevention programs for alcohol misuse in young people," *Cochrane Database of Systematic Reviews* 9 (September 2011) note that they examined "[u]niversal prevention strategies… without any prior screening for risk factors." This contrasts to the screening approach often used before initiating BIs.

[153] See the spreadsheet "Strength of Evidence Assessments."

[154] See the spreadsheet "Effect Size Estimates."

[155] For example, Laurie M. Anderson, Kathryn L. Adeney, Carolynne Shinn, Sarah Safranek, Joyce Buckner-Brown, and L. Kendall Krause, "Community coalition-driven interventions to reduce health disparities among racial and ethnic minority populations," *Cochrane Database of Systematic Reviews* 6 (June 2015) does not report costs of the interventions, the descriptions provided suggest that such interventions are resource-intensive, and not comparable to plausible interventions for the current farmed animal movement. They explain that the "multi-sector coalition model is a social initiative that connects a community targeted for intervention with stakeholders who share a common interest in

Reviews providing direct evidence on the effectiveness of interventions in community settings compared to other settings were mixed; one review found significant evidence in favor of community settings, one found significant evidence in favor of other settings, and one found insignificant differences.[156] Indirect comparisons in two meta-analyses also had contrasting implications.[157]

An old review[158] and a more recent small study[159] have found promising results in church settings. Most trials were conducted with African American men. This suggests that interventions can be effective in some community-based settings that offer benefits for targeting specific demographics.

Other settings

There are a variety of other plausible settings for the farmed animal movement to implement behavior change interventions, such as supermarkets, restaurants, and cafeterias. Only three reviews specifically addressed interventions in such settings, although it is possible that some studies included within the reviews discussed elsewhere in this literature review were conducted in such settings. The health behavior literature provides very weak evidence that interventions in such settings are likely to be effective at changing behavior in the farmed animal movement.[160]

Identified comparisons across settings in three reviews or overviews found no or relatively little difference between settings.[161]

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reducing health disparities by changing community-level structures, processes, and policies to promote the health and well-being of local residents." Further detail of the components is provided in the review.

[156] See the spreadsheet "Strength of Evidence Assessments."

Jaelan Sumo Sulat, Yayi Suryo Prabandari, Rossi Sanusi, Elsi Dwi Hapsari, and Budiono Santoso, "The impacts of community-based HIV testing and counselling on testing uptake: A systematic review," *Journal of Health Research* 32, no. 2 (2018), 152-63, the review that found evidence in favor of community settings, evaluated a relatively different sort of intervention. Rather than testing persuasive educational, behavioral, or environmental components, the shift to community settings essentially increased the convenience of the HIV tests. This may indicate that community settings hold promise for certain types of intervention. However, it could just be an effect of the included studies focusing on lower-income countries than many of the reviews evaluated elsewhere in this literature review; they note that, "[a]ll papers which met inclusion criteria (n=6) were cluster randomized trials conducted in China, Lesotho, Zambia, Nigeria, and South Africa, and one study each was conducted in Thailand, Tanzania, Zimbabwe, Soweto, and KwaZulu-Natal."

[157] See the spreadsheet "Effect Size Estimates."

[158] Marci Kramish Campbell, Marlyn Allicock Hudson, Ken Resnicow, Natasha Blakeney, Amy Paxton, and Monica Baskin, "Church-Based Health Promotion Interventions: Evidence and Lessons Learned," *Annual Review of Public Health* 28 (2007), 213-34.

[159] Carolyn M. Tucker, Guillermo M. Wippold, Jaime L. Williams, Tya M. Arthur, Frederic F. Desmond, and Karlyne C. Robinson, "A CBPR Study to Test the Impact of a Church-Based Health Empowerment Program on Health Behaviors and Health Outcomes of Black Adult Churchgoers," *Journal of Racial and Ethnic Health Disparities* 4, no. 1 (February 2017), 70-8.

[160] See the spreadsheet "Strength of Evidence Assessments."

[161] Note, however, that it is quite likely that many other reviews included elsewhere in this literature review contain information about generalized comparisons across settings, but that this information was not included; the author was not initially intending to include comparisons across settings.

Other moderators of the effectiveness of individual and small group educational and supportive behavioral interventions

Behavior Change Techniques (BCTs)

Several reviews evaluate associations between the inclusion of certain Behavior Change Techniques (BCTs) within an intervention and the intervention's overall effectiveness. BCTs are specific components of interventions. While simple interventions might contain a single BCT (such as "information on consequences"), more complex interventions might contain many. BCT analysis usually utilizes the taxonomy developed by Charles Abraham and Susan Michie[162] or variations of that taxonomy developed by Susan Michie and colleagues.[163]

Often, BCT analysis is conducted using the results of meta-analysis; reviewers code the interventions according to their inclusion or exclusion of certain BCTs and then conduct separate sub-analyses of the combined effect sizes for interventions that contain or lack that BCT. If no meta-analysis was conducted, reviewers sometimes comment on the proportion of studies that contain a particular BCT that found significant effects, and sometimes contrast this to the proportion of studies that did not contain the BCT that found significant effects.

These analyses do not constitute strong evidence that the inclusion or exclusion of a particular BCT caused the intervention's success or failure; they only note correlations.[164] A smaller number of reviews use

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[162] Charles Abraham and Susan Michie, "A Taxonomy of Behavior Change Techniques Used in Interventions," *Health Psychology* 27, no. 3 (2008), 379-87.

[163] These include:

Susan Michie, Stefanie Ashford, Falko F. Sniehotta, Stephan U. Dombrowski , Alex Bishop, and David P. French, "A refined taxonomy of behaviour change techniques to help people change their physical activity and healthy eating behaviours: The CALORE taxonomy," *Psychology and Health* 26, no. 11 (November 2011), 1479-98,

Susan Michie, Michelle Richardson, Marie Johnston, Charles Abraham, Jill Francis, Wendy Hardeman, Martin P. Eccles, James Cane, and Caroline E. Wood, "The Behavior Change Technique Taxonomy (v1) of 93 Hierarchically Clustered Techniques: Building an International Consensus for the Reporting of Behavior Change Interventions," *Annals of Behavioral Medicine* 46, no. 1 (March 2013), 81-95, and

Susan Michie, Natasha Hyder, Asha Walia, and Robert West, "Development of a taxonomy of behaviour change techniques used in individual behavioural support for smoking cessation," *Addictive Behaviors* 36, no. 4 (April 2011), 315-9.

[164] These correlations could be explained by confounding variables, and the results of BCT analyses might mask the true underlying cause of the differences in effectiveness across interventions. For example, if a group of studies finding statistically significant results tended to use a particular theory or combination of BCTs, it could be that success was mostly driven by one specific BCT, which would lead the other BCTs that those researchers tended to use to have misleadingly high correlations with success. Alternatively, as Kevin A. Cradock, Gearóid ÓLaighin, Francis M. Finucane, Heather L. Gainforth, Leo R. Quinlan, and Kathleen A. Martin Ginis, "Behaviour change techniques targeting both diet and physical activity in type 2 diabetes: A systematic review and meta-analysis," *The International Journal of Behavioral Nutrition and Physical Activity* 14 (2017) point out, it could be that "certain BCTs are necessary but not sufficient elements

additional statistical techniques to identify differences in combinations of BCTs working synergistically.[165] Given that BCT analyses tend to find more statistically significant positive associations with intervention effectiveness than significant negative associations, the more BCT analyses that are included, the more likely it is that a BCT will have multiple reviews finding positive associations. An accumulation of evidence suggesting that particular groups of BCTs seem to be effective should therefore be interpreted with caution. Another methodological limitation is that the effects of variations in the use of BCTs are rarely considered specifically for longer-term follow-up periods.

Some of the BCTs identified as promising in this section are evaluated more directly as independent interventions in the section on "Individual and small group educational and supportive behavioral interventions."

To see if BCT analyses across various intervention types and health behaviors found consistent associations between certain BCTs and effectiveness (or ineffectiveness), the analyses have been plotted on a spreadsheet.[166] Plotting the findings of reviews in this way presents them as if their conclusions are equally robust. Although a few steps were taken to reduce this problem,[167] comments have not been provided on the strength of evidence for each association within each BCT analysis, or the methodological quality of the included reviews.

A small number of BCTs were found to be associated with intervention effectiveness in multiple reviews, across multiple health behaviors. These were "prompt specific goal setting," "prompt feedback on performance," "barrier identification/problem solving," and "social support (unspecified)." Several BCTs were found to have positive associations with effectiveness in several reviews, but were confined to a small spread of health behaviors.[168]

Given that several different BCT taxonomies were used in the various BCT analyses included, seemingly similar BCTs were also grouped together in a separate analysis.

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of interventions and perhaps the presence of certain BCTs is required for the key BCTs to work as intended," and some BCTs may "work synergistically." These interaction effects of BCTs would not be easily picked up in most BCT analyses and misleading results could encourage a focus on some BCTs at the expense of others, which might actually reduce effectiveness.

165 Lenneke van Genugten, Elise Dusseldorp, Thomas Llewelyn Webb, and Pepijn van Empelen, "Which Combinations of Techniques and Modes of Delivery in Internet-Based Interventions Effectively Change Health Behavior? A Meta-Analysis," *Journal of Medical Internet Research* 18, no. 6 (June 2016), e15 use the meta-CART technique. They explain that "Meta-CART consists of two phases. In the first phase, a CART analysis is applied and in the second phase, subgroup meta-analysis is applied to the results of the first phase. CART is a machine learning technique that builds classification trees for categorical outcome variables and regression trees for continuous outcome variables. In the context of our review, the CART algorithm partitions interventions into homogeneous subsets, resulting in a binary tree in which the end nodes contain the most homogeneous groups with respect to within-group effect size. The partitioning is based on intervention characteristics (eg, a BCT)."

166 See the spreadsheet on "Moderator Analyses."

167 See the sections for "Markings on the review authors" and "Color coding" on the spreadsheet for "Moderator Analyses."

168 These included "provide instruction," "prompt self-monitoring of behavior," "facilitate social comparison," "provide feedback on performance," and "inform about antecedents," all of which included some positive evidence for diet interventions. Others that did not have positive associations with effectiveness in dietary consumption interventions were "teach to use prompts or cues," "prompt practice," "action planning," "credible source," "goal setting (behavior)," "behavioral skills arguments," "intrapersonal skills training," and "interpersonal skills training."

The overlapping groups of "barrier identification" and "problem solving" were found to be positively associated with effectiveness across a variety of health behaviors, including from one review for dietary interventions. The related group for action planning included positive evidence from both PA and smoking. The BCTs in this group all focus on assisting individuals to identify potential difficulties with their behavioral change plans and to plan for how to deal with these issues.

A group for various forms of social support contained BCTs found to be associated with effectiveness in four health behaviour areas, including dietary change.

The groups of "self-monitoring,"[169] "feedback," and "goal setting" were all found to have positive associations across several health behaviors, including dietary change. Reviews only found positive associations between these BCTs and intervention effectiveness, except for one review of low methodological quality that found negative associations for a large number of BCTs.[170] These three groups combined, plus several other BCTs, can be understood as facilitating self-management of behavioral change. This broader group for self-management was positively associated with effectiveness in some form in a large number of reviews, across five separate health behaviors. Arguably, "social support" should be included in this group too, in which case the evidence would be even stronger.

BCTs relating to groups for rewards and for practice of the behavior were associated with effectiveness in multiple reviews, but only for PA.

The BCT "provide normative information about others' behavior" and the overlapping groups for "provide information about others" and "social comparison and norms" each had a mixture of several reviews finding positive associations with effectiveness and several finding negative associations. There was some positive evidence from reviews focused specifically on dietary change, but the mixed findings here suggest that providing norms information may be counterproductive in certain contexts.

Two reviews for PA found negative associations between the BCT "provide information on where and when to perform the behavior" and effectiveness.

Two overviews found mixed evidence that weakly suggested that inclusion of interpersonal skills training improves effectiveness for interventions addressing contraception use, and another review found evidence suggesting that the involvement of the male partner improves contraceptive use.[171]

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[169] Erin S. Pearson, "Goal setting as a health behavior change strategy in overweight and obese adults: A systematic literature review examining intervention components," *Patient Education and Counseling* 87, no. 1 (2012), 32-42, summarize that, "[s]elf-monitoring is a process whereby an individual observes and manually monitors his or her own behavior, and then evaluates the outcomes through comparisons to performance standards or goals."

[170] David P. French, Ellinor K. Olander, Anna Chisholm, and Jennifer McSharry, "Which Behaviour Change Techniques Are Most Effective at Increasing Older Adults' Self-Efficacy and Physical Activity Behaviour? A Systematic Review," *Annals of Behavioral Medicine* 48, no. 2, (October 2014), 225–34.

[171] Judith Covey, Harriet E. S. Rosenthal-Stott, and Stephanie J. Howell, "A synthesis of meta-analytic evidence of behavioral interventions to reduce HIV/STI," *Journal of Behavioral Medicine* 39, no. 3 (June 2016), 371-85 found positive significant effects in 5 out of 20 included analyses that measured the inclusion of interpersonal skills training as a potential moderator of effectiveness in interventions promoting condom use, negative significant effects in 2, and non-significant effects in 9 (4 of which may have been due to insufficient statistical power).

Five included reviews conducted BCT analyses specifically for non face-to-face modes of delivery, such as computer-based or digital interventions. There were multiple positive associations with effectiveness for the BCTs "prompt review of behavioral goals" and "social support (unspecified)." The groups for "problem solving," "goal setting," "self-management more broadly," and "social support" all had more than one positive association between included BCTs and non face-to-face intervention effectiveness.

Analysis of the content of phone apps suggests that they have not always focused on the BCTs found to be effective in health behavior research.[172] This suggests that the most marketable features of behavior change interventions are not necessarily the most effective.

Cleo Protogerou and Blair T. Johnson, "Factors Underlying the Success of Behavioral HIV-Prevention Interventions for Adolescents: A Meta-Review," *Aids and Behavior* 18, no. 10 (2014), 1847-63, an overview of 11 reviews considering behavioral HIV-prevention interventions found that, "[t]he most frequently cited efficacious BCTs were sexual communication and negotiation skills training (e.g., learning how to communicate sexual needs, negotiate and practice condom use, be assertive, and refuse unprotected sex)." They were not able to compare between effective and ineffective studies to note the associations between BCTs and effectiveness, since all included reviews found significant effects on at least one outcome (not all of which were behavioral).

Mwelwa Phiri, R. King, and J. N. Newell, "Behaviour change techniques and contraceptive use in low and middle income countries: a review," *Reproductive Health* 12, no. 100 (October 2015). They summarize that, "[t]he most effective interventions appear to be those that involve male partner involvement in the decision to initiate contraceptive use [4 studies cited]... However, two of these studies consisted of self-reporting of contraceptive use either in the presence of the male partners or by the male partners. As the methods included in the studies were female user dependent (pills and injectables), this could affect the validity of the results, as male partners may not have been present when their female partners used the contraceptive."

[172] Sarah Hales, Caroline Dunn, Sara Wilcox, and Gabrielle M. Turner-McGrievy, "Is a Picture Worth a Thousand Words? Few Evidence-Based Features of Dietary Interventions Included in Photo Diet Tracking Mobile Apps for Weight Loss," *Journal of Diabetes Science and Technology* 10, no. 6 (2016), 1399-1405, a review of "mobile apps for photo diet tracking" found that of the 29 apps reviewed, "6 apps (21%) did not use any of the self-regulation or other behavior change techniques examined."

Chih-Hsiang Yang, Jaclyn P. Maher, and David E. Conroy, "Implementation of Behavior Change Techniques in Mobile Applications for Physical Activity," *American Journal of Preventive Medicine* 48, no. 4 (April 2015), 452-455 identified the top-ranked PA mobile apps and found that they do not tend to focus on BCTs identified as most promising in research.

Artur Direito, Leila Pfaeffli Dale, Emma Shields, Rosie Dobson, Robyn Whittaker, and Ralph Maddison, "Do physical activity and dietary smartphone applications incorporate evidence-based behaviour change techniques?" *BMC Public Health* 14, no. 646 (June 2014) concluded that, "BCTs associated with increased intervention effectiveness were in general more common in paid apps." They found "[n]o differences in the number of behavior change techniques between free and paid apps, or between the app stores" (iTunes and Google Play).

Elizabeth J. Lyons, Zakkoyya H. Lewis, Brian G. Mayrsohn, and Jennifer L. Rowland, "Behavior Change Techniques Implemented in Electronic Lifestyle Activity Monitors: A Systematic Content Analysis," Journal of Medical Internet Research 16, no. 8 (August 2014), e192, a study of the BCTs in "Electronic activity monitors (such as those manufactured by Fitbit, Jawbone, and Nike)" found that, "[t]he monitors included a range of 5-10 of 14 total techniques identified from the research literature as potentially effective."

Emmanuel Kuntsche, Sandra Kuntsche, Johannes Thrul, and Gerhard Gmel, "Binge drinking: Health impact, prevalence, correlates, and interventions," *Psychology & Health* 32 (May 2017), 21 note that, "while there are now hundreds of commercial alcohol-related smartphone apps available on the iTunes and Google Play stores, less than 20% of apps promote alcohol reduction, and very few of these contain valid behavioural change techniques."

Intensity of intervention

Making interventions more intensive—such as providing greater amounts of contact time, increasing the number of contacts, or lengthening the duration of the intervention—seems intuitively likely to increase the impact of the intervention. Some reviews evaluate this by conducting separate meta-analyses for interventions above or below certain arbitrary cutoff points that represent more or less intensive interventions, such as comparing interventions sending text messages once a day or more to those that send text messages less frequently than this. Sometimes significance tests are carried out between these groups; otherwise the CIs for the effect sizes can be used to roughly compare between groups. Other reviews conduct regression analyses to see whether effect sizes are significantly correlated with certain measures of intensity. Qualitative reviews sometimes comment on whether high levels of intensity were more or less common among the interventions that found significant effects. All such evaluations are included here where the review is focused primarily on individual or small group educational or behavioral interventions.

Similar numbers of reviews were categorized as mostly providing evidence that higher intensity increases effectiveness (27 reviews and 2 overviews) and as mostly providing evidence that it does not (28 reviews and 2 overviews). Six reviews found some significant evidence suggesting that increased intensity decreases overall effectiveness. This constitutes strong evidence that increasing the intensity of interventions in the farmed animal movement would be more likely to increase their overall effectiveness than to decrease their effectiveness but only very weak evidence that more intensive interventions are likely to be more effective at changing behavior in the farmed animal movement than less intensive interventions.[173] Where meta-analyses directly evaluated the behavioral effects of more intensive interventions compared to less intensive interventions, or where the importance of intensity as a moderator was measured in meta-regression, there was a range from very slightly lower behavioral effects to very substantially larger effects. Slightly larger effects seem most typical. The results of indirect comparisons in meta-analyses were even less clear, though they also suggest that small differences in favor of higher intensity interventions are most typical.[174]

More specifically, meta-analyses with behavioral outcomes suggest a small or very small benefit from increasing the duration of an intervention. Direct comparison in one meta-analysis suggested that increasing the contact time involved in interventions has very large benefits for behavioral outcomes, though indirect comparisons suggested smaller benefits were likely. Meta-analyses suggest very small benefits may occur from increasing the number of contacts in an intervention. However, the CIs are very wide for each of these specific issues and some of these findings are based on a small number of meta-analyses.[175]

Considering the effects of more specific forms of changes in intensity by more specific types of intervention provides a small number of useful insights.[176] For most such questions, there was only one review that provided relevant evidence, if evidence was identified at all. Among such questions, the most consistent,

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Leila Kahwati, Meera Viswanathan, Carol E. Golin, Heather Kane, Megan Lewis, and Sara Jacobs, "Identifying configurations of behavior change techniques in effective medication adherence interventions: a qualitative comparative analysis," *Systematic Reviews* 5, no. 83 (May 2016), a review of 166 medication adherence apps, found that, "[t]he number of behavior change techniques contained in an app ranged from zero to seven (mean=2.77)." Given that only "12 of a possible 96" BCTs were used, they conclude that many BCTs are being undervalued in apps.

[173] See the spreadsheet "Strength of Evidence Assessments."

[174] See the spreadsheet "Effect Size Estimates."

[175] See the spreadsheet "Effect Size Estimates."

[176] See the tab "Other moderators" in the supplementary file on "Moderator Analyses."

positive evidence comes from four reviews that found that increasing the number of contacts in interventions delivering tailored print-based materials increased their effectiveness. Although it is possible that the increase in effectiveness in these interventions was caused by the ability to provide tailored support at different stages on the path to behavioral change, rather than an increase in the number of contacts,[177] one Cochrane review found that, for print-based self-help materials, "results favoured tailored interventions when the tailored interventions involved more mailings than the non-tailored interventions" (RR 1.42, 95% CI 1.20 to 1.68, 9 studies), "but not when the two conditions were contact-matched" (RR 1.07, 95% CI 0.89 to 1.30, 10 studies).[178]

There is consistent evidence from 7 separate included reviews that increasing the intensity of online and computer-based interventions does not increase their effectiveness; two of these reviews found significant evidence that increasing intensity actually reduced the impact, and another review found insignificant evidence pointing in this direction.[179] Most of the evidence relates to the overall duration of the interventions, although two reviews found that increasing the number of online contacts had no effect.

There is also evidence that increasing the number of messages received in text messaging interventions has no significant impact on the intervention's effectiveness.[180] However, the evidence relating to the effects of increasing the overall duration of such interventions, or incorporating two-way text messaging (where the participant is required to reply to the text messages that they receive) was mixed. On the specific issue of the effects of incorporation of two-way communication on behavioral effects, indirect comparisons in meta-analyses suggest that very small or small differences in favor of one-way communication may be most typical.[181]

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[177] The term "contacts" is not clearly defined in these reviews, but presumably refers to the number of separate print-based materials that individuals receive, as opposed to a variable of less interest such as the number of times that participants interact with experimenters.

Hypothesizing an explanation for the association between a greater number of contacts and higher intervention effectiveness, Seth M. Noar, Melissa S. Harris, and Christina Anderson, "Does Tailoring Matter? Meta-Analytic Review of Tailored Print Health Behavior Change Interventions," *Psychological Bulletin* 133, no. 4 (August 2007), 686 note that, "analyses revealed that another important moderating variable was number of intervention contacts. This is particularly important in the tailoring area given that many studies are based on a stage of change perspective that suggests that individuals may move slowly through the stages and may cycle and recycle through the stages numerous times before ultimately maintaining a behavior change (Prochaska et al., 1992). Thus, such a model suggests that individuals may need multiple points of contact in which feedback is dynamically tailored to their current stage of change, attitudes, and so forth. Moreover, studies with additional intervention contacts have the opportunity not only to give additional feedback but to give a different type of feedback. Studies with one point of contact typically give individuals normative feedback, or tailored messages based on a comparison of one's responses to those of their peers. Studies with multiple contacts, however, have the opportunity to give individuals so called ipsative feedback, or messages based on a comparison of one's current responses with their responses at the previous intervention time point (Prochaska et al., 1993; Velicer et al., 1993). The current meta-analysis suggests that studies that utilized more intervention contact points, many of which included ipsative feedback, were more effective in stimulating health behavior change than those that did not."

[178] Jamie Hartmann-Boyce, Tim Lancaster, and Lindsay F. Stead, "Print-based self-help interventions for smoking cessation," *Cochrane Database of Systematic Reviews* 6 (June 2014; first published 2002). They rated the quality of the evidence as moderate for each finding.

[179] See the tab "Other moderators" in the spreadsheet "Moderator Analyses."

[180] See the tab "Other moderators" in the spreadsheet "Moderator Analyses."

[181] See the spreadsheet "Effect Size Estimates."

There was some evidence suggesting that brief interventions are not made more effective by increasing the amount of contact time involved in interactions and there was mixed evidence regarding the issue of whether increasing the number of contacts in BIs would increase the overall effect.[182] Combined with the evidence suggesting the BIs are likely to be effective overall,[183] this suggests that single-contact BIs where the conversations do not last very long can still be effective. There is some evidence that increasing the intensity of motivational interviewing does not increase its effectiveness.[184] Two reviews found that increases in the duration of interventions focused on self-help, self-monitoring, or self-management did not alter the effect size.[185]

Complexity of intervention

Some interventions are more complex than others because they incorporate a larger number of BCTs, because they incorporate both educational and behavioral components, or because they are delivered simultaneously in multiple settings. Some reviews evaluate whether these sorts of modifications improve the effectiveness of interventions. Similarly to evaluations of intensity, this can be done through indirect comparison of the results of separate sub-analyses or through meta-regression. Some relevant information from research items included elsewhere in this literature review may be missing from this section, since analysis of the effects of increasing complexity was not initially expected to be included in this literature review.

Overall, the health behavior literature provides very weak evidence that more complex interventions are likely to be more effective at changing behavior in the farmed animal movement.[186] Indirect comparisons suggest moderately or substantially larger behavioral effects from more complex interventions than less complex interventions, though CIs suggest a wide range of possibilities and results vary across reviews.[187] Given that increases in complexity are likely to require increases in costs, the effects of increases in complexity on the overall cost-effectiveness of interventions are unclear.

More specifically, in two meta-analyses across health behaviors, one found small positive but statistically insignificant effects of increasing the number of intervention components on behavioral outcomes, while another found moderate positive effects. Meta-regression in an analysis of 22 papers for dietary interventions among adults of retirement age "showed that one additional BCT led to 8.3g (95% CI 0.006 to 16.6g) increase" in fruit and vegetable intake.[188] Indirect comparisons also suggest moderate or large increases in

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[182] See the tab "Other moderators" in the spreadsheet "Moderator Analyses."

[183] See the section on "Brief interventions (BIs)."

[184] See the tab "Other moderators" in the spreadsheet "Moderator Analyses." Additionally, C. C. DiClemente, C. M. Corno, M. M. Graydon, A. E. Wiprovnick, D. J. Knoblach, "Motivational interviewing, enhancement, and brief interventions over the last decade: A review of reviews of efficacy and effectiveness," *Psychology of Addictive Behaviors* 31, no. 8 (December 2017), 862-887 concluded that "Findings for effectiveness of more intensive motivational interventions or combinations are mixed."

[185] See the tab "Other moderators" in the spreadsheet "Moderator Analyses."

[186] See the spreadsheet "Strength of Evidence Assessments."

[187] See the tab "Indirect tests individual reviews" in the spreadsheet "Effect Size Estimates."

[188] Jose Lara, Elizabeth H. Evans, Nicola O'Brien, Paula J. Moynihan, Thomas D. Meyer, Ashley J. Adamson, Linda Errington, Falko F. Sniehotta, Martin White, and John C. Mathers, "Association of behaviour change techniques with effectiveness of dietary interventions among adults of retirement age: a systematic review and meta-analysis of randomised controlled trials," *BMC Medicine* 12, no. 177 (October 2014).

behavioral outcomes from increasing the number of intervention components, though CIs suggest a wide range of possibilities.[189]

Several reviews found that education-only interventions were less successful than those that incorporated additional behavioral components.[190] Indirect comparisons suggest that large or moderate increases in behavioral outcomes are most typical for the additional inclusion of behavioral components. CIs suggest a wide range of possibilities. Meta-regression in one review also suggested small improvements in effectiveness from spending a larger proportion of the time in each session on "skills training."[191]

Social influences curricula are curricula where "students are taught how to deal with peer pressure, high risk situations, [and] how to effectively refuse attempts to persuade substance use from both direct and indirect sources." Social competence curricula aim to improve general social competence and to decrease susceptibility to smoking or other substances from "poor personal or social skills" or "a poor personal self concept."[192] Evidence suggests that mixed curricula in schools are more effective at reducing smoking and drug use than either social competence or social influence curricula delivered individually.[193]

There is some qualitative evidence that interventions in multiple settings were more effective than interventions carried out solely in schools.[194] There is some qualitative evidence (mostly focused on medication adherence) that increasing the complexity of self-management interventions increases their effectiveness.[195]

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[189] See the tab "Indirect tests individual reviews" in the spreadsheet "Effect Size Estimates."

[190] See the tab "Other moderators" in the supplementary file on "Moderator Analyses."

[191] See the tab "Direct tests individual reviews" in the spreadsheet "Effect Size Estimates."

[192] Roger E. Thomas, Julie McLellan, and Rafael Perera, "School-based programmes for preventing smoking," *Cochrane Database of Systematic Reviews* 4 (April 2013; first published 2002).

[193] Roger E. Thomas, Julie McLellan, and Rafael Perera, "School-based programmes for preventing smoking," *Cochrane Database of Systematic Reviews* 4 (April 2013; first published 2002) found that, "the combined social competence and social influences curricula (six RCTs) showed a statistically significant effect in preventing the onset of smoking (OR 0.49, 95% CI 0.28 to 0.87; seven arms); whereas significant effects were not detected in programmes involving information only (OR 0.12, 95% CI 0.00 to 14.87; one study), social influences only (OR 1.00, 95% CI 0.88 to 1.13; 25 studies)." Additionally, "Social competence curricula (five C-RCTs/seven arms) versus control showed a statistically significant result in favour of the intervention (OR 0.52, 95 % CI 0.30 to 0.88; P = 0.02; I^2 = 0%)." Although the study on information only has wide CIs, we can be more confident that the pooled effect of social influences curricula is lower than social competence or combined curricula.

The authors explain that social influences curricula are when "students are taught how to deal with peer pressure, high risk situations, how to effectively refuse attempts to persuade substance use from both direct and indirect sources." Social competence curricula improve general social competence and aim to decrease susceptibility to smoking from "poor personal or social skills" or "a poor personal self concept."

Fabrizio Faggiano, Silvia Minozzi, Elisabetta Versino, Daria Buscemi, "Universal school-based prevention for illicit drug use," *Cochrane Database of Systematic Reviews* 12 (December 2014; first published 2005) compared "social competence" approaches to usual curricula or no intervention and then did the same for "social influence" approaches and approaches that combined both. Social competence curricula had similar, insignificant effects on marijuana use (RR 0.90, 95% CI 0.81 to 1.01, 4 studies) to social influence curricula (RR 0.88, 95% CI 0.72 to 1.07, 3 studies at follow-up). Combinations of both produced better outcomes for maijuana use (RR 0.79, 95% CI 0.59 to 1.05, 3 studies), though the CIs of each group overlapped.

[194] See the tab "Other moderators" in the spreadsheet "Moderator Analyses."

[195] See the tab "Other moderators" in the spreadsheet "Moderator Analyses."

Most evaluations of the effects of adding further modes of delivery to online and computer-based interventions found that this improved effectiveness. The evidence was more mixed for doing the same for text messaging interventions.[196] Several meta-analyses of text messaging for smoking cessation found significant effects in spite of several of the included studies using fairly intensive additional interventions in both the control and intervention groups, such as counseling or additional tailored materials. Other comparisons to no intervention controls also found significant effects.[197] These findings suggest that text messaging interventions and online or computer-based interventions can be effective as an adjunct to other intervention types.

Indirect comparisons from included meta-analyses suggest that, relative to using a single mode of delivery, using multiple modes of delivery most typically encourages very small increases or no change in behavioral effects.[198] However, a review summarizes that one study foind that "website information without e-mail messaging had significantly increased smoking abstinence because messaging may undermine website utilization."[199] No other reviews found significant negative effects of increased complexity and other reviews found that adding supplementary modes of delivery improved effectiveness of internet interventions, but this study's finding suggests that the different components of interventions may interact in unexpected ways.[200]

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[196] See the tab "Other moderators" in the spreadsheet "Moderator Analyses."

[197] See the tab "GRADE individual reviews" on the spreadsheet "Strength of Evidence Assessments."

For example, Robyn Whittaker, Hayden McRobbie, Chris Bullen, Anthony Rodgers, Yulong Gu, "Mobile phone-based interventions for smoking cessation," *Cochrane Database of Systematic Reviews* 4 (April 2016; first published 2009). They rated the evidence as moderate quality by GRADE criteria. The authors note that when they "removed studies with interventions that included in-person contacts from the main analysis (all studies 26 week outcomes) in order to examine only those interventions that used text messaging only, there was no difference in the results (RR 1.69, 95% CI 1.46 to 1.95, I2 = 74%; seven studies; 9887 participants)." They note that, "[t]he control programmes across the studies varied from nothing... to fortnightly... or daily… text messages, written/Internet untailored materials… and untailored messages, to standard cessation advice and treatment." However, the authors "carried out a sensitivity analysis on the main analysis of all studies' 26 week outcomes (12 studies). We removed studies with more active control programmes... this made minimal difference to the overall result of the pooled analysis (RR 1.66, 95% CI 1.45 to 1.91, I2 = 66%; 10 studies; 11,176 participants)."

[198] See the tab "Indirect tests individual reviews" in the spreadsheet "Effect Size Estimates."

[199] Huyen Phuc Do, Bach Xuan Tran, Quyen Le Pham, Long Hoang Nguyen, Tung Thanh Tran, Carl A. Latkin, Michael P. Dunne, and Philip R. A. Baker, "Which eHealth interventions are most effective for smoking cessation? A systematic review," *Patient Preference and Adherence* 2018, no. 12 (July 2018), 2071, citing D. Fraser, K. Kobinsky, S. S. Smith, J. Kramer, W. E. Theobald, T. B. Baker, "Five population-based interventions for smoking cessation: a MOST trial," *Transl Behav Med* 4, no. 4 (2014), 382–390.

[200] More speculatively, the evidence from this study, the evidence from a review that found that increasing complexity may have detracted from the effectiveness of some of the evaluated BIs (Megan C. Whatnall, Amanda J. Patterson, Lee M. Ashton, and Melinda J. Hutchesson, "Effectiveness of brief nutrition interventions on dietary behaviours in adults: A systematic review," *Appetite* 120 (2018), 342, note that, "[t]he proportion of effective interventions was <30% for interventions with zero, one and two BCTs, 100% of interventions with seven BCTs, and 50% for interventions with nine BCTs"), and the mixed evidence on increasing the complexity of text messaging interventions together provide evidence that overcomplicating intervention types that work partially through their simplicity and brevity might be ineffective or even counterproductive.

One review focused on obesity explored specific combinations of BCTs, finding that some were more effective than others. For example, providing information about the health consequences of behavior influenced healthy eating and PA more effectively if it was combined with intention formation prompting.[201]

Tailoring

Tailored interventions are those that have content that varies according to a recipient's individual characteristics or needs. Tailoring in the health behavior literature is often based on the transtheoretical model's stages of change or on personalized risk assessments, although other forms of tailoring are possible.[202] Any reviews measuring the effects of tailoring are included here.

There is very weak evidence from the health behavior literature that tailored interventions in the farmed animal movement are likely to be more effective than non-tailored equivalents.[203] One outlier review found a very high coefficient in meta-regression, but the other meta-analyses suggest that tailoring most typically encourages very small or small differences in behavioral outcomes, relative to similar interventions that are not tailored. CIs ranged from moderate differences in favor of non-tailored interventions to very large differences in favor of tailored interventions. Indirect comparisons in meta-analyses suggest that moderate or large differences in favor of tailored interventions are possible.[204] Additionally, many of the interventions evaluated—and found to be effective—elsewhere in this literature review involve some form of screening or tailoring.[205] It is possible that tailoring helps to explain why such interventions are effective.

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[201] Elise Dusseldorp, Lenneke van Genugten, Stef van Buuren, Marieke W. Verheijden, and Pepijn van Empelen, "Combinations of techniques that effectively change health behavior: Evidence from MetaCART analysis," *Health Psychology* 33, no. 12 (2014), 1535. For this combination (n = 22), the combined effect size was SMD 0.77. For those prompting intention formation but not providing information about the behavior-health link (n = 51), SMD was lower (0.41) and SMD was also lower (0.36, n = 33) for those not prompting intention formation at all.

On page 1537 they note that subgroup analysis showed that the difference between the three groups in mean effect sizes was significant ($p < 0.01$).

[202] Seth M. Noar, Melissa S. Harris, and Christina Anderson, "Does Tailoring Matter? Meta-Analytic Review of Tailored Print Health Behavior Change Interventions," *Psychological Bulletin* 133, no. 4 (August 2007), 674 note that, "tailored communication is uniquely individualized to each person, whereas targeted messages are developed to be effective with an entire segment of the population. Tailored messages, however, do require individualized assessments of members of the population to develop such communications… A theoretical perspective that has been a driving force in the tailored message arena is the transtheoretical model (TTM) and stages of change… The TTM suggests that because individuals' attitudes, strategies, and skills differ at varying stages of the change process, interventions should be uniquely tailored to those stages."

For examples of other possible tailoring methods, see Eline S. Smit, Annemiek J. Linn, and Julia C. M. van Weert, "Taking online computer-tailoring forward: The potential of tailoring the message frame and delivery mode of online health behaviour change interventions," *The European Health Psychologist* 17, no. 1 (2015), 25-31.

[203] See the spreadsheet "Strength of Evidence Assessments."

[204] See the tab "Indirect tests individual reviews" in the spreadsheet "Effect Size Estimates."

[205] See, for example, the reviews that refer to "screening" in the section on "Brief Interventions (BIs)" in "Alcohol." As another example, Julia V. Bailey, Elizabeth Murray, Greta Rait, Catherine H. Mercer, Richard W. Morris, Richard Peacock, Jackie Cassell, and Irwin Nazareth, "Interactive computer-based interventions for sexual health promotion," *Cochrane Database of Systematic Reviews* 9 (September 2010) found significant effects of tailored computer interventions on sexual behavior (OR 1.75, 95% CI 1.18 to 2.59), though one study cited in Bailey et al. which directly compared tailored versions to non-tailored versions produced unclear results.

Included research items found evidence in favor of tailoring for interventions delivered by telephone and for online or computer-based interventions. The results for the effects of tailoring on interventions using print-based materials were more mixed. There is evidence from 3 reviews that tailoring does not improve the effectiveness of text messaging interventions, although 1 review came to the opposite conclusion.[206]

Three reviews found no effect on behavioral outcomes from providing multiple variations of an intervention to the same individual, with content that is tailored by their stage of change in the transtheoretical model. However, one review found evidence of very small increases in effect sizes.[207]

Fear appeals

Fear appeals are messages or images that encourage a sense of fear or threat. Although evidence relating to this was not identified in systematic searches, additional evidence was sought out for this question, since it seems especially relevant to the farmed animal movement; advocates have often used graphic images of animal suffering, though the effects this has on behavior are unclear.

There is a variety of evidence from non-experimental studies (e.g. studies using focus groups) that suggests that fear appeals successfully impact certain key determinants of behavior change.[208] There is also experimental evidence that fear appeals positively affect these determinants.[209] In a recent academic debate, evidence cited variously suggested that the effects of threatening messaging will be small, non-existent, or counterproductive if the recipient's "efficacy" (including both their "assessments of the effectiveness of potential responses" and "ability to undertake these successfully"[210]) is not also improved, and that other

[206] See the tab "Other moderators" in the spreadsheet "Moderator Analyses."
[207] See footnote 6 on the main report.
[208] See, for example, David Hammond, "Health warning messages on tobacco products: a review," *Tobacco Control* 20 (2011), 327-37.
[209] See, for example, Melanie B. Tannenbaum, Justin Hepler, Rick S. Zimmerman, Lindsey Saul, Samantha Jacobs, Kristina Wilson, and Dolores Albarracín, "Appealing to Fear: A Meta-Analysis of Fear Appeal Effectiveness and Theories," *Psychological Bulletin* 141, no. 6 (2015), 1178-1204 and the five criticized meta-analyses in Robert A. C. Ruiter, Loes T. E. Kessels, Gjalt-Jorn Y. Peters, and Gerjo Kok, "Sixty years of fear appeal research: Current state of the evidence," *International Journal of Psychology* 49, no. 2 (April 2014), 63-70.
[210] Robert A. C. Ruiter, Loes T. E. Kessels, Gjalt-Jorn Y. Peters, and Gerjo Kok, "Sixty years of fear appeal research: Current state of the evidence," *International Journal of Psychology* 49, no. 2 (April 2014), 63-70.

psychological factors are also important.[211] Some research on substance abuse outcomes,[212] moderator analysis in reviews on sexual health, and brain-scanning evidence[213] also suggests that there may be negative effects of fear appeals.

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[211] See, for example, Gjalt-Jorn Ygram Peters, Robert A. C. Ruiter, Gill A. ten Hoor, Loes T. E. Kessels, and Gerjo Kok, "Towards consensus on fear appeals: a rejoinder to the commentaries on Kok, Peters, Kessels, ten Hoor, and Ruiter (2018)," *Health Psychology Review* 12, no. 2 (2018), 152.

Some research suggests that the following factors affect the total impact of fear appeals:

- Personality factors; for example, Chrysantus Awagu and Debra Z. Basil, "Fear appeals: the influence of threat orientations," *Journal of Social Marketing* 6, no. 4 (2016), 361-6 conducted a study aiming "to assess the interactive impact of dispositional threat orientation and affirmation (both self-affirmation and self-efficacy) on the effectiveness of fear appeals." Though methodological weaknesses prevent this study from providing strong evidence, its results suggest that "Control-oriented individuals respond in a more adaptive manner" than "denial-oriented individuals" to fear appeals.
- Demographic factors; for example, Judith Covey, Harriet E. S. Rosenthal-Stott, and Stephanie J. Howell, "A synthesis of meta-analytic evidence of behavioral interventions to reduce HIV/STI," *Journal of Behavioral Medicine* 39, No. 3 (June 2016), 371-85 note that, "there is some evidence that the use of fear might be effective with Latino groups (Albarracin et al., 2008) or within interventions conducted in groups, rather than at an individual or community level (Johnson et al., 2005). Although further research is needed to support these observations, these findings highlight how the effectiveness of some techniques might be dependent on specific population or intervention characteristics." See also Melanie B. Tannenbaum, Justin Hepler, Rick S. Zimmerman, Lindsey Saul, Samantha Jacobs, Kristina Wilson, and Dolores Albarracin, "Appealing to fear: A Meta-Analysis of Fear Appeal Effectiveness and Theories," *Psychological Bulletin* 141, no. 6 (November 2015), 1178-1204.
- The interaction between fear appeals and efficacy messaging. Robert A. C. Ruiter, Loes T. E. Kessels, Gjalt-Jorn Y. Peters, and Gerjo Kok, "Sixty years of fear appeal research: Current state of the evidence," *International Journal of Psychology* 49, no. 2 (April 2014), 63-70 note that, "[a]ccording to the five meta-analyses summarized above, then, the elements of fear appeals most likely to motivate risk reduction behaviors are: (a) strengthening self-efficacy (i.e., suggesting that the person can successfully perform the recommended protective actions); (b) promotion of response efficacy (i.e., suggesting that the recommended action will avoid the danger); (c) awareness of susceptibility (i.e., suggesting that the threat is personally relevant); and not, (d) messages suggesting in an emotional way that the threat is severe." G.-J. Y. Peters, R. A. C. Ruiter, and G. Kok, "Threatening communication: a critical re-analysis and a revised meta-analytic test of fear appeal theory," *Health Psychology Review* 7, Supplement1 (2012), S8–S31 found that, "threat only had an effect under high efficacy (d = 0.31; 95% CI: 0.02–0.60, p < .05) [though note that here, the effect is still only just significant], and efficacy only had an effect under high threat (d = 0.71; 95% CI: 0.40–1.03, p < .001). In addition, some support was found for possible negative effects of threatening health information on persuasion if perceived efficacy is low (d = −0.31; 95% CI = −0.63 to 0.01, p = .07) [note that this result was not quite statistically significant]. That is, when acknowledging the threat, but feeling helpless what to do, people might engage in defensive action including more intensive continuation of the health risk behavior (cf. Goldenberg & Arndt, 2008). See also Melanie B. Tannenbaum, Justin Hepler, Rick S. Zimmerman, Lindsey Saul, Samantha Jacobs, Kristina Wilson, and Dolores Albarracin, "Appealing to fear: A Meta-Analysis of Fear Appeal Effectiveness and Theories," *Psychological Bulletin* 141, no. 6 (November 2015), 1178-1204).
- The degree of "severity" and "susceptibility." Melanie B. Tannenbaum, Justin Hepler, Rick S. Zimmerman, Lindsey Saul, Samantha Jacobs, Kristina Wilson, and Dolores Albarracin, "Appealing to fear: A Meta-Analysis of Fear Appeal Effectiveness and Theories," *Psychological Bulletin* 141, no. 6 (November 2015), 1178–1204 note that "The first hypothesis concerning depicted susceptibility and severity states that fear appeals high in depicted severity (but not depicted

In the recent debate, it was alleged that there was no experimental evidence showing that fear appeals have any positive effects on behavioral outcomes when compared to otherwise similar, non-fear-based messaging.[214] One response has highlighted experimental evidence of this kind that shows statistically significant positive effects.[215] This meta-analysis suggests small positive behavioral effects of fear-based messaging (SMD 0.36, 95% CI 0.20 to 0.51, 31 studies), though another meta-analysis of 13 studies on threat-based messages to modify driver behavior found no significant effect on behavior ($r = 0.03$, $p = .17$).[216]

> susceptibility) will positively influence attitudes but will not influence intentions or behaviors. The 95% CIs indicated that fear appeals that were only high in depicted severity had positive effects for attitudes (95% CI: [0.06, 0.37]) and intentions (95% CI: [0.20, 0.39]) but not behaviors (95% CI: [−0.08, 0.42])…. Although this hypothesis was not supported, our results partially replicated a previous meta−analytic finding in which high depicted severity influenced all three outcome measures (de Hoog et al., 2007). The second hypothesis is that fear appeals high in depicted susceptibility (but not severity) will positively influence intentions and behaviors but will not influence attitudes. The 95% CIs indicated that fear appeals that were only high in depicted susceptibility had positive effects for intentions (95% CI: [0.15, 0.59]) and behaviors (95% CI: [0.01, 0.88]) but not attitudes (95% CI: [−0.51, 1.47]). Therefore, this hypothesis was supported. The third hypothesis is that fear appeals with high depicted severity and high depicted susceptibility will positively influence attitudes, intentions, and behaviors. The 95% CIs confirmed this prediction and indicated that fear appeals high on both moderators had positive effects for attitudes (95% CI: [0.05, 0.38]), intentions (95% CI: [0.23, 0.47]), and behaviors (95% CI: [0.24, 0.63]). Further, the 95% CI for the focal outcome in our meta−analysis (the average of attitude, intention, and behavior outcomes) also supported this result: [0.28, 0.50]. Thus, when testing all three hypotheses, fear appeals generally had positive effects on attitudes, intentions, and behaviors when they were high in depicted severity and/or susceptibility."

[212] See, for example, Robert Hornik, Lela Jacobsohn, Robert Orwin, Andrea Piesse, and Graham Kalton, "Effects of the National Youth Anti-Drug Media Campaign on Youths," *American Journal of Public Health* 98, no. 12 (December 2008), 2229-36.

[213] Robert A. C. Ruiter, Loes T. E. Kessels, Gjalt-Jorn Y. Peters, and Gerjo Kok, "Sixty years of fear appeal research: Current state of the evidence," *International Journal of Psychology* 49, No. 2 (April 2014), 63-70 cite L. T. E. Kessels, R. A. C Ruiter, and B. M. Jansma, "Increased attention but more efficient disengagement: Neuroscientific evidence for defensive processing of threatening health information," *Health Psychology* 29 (2010), 346–354, a study that "recorded brain activity with an electroencephalogram and showed that daily smokers attend less to high-threat information about smoking (e.g., picture of a diseased lung) than to low-threat smoking information (e.g., picture of a person holding a cigarette). This effect was not found for non-smokers."

[214] Most notably Gerjo Kok, Gjalt-Jorn Ygram Peters, Loes T. E. Kessels, Gill A. ten Hoor, and Robert A. C. Ruiter, "Ignoring Theory and Misinterpreting Evidence: The False Belief in Fear Appeals," *Health Psychology Review* 12, no. 2 (December 2017), 111-25.

[215] Benjamin Xavier White and Dolores Albarracín, "Investigating Belief Falsehood. Fear Appeals Do Change Behavior in Experimental Laboratory Studies. A Commentary on Kok et al.," *Health Psychology Review* 12, No. 2 (2018), citing Melanie B. Tannenbaum, Justin Hepler, Rick S. Zimmerman, Lindsey Saul, Samantha Jacobs, Kristina Wilson, and Dolores Albarracin, "Appealing to fear: A Meta-Analysis of Fear Appeal Effectiveness and Theories," *Psychological Bulletin* 141, No. 6 (November 2015), 1178-1204.

[216] Rachel N. Carey, Daragh T. McDermott, and Kiran M. Sarma, "The Impact of Threat Appeals on Fear Arousal and Driver Behavior: A Meta-Analysis of Experimental Research 1990–2011," *PLoS ONE* (May 2013).

The evidence on this debate has come primarily from interventions discouraging smoking.[217] There is also evidence that the inclusion of pictures on cigarette health warning labels positively affects self-report of the determinants of smoking behavior and that gruesome or distressing images have greater effects than some types of non-gruesome images (see the section on "Packaging and labelling"). These findings also seem to provide indirect evidence in favor of the effectiveness of fear appeals.[218]

Overall, there is very weak evidence from the health behavior literature suggesting that fear appeals are likely to be effective overall in the farmed animal movement and that they are likely to be more effective than alternative plausible messaging strategies.[219]

Framing

"Gain-framed" messages emphasize the positive consequences of compliance with an advocated view or behavior, such as "if you stop eating meat, you are likely to live longer." "Loss-framed" messages emphasize the negative consequences of non-compliance, such as "eating meat decreases your expected life span." Some reviews also distinguish the gain-framed versus loss-framed dichotomy from differences in attribute framing; "Attribute framing is the positive versus negative description of a specific attribute of a single item or a state, for example, 'the chance of survival with cancer is 2/3' [positive attribute framing] versus 'the chance of mortality with cancer is 1/3' [negative attribute framing]."[220]

There is very weak evidence from the health behavior literature that gain-framed messages are similarly effective at changing behavior in the farmed animal movement to loss-framed messages. There is very weak evidence suggesting that positive attribute framing is likely to be similarly effective to negative attribute framing.[221]

If a significant difference were to exist in the farmed animal movement, there is weak evidence from the health behavior literature suggesting that gain-framed messaging would be more likely to be more effective

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[217] A protocol exists for a Cochrane review of "aversive visual images" across wider health behaviors (Gareth J. Hollands, Linda D. Cameron, Rachel A. Crockett, and Theresa M. Marteau, "Presentation of aversive visual images in health communication for changing health behaviour," *Cochrane Database of Systematic Reviews* 4 (April 2011)) but no review has yet been published.

[218] Indeed, Noel T. Brewer, Marissa G. Hall, and Seth M. Noar, "Pictorial cigarette pack warnings increase quitting: A comment on Kok et al.," *Health Psychology Review* 12, no. 2 (2018), 129-32 seem to assume that evidence of the effectiveness of pictorial health warning labels constitutes direct evidence of the effectiveness of fear appeals.

[219] See the spreadsheet "Strength of Evidence Assessments."

[220] Elie A. Akl, Andrew D. Oxman, Jeph Herrin, Gunn E. Vist, Irene Terrenato, Francesca Sperati, Cecilia Costiniuk, Diana Blank, and Holger Schünemann, "Framing of health information messages," *Cochrane Database of Systematic Reviews* 12 (December 2011).

As a further example, a gain-framed message might emphasize a positive consequence of positive behaviors (improved health from lower meat consumption), and use either positive attribute framing ("if you stop eating meat, you are likely to live longer") or negative attribute framing ("if you stop eating meat, you will decrease your risk of developing chronic diseases such as heart disease"). Alternatively, a loss-framed message might emphasize a negative consequence of negative behaviors (worsened health from higher meat consumption), and use either positive attribute framing ("eating meat decreases your expected life span") or negative attribute framing ("eating meat increases your risk of developing chronic diseases such as heart disease").

[221] See the spreadsheet "Strength of Evidence Assessments."

than loss-framed messaging. Three included meta-analyses (one of which used a combined measure of behavioral and indirect effects) suggest that differences are likely to be very small; the CIs ranged from very slightly higher effects from loss-framed messaging to slightly higher effects from gain-framed messaging.[222] Indirect comparison in one review seems to suggest large differences in favor of gain-framed messages.[223]

A narrative review and a small study focused on smoking propose specific contexts in which either gain-framing or loss-framing might be more effective,[224] while another review hypothesizes that "regulatory fit" may be a more important variable for explaining the inconsistencies in the research on framing.[225] A variety of other individual studies hypothesize and test potential moderators of framing effects.[226]

Narratives and testimonials

One review defines a narrative as a story that has "identifiable structure, is bounded in space and time, and contains implicit or explicit messages about the topic being addressed."[227] Such stories—often focusing on individuals whose health is at risk or has been affected by their behavior—are sometimes evaluated in the literature in comparison to non-narrative messages. Some research on smoking has evaluated testimonials; text or pictures with information from real individuals, rather than staged images or created text. This is related to the issue of narratives, in the sense that both are methods of personalizing health warnings and making them more credible, although a testimonial could be compared to another form of narrative health warning.

There is very weak evidence from the health behavior literature that the use of real-life testimonials would not improve the effectiveness of interventions in the farmed animal movement.[228] Nevertheless, there may be indirect advantages to using testimonials such as protecting the wider credibility of animal advocates and improving the legal security of organizations conducting behavior change interventions.[229]

The results of two meta-analyses are unclear on the effects of narratives; while both report significant positive results, there are methodological reasons to suspect that better quality meta-analyses, or equivalent meta-analyses more directly focused on dietary outcomes, would have found insignificant effects on some of the

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[222] See the tab "Direct tests individual reviews" in the spreadsheet "Effect Size Estimates."

[223] See the tab "Indirect tests individual reviews" in the spreadsheet "Effect Size Estimates."

[224] Brian Wansink and Lizzy Pope, "When do gain-framed health messages work better than fear appeals?" *Nutrition Reviews* 73, no. 1 (January 2015), 4-11 and Hye Kyung Kim and Tae Kyoung Lee, "Conditional Effects of Gain–Loss-Framed Narratives among Current Smokers at Different Stages of Change," *Journal of Health Communication* 22, no. 12 (2017), 990-8.

[225] Ramona Ludolph and Peter J. Schulz, "Does regulatory fit lead to more effective health communication? A systematic review," *Social Science & Medicine* 128 (2015), 142-50.

[226] Searching into Google Scholar for ("gain-framed" OR "loss-framed" OR "gain-framing" OR "loss-framing") AND ("systematic review" OR meta-analysis) and limiting to the timeframe to 2014 onwards reveals several such results.

[227] Fuyuan Shen, Vivian C. Sheer, and Ruobing Li, "Impact of Narratives on Persuasion in Health Communication: A Meta-Analysis," *Journal of Advertising* 44, no. 2 (May 2015), 107.

[228] See the spreadsheet "Strength of Evidence Assessments."

[229] On the legal benefit, see the introduction of Emily Brennan, Erin K. Maloney, Yotam Ophir, and Joseph N. Cappella, "Potential Effectiveness of Pictorial Warning Labels That Feature the Images and Personal Details of Real People," *Nicotine & Tobacco Research* 19, no. 10 (October 2017), 1138-48. In summary, they note that revised tobacco labelling in the US experienced legal difficulties, which may have been avoided with non-staged pictorial warning labels.

outcomes used.[230] There is very weak evidence from the health behavior literature that the use of narratives would improve the effectiveness of interventions in the farmed animal movement.[231] The two included meta-analyses suggest that slightly higher effect sizes are most typical when narrative messages are used, compared to when non-narrative messages are used.[232]

Cultural competency

As one overview explains, "[c]ultural competency is a broad concept used to describe a variety of interventions that aim to improve the accessibility and effectiveness of health care services for people from racial/ethnic minorities… Many models include dimensions of knowledge (e.g., understanding the meaning of culture and its importance to healthcare delivery), attitudes (e.g., having respect for variations in cultural norms) and skills (e.g., eliciting patients' explanatory models of illness)."[233] Included research items often incorporate their target demographics (specific minority or disadvantaged groups) in intervention design or in intervention delivery.

There is moderate evidence from the health behavior literature that culturally competent interventions are likely to be effective at changing behavior in the farmed animal movement when compared to no intervention or to minimal interventions.[234] Intuitively, the case is stronger than this; if a generic version of an intervention tends to have significant behavioral effects, then a culturally competent version will also likely have significant effects, unless the cultural modifications somehow reduce the intervention effectiveness. Two included meta-analyses found small behavioral effects.[235]

However, there is very weak evidence suggesting that culturally competent interventions are similarly effective to generic interventions.[236] The only included meta-analysis with behavioral outcomes found statistically insignificant very small differences in favor of interventions that were not culturally competent from two studies with "bona fide comparison groups that received the same type of treatment and dosage" but that lacked "additional content that was culturally sensitive" ($g = -0.08$, 95% CI -0.51 to 0.35).[237] Additionally, a Cochrane review noted some seemingly quite high costs for culturally competent interventions compared to the conventional diabetes education.[238] Given

[230] See the section on "Narratives and testimonials" in "Interventions across multiple health or risk behaviors or for miscellaneous, less researched health behaviors."

[231] See the spreadsheet "Strength of Evidence Assessments."

[232] See the spreadsheet "Effect Size Estimates."

[233] Mandy Truong, Yin Paradies, and Naomi Priest, "Interventions to improve cultural competency in healthcare: a systematic review of reviews," *BMC Health Services Research* 14, no. 99 (2014), 1.

[234] See the tab "GRADE overview" in the spreadsheet "Strength of Evidence Assessments."

[235] See the spreadsheet "Effect Size Estimates."

[236] See the spreadsheet "Strength of Evidence Assessments."

[237] Katarzyna T. Steinka-Fry, Emily E. Tanner-Smith, Gayle A. Dakof, and Craig Henderson, "Culturally sensitive substance use treatment for racial/ethnic minority youth: A meta-analytic review," *Journal of Substance Abuse Treatment* 75 (2017), 22-37. The quality of this evidence is rated as low by GRADE criteria.

[238] Madeleine Attridge, John Creamer, Michael Ramsden, Rebecca Cannings-John, and Kamila Hawthorne, "Culturally appropriate health education for people in ethnic minority groups with type 2 diabetes mellitus," *Cochrane Database of Systematic Reviews* 9 (September 2014; first published 2008) note that low quality evidence from one study (417

that culturally competent intervention design or delivery will increase the costs of an intervention, these modifications may not be cost-effective in the short term in the farmed animal movement. However, there may be indirect benefits; an overview and a Cochrane review focused on diabetes noted positive effects on other measures such as knowledge and attitudes.[239]

Variations across professionals

Some reviews evaluate whether the effectiveness of interventions varies by the training and qualifications of the professionals delivering the intervention. This is evaluated through comparison of separate meta-analytic subanalyses.

There is very weak evidence from the health behavior literature that professionals with more specialized skillsets and expertise (e.g. dieticians) are likely to be more effective at encouraging or supporting behavior change than less specialized professionals (e.g. general practitioners).[240] The two meta-analyses with behavioral outcomes provide unclear evidence on the likely size of differences from indirect comparison. CIs suggest that anything from very large negative to moderate positive moderating effects are possible.[241]

It seems intuitively plausible that professionals with longer training times and greater public respect or credibility will be more effective at encouraging or supporting behavior change than those with less respect or credibility. However, the health behavior literature provides weak evidence suggesting that this is not the case.[242] Indeed, some reviews found evidence suggesting the opposite conclusion, such as one review that found higher clinical effects for community link workers (workers who often have the same ethnic background and language as those that they work with, but who aren't necessarily fully trained doctors) than nurses or dieticians among ethnic minority diabetes patients.[243] These evaluations tend to compare between categories of professional, so any observed differences could be due to a number of factors. Included meta-analyses provide unclear evidence on the likely size of differences in behavioral outcomes between professionals with longer training times, greater public respect, and greater credibility and those with less

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participants) found that "Intervention vs control resulted in £28,933 per QALY gained" and "Five studies provided rough estimates of costs ranging from $250 per participant over 6 weeks to $701 per participant over 2 years."

[239] Mandy Truong, Yin Paradies, and Naomi Priest, "Interventions to improve cultural competency in healthcare: a systematic review of reviews," *BMC Health Services Research* 14, no. 99 (2014) and Madeleine Attridge, John Creamer, Michael Ramsden, Rebecca Cannings-John, and Kamila Hawthorne, "Culturally appropriate health education for people in ethnic minority groups with type 2 diabetes mellitus," *Cochrane Database of Systematic Reviews* 9 (September 2014; first published 2008).

[240] See the spreadsheet "Strength of Evidence Assessments."

[241] See the spreadsheet "Effect Size Estimates."

[242] See the spreadsheet "Strength of Evidence Assessments."

[243] Madeleine Attridge, John Creamer, Michael Ramsden, Rebecca Cannings-John, and Kamila Hawthorne, "Culturally appropriate health education for people in ethnic minority groups with type 2 diabetes mellitus," *Cochrane Database of Systematic Reviews* 9 (September 2014; first published 2008) note that, "[u]se of a community worker or a link worker showed a reduction in HbA1c at all endpoints, which was sustained at two years to almost the same degree as at three months and one year. A consistent increase in diabetes knowledge was demonstrated, although a significant reduction in cholesterol was evident only at one year. Use of a diabetes nurse also created a good reduction in HbA1c initially, but this finding was no longer significant at one year and was much reduced at two years. Participants showed little improvement in knowledge, but again cholesterol did become significantly reduced after one year, to the same extent as with community/link workers. Use of a dietician yielded the least reduction in HbA1c and cholesterol but did seem to increase knowledge to a comparable effect as the community/link workers."

training, respect, and credibility. CIs for indirect comparisons suggest that very large differences in either direction are possible.[244]

There is also moderate evidence that interventions provided by health professionals other than nurses and doctors (such as oral health professionals or pharmacists) are likely to be effective.[245] Two included meta-analyses suggest moderate or large effects.[246]

Other variations

An overview focused on sexual health found that matching the demographic characteristics of the deliverer and recipient of an intervention increased its impact.[247] Several other studies and meta-analyses indirectly support this conclusion.[248] The health behavior literature therefore provides weak evidence that interventions

[244] See the spreadsheet "Effect Size Estimates."

[245] See the spreadsheet "Strength of Evidence Assessments."

[246] See the spreadsheet "Effect Size Estimates."

[247] Judith Covey, Harriet E. S. Rosenthal-Stott, and Stephanie J. Howell, "A synthesis of meta-analytic evidence of behavioral interventions to reduce HIV/STI," *Journal of Behavioral Medicine* 39, no. 3 (June 2016), 381 found positive significant effects in 6 out of 14 included analyses that measured matched ethnicity between those delivering and receiving the intervention as a potential moderator of effectiveness in interventions promoting condom use. They found negative significant effects in 1, and non-significant effects in 7 (1 of which may have been due to insufficient statistical power). However, the authors note that "the non-significant effects were obtained from meta-analyses with much smaller numbers of studies—6 out of the 7 non-significant effects came from meta-analyses with fewer than 50 studies, whereas 5 out of the 6 significant positive effects came from two meta-analyses with over 200 studies." For matched gender, 8 found positive effects, 0 negative, and 4 insignificant. For similar age, 3 found positive effects, 0 negative, and 5 insignificant. They add that, "[m]atching gender produced most of the significant positive effects, although the effects were quite small... Cohen's d effect sizes were between .14 and .38 larger when the facilitator's gender was matched to the recipient… the positive significant effects for matching ethnicity and age were of a similar magnitude."

[248] Although not referring to health behavior interventions, Raquel R. Cabral and Timothy B. Smith, "Racial/Ethnic Matching of Clients and Therapists in Mental Health Services: A Meta-Analytic Review of Preferences, Perceptions, and Outcomes," *Journal of Counseling Psychology* 58, no. 4 (2011), 542 found that, "[r]acial/ethnic matching of clients and therapists in mental health services" improved perceptions of therapists and had a very small statistically significant effect on treatment outcomes. "Across the 52 studies investigating participants' preferences for therapist race/ethnicity, the random effects weighted average effect size was 0.63 (SE 0.08, p .001, 95% CI [0.48, 0.78]), indicating a moderately strong preference for a therapist of the same race/ethnicity. Across the 81 studies investigating client perceptions of therapists as a function of racial/ethnic matching, the random effects weighted average effect size was 0.32 (SE 0.07, p .001, 95% CI [0.19, 0.45]), indicating a tendency for participants to evaluate matched therapists somewhat better than unmatched therapists. Across the 53 studies investigating client treatment outcomes under matched versus unmatched conditions, the random effects weighted average effect size was 0.09 (SE 0.02, p .001, 95% CI [0.05, 0.13]), indicating almost no difference in outcome when clients were matched with a therapist of their own race/ethnicity." The quality of evidence was rated as "very low" by GRADE criteria.

Nolan Zane and Helen Ku, "Effects of ethnic match, gender match, acculturation, cultural identity, and face concern on self-disclosure in counseling for Asian Americans," *Asian American Journal of Psychology* 5, no. 1 (2014), 66-74 found that, "[g]ender match between participants and counselors facilitated self-disclosure about one's sex life. There were no ethnic match effects on the various types of self-disclosure."

Laurie A. Gayes and Ric G. Steele, "A meta-analysis of motivational interviewing interventions for pediatric health behavior change," *Journal of Consulting and Clinical Psychology* 82, no. 3 (June 2014), 521-35, a meta-analysis of 37 studies of MI for multiple health behaviors for children and adolescents found significant effects overall and notes that "MI seems to be most effective… when the cultural background of the practitioner matches the family." The effect size for community health workers (who share the same cultural background as the patients) was 0.491 (95% CI 0.334 to 0.649,

where the patient and deliverer are matched on demographic characteristics are likely to be more effective at changing behavior in the farmed animal movement than interventions without demographic matching. Indirect comparison in one included meta-analysis suggests small differences in behavioral effects in favor of demographically matched interventions.[249]

It seems intuitively plausible that interventions will be more effective when the participants are already motivated to move towards the preferred behavior. Two Cochrane reviews for smoking cessation found evidence against this hypothesis,[250] but empirical testing of social cognition models has found that "intention" is an important predictor of behavioral change.[251]

The section on "Effectiveness of interventions varying by demographic characteristics" in "Other intervention types or points of interest" also considers a moderator of effectiveness.

Other individual and small group interventions

Pharmacology

In health behavior, pharmacological treatments are those that use medicinal drugs to support behavior change. For smoking, evidence suggests that many pharmacological treatments and various types of nicotine replacement therapies (NRTs) are effective.[252] Pharmacological treatments are also used to reduce substance abuse. Estimates for the total effect size of pharmacological treatments do not seem useful for the farmed animal movement, since pharmacology is used to combat the addictiveness of tobacco and other drugs. However, the conditions in which NRTs are effective may have indirect implications for the use and promotion of animal-free foods.

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4 studies), which was larger than for "professional" interventionists (0.361, 95% CI 0.252 to 0.470, 10 studies) or "[m]aster's +" interventionists (0.240, 95% CI 0.191 to 0.289, 13 studies).

[249] See the tab "Indirect tests individual reviews" in the spreadsheet "Effect Size Estimates."

[250] Nicola Lindson-Hawley, Tom P. Thompson, and Rachna Begh, "Motivational interviewing for smoking cessation," *Cochrane Database of Systematic Reviews* 3 (March 2015; first published 2010) found that, "[p]ooling trials which only recruited participants already motivated to make a quit attempt… yielded a similar effect size (RR 1.27; 95% CI 1.13 to 1.42; 6 trials, N = 6511; I^2 = 58%) to the main pooled effect" (RR 1.26; 95% CI 1.16 to 1.36)."

Nicola Lindson-Hawley, Jamie Hartmann-Boyce, Thomas R. Fanshawe, Rachna Begh, Amanda Farley, Tim Lancaster, "Interventions to reduce harm from continued tobacco use," *Cochrane Database of Systematic Reviews* 10 (October 2016; first published 2007) found that, "[p]eople who do not wish to quit can be helped to cut down the number of cigarettes they smoke and to quit smoking in the long term, using NRT, despite original intentions not to do so." Their results were that, "[i]n a pooled analysis of eight trials, NRT significantly increased the likelihood of reducing CPD by at least 50% for people using nicotine gum or inhaler or a choice of product compared to placebo (risk ratio (RR) 1.75, 95% confidence interval (CI) 1.44 to 2.13; 3081 participants)... However, we rated the evidence contributing to the cessation outcome for NRT as 'low' by GRADE standards."

[251] See the section on "Empirical testing of SCMs" in Appendix B: Theory Used in Health Behavior Intervention Design and Research.

[252] See especially Kate Cahill, Sarah Stevens, Rafael Perera, and Tim Lancaster, "Pharmacological interventions for smoking cessation: an overview and network meta-analysis," *Cochrane Database of Systematic Reviews* 5 (May 2013).

There is very weak evidence from one Cochrane review that motivation is important to quitting success even with the assistance of NRTs.[253] There is also weak evidence suggesting that NRTs are similarly effective regardless of the level of behavioral support.[254] One review notes that, "many people relapse after the end of therapy."[255] An older review of NRTs notes that, "[i]ndirect comparison did not detect a significant difference between rates of success in nine trials where end of treatment was abrupt versus 32 trials where participants were weaned from patch use by tapering the dose (RR 1.89, 95% CI 1.50 to 2.37 and RR 1.58, 95% CI 1.44 to 1.72, respectively)."[256]

Convincing imitations

For smoking, electronic cigarettes seem much more similar to conventional cigarettes than other NRTs or treatments. There is weak evidence suggesting that they can be effective at reducing smoking[257] and one included meta-analysis suggested that anything from very small to very large behavioral effects were possible.[258] There is very weak evidence that they are similarly effective to other NRTs.[259] Additionally, a qualitative review included three studies of multicomponent interventions that included provision of meat substitutes and various informational, motivational, or supportive components. All three found significant effects on meat consumption, though they were all observational studies.[260] The health behavior literature therefore provides weak evidence that interventions that provide convincing alternatives are likely to be effective at changing behavior in the farmed animal movement.

Evidence suggests that although electronic cigarettes are popular in assisting quit attempts, they can also serve as a gateway to smoking for other individuals.[261]

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[253] Jamie Hartmann-Boyce, Samantha C. Chepkin, Weiyu Ye, Chris Bullen, Tim Lancaster, "Nicotine replacement therapy versus control for smoking cessation," *Cochrane Database of Systematic Reviews* 5 (May 2018) only considered trials of "men or women who smoked and were motivated to quit," and the only trial that "recruited people who had relapsed after patch and behavioural support in an earlier phase of the study but were motivated to make a second attempt… did not detect an effect on continuous abstinence (RR 1.25, 95% CI 0.34 to 4.60, analysis not shown), although it did detect a significant increase in 28-day point prevalence abstinence (RR 2.49, 95% CI 1.11 to 5.57)."

See the spreadsheet "Effect Size Estimates."

[254] Jamie Hartmann-Boyce, Samantha C. Chepkin, Weiyu Ye, Chris Bullen, Tim Lancaster, "Nicotine replacement therapy versus control for smoking cessation," *Cochrane Database of Systematic Reviews* 5 (May 2018).

See the spreadsheet "Effect Size Estimates."

[255] Jamie Hartmann-Boyce, Samantha C. Chepkin, Weiyu Ye, Chris Bullen, Tim Lancaster, "Nicotine replacement therapy versus control for smoking cessation," *Cochrane Database of Systematic Reviews* 5 (May 2018).

[256] Lindsay F. Stead, Rafael Perera, Chris Bullen, David Mant, Jamie Hartmann-Boyce, Kate Cahill, and Tim Lancaster, "Nicotine replacement therapy for smoking cessation," *Cochrane Database of Systematic Reviews* 11 (November 2012).

[257] See the spreadsheet "Strength of Evidence Assessments."

[258] See the spreadsheet "Effect Size Estimates."

[259] See the spreadsheet "Strength of Evidence Assessments."

[260] Filippo Bianchi, Emma Garnett, Claudia Dorsel, Paul Aveyard, and Susan A. Jebb, "Restructuring physical micro-environments to reduce the demand for meat: a systematic review and qualitative comparative analysis," *The Lancet Planetary Health* 2, no. 9 (September 2018), e384-e397. The authors conclude that, "providing meat alternatives with supporting educational material" offered some of "the most promise to reduce meat demand."

[261] Jamie Hartmann-Boyce, Hayden McRobbie, Chris Bullen, Rachna Begh, Lindsay F. Stead, Peter Hajek, "Electronic cigarettes for smoking cessation," *Cochrane Database of Systematic Reviews* 9 (September 2016; first published 2014) found electronic cigarettes to be effective (RR 2.29, 95% CI 1.05 to 4.96, 2 studies) and comparable to the nicotine patch, another NRT (RR 1.26, 95% CI 0.68 to 2.34 in direct comparison, 1 study), although they lack confidence in the

There is weak evidence suggesting that interventions to promote safer sexual behaviors are more effective than interventions to avoid sex entirely.[262] One included meta-analyses found slightly larger effects of interventions that promote safer sexual behaviors than those that encourage people to avoid sex entirely in direct testing and another meta-analysis found a moderately larger effects in indirect comparison.[263]

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evidence. Comparison to evidence of the wider effectiveness of NRT in Kate Cahill, Sarah Stevens, Rafael Perera, and Tim Lancaster, "Pharmacological interventions for smoking cessation: an overview and network meta-analysis," *Cochrane Database of Systematic Reviews* 5 (May 2013), who summarize that NRT was superior to placebo (OR 1.84; 95% credible interval 1.71 to 1.99), suggests that effects may be higher, although CIs are wide and overlap.

Hartmann-Boyce et al. explain that 2 out of 3 recent meta-analyses focusing on e-cigarettes for smoking cessation came to similar conclusions; the third came to different conclusions because of the inclusion of non-randomized trials (see the paragraph beginning "When this review was initially published…" in that review). M. Malas, J. van der Tempel, R. Schwartz, A. Minichiello, C. Lightfoot, A. Noormohamed, et al., "Electronic cigarettes for smoking cessation: A systematic review," *Nicotine & Tobacco Research* 18, no. 10 (2016), 1926-36 summarize that, "[w]hile the majority of studies demonstrate a positive relationship between e-cigarette use and smoking cessation, the evidence remains inconclusive due to the low quality of the research published to date. Well-designed randomized controlled trials and longitudinal, population studies are needed to further elucidate the role of e-cigarettes in smoking cessation."

Robert West, Emma Beard, Jamie Brown, "Trends in electronic cigarette use in England," *Smoking Toolkit Study* (August 2018), http://www.smokinginengland.info/latest-statistics/ suggest that electronic cigarettes are far more popular in smokers' quit attempts (used in nearly 35% of attempts) than any other form of NRT, including over the counter NRTs (little over 15% of quit attempts). "Reasons for use, ASH Smokefree GB adult survey, 2015 (weighted)," in A. McNeill, L. S. Brose, R. Calder, S. C. Hitchman, *E-cigarettes: an evidence update A report commissioned by Public Health England* (London: Public Health England, 2015), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/733022/Ecigarettes_an_evidence_update_A_report_commissioned_by_Public_Health_England_FINAL.pdf and Ann McNeil, Leonie S. Brose, Robert Calder, Linda Bauld, and Debbie Robson, *Evidence review of e-cigarettes and heated tobacco products 2018 A report commissioned by Public Health England* (London: Public Health England, 2018), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/684963/Evidence_review_of_e-cigarettes_and_heated_tobacco_products_2018.pdf, 96 suggest that two of the main reasons for electronic cigarette use are "[t]o help me stop smoking tobacco entirely" (44% of survey respondents in 2015, 35.6% in 2018) and "[b]ecause I had made an attempt to quit smoking already and I wanted an aid to help me keep off tobacco" (35% in 2015, 24.5% in 2018).

On the other hand, Samir Soneji, Jessica L. Barrington-Trimis, Thomas A. Wills, Adam M. Leventhal, Jennifer B. Unger, Laura A. Gibson, JaeWon Yang, Brian A. Primack, Judy A. Andrews, Richard A. Miech, Tory R. Spindle, Danielle M. Dick, Thomas Eissenberg, Robert C. Hornik, Rui Dang, and James D. Sargent, "Association Between Initial Use of e-Cigarettes and Subsequent Cigarette Smoking Among Adolescents and Young Adults: A Systematic Review and Meta-analysis," *JAMA Pediatrics* 171, no. 8 (2017), 788-97 "showed strong and consistent evidence of an association between initial e-cigarette use and subsequent cigarette smoking initiation, as well as between past 30-day e-cigarette use and subsequent past 30-day cigarette smoking," suggesting that e-cigarettes can also serve as gateways to the smoking of traditional cigarettes. Kathleen Stratton, Leslie Y. Kwan, and David L. Eaton (eds.) *Public Health Consequences of E-Cigarettes* (Washington: The National Academies Press, 2018), 9, a book focusing on U.S. evidence, similarly conclude that, "e-cigarettes might cause youth who use them to transition to use of combustible tobacco products," although they might also "increase adult cessation of combustible tobacco cigarettes." These findings do not provide strong evidence that e-cigarettes themselves encourage smoking; it still seems plausible that the e-cigarettes had delayed or simply not affected a gravitation of their users towards smoking that was happening anyway.

[262] See the spreadsheet "Effect Size Estimates."

[263] See the spreadsheet "Effect Size Estimates."

Direct financial incentives

This section includes reviews and studies of incentives provided to individuals or groups. These incentives are given in various forms including vouchers, conditional cash payments, lotteries, or deposit schemes.[264] These interventions are more frequently assessed in RCTs than in economic models, unlike the studies of population-level tax, subsidy, and price changes discussed in the section below.

There is strong evidence from the health behavior literature that direct financial incentives are likely to be effective at changing behavior in the farmed animal movement.[265] In the included meta-analyses, CIs suggested that anything from small negative to very large positive behavioral effects were possible, with small or moderate positive effects seeming most typical.[266]

There is very weak evidence that incentives are not likely to be effective at changing behavior in the farmed animal movement if the recipients are also receiving other types of intervention simultaneously.[267] One included meta-analysis found no clear behavioral effects from incentives delivered alongside other interventions, though indirect comparison in another meta-analysis suggested moderate or small effects.[268]

There is weak evidence that direct financial incentives have no long-term effects.[269] In the two included meta-analyses, CIs suggested that anything from moderate negative to very large positive behavioral effects were possible at long-term follow-up, though moderate positive effects seem most typical. Indirect comparisons in two meta-analyses suggested slightly larger behavioral effect sizes at short-term follow-up, though the CIs suggest a wide range of possible differences in favor of either short-term or long-term follow-up.[270] This question is complicated by the issue of incentive withdrawal; although some reviews report on studies that measured effects at 12 months' follow-up or longer, this can be 12 months from the start of the intervention, rather than the point at which incentives cease to be given. One review highlights that previous literature provides mixed indirect evidence on the question of whether the effects of incentives persist after the incentives have been removed.[271] Overall, the health behavior literature provides weak evidence that the

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[264] Nancy Haff, Mitesh S. Patel, Raymond Lim, Jingsan Zhu, Andrea B. Troxel, David A. Asch, and Kevin G. Volpp, "The Role of Behavioral Economic Incentive Design and Demographic Characteristics in Financial Incentive-Based Approaches to Changing Health Behaviors: A Meta-Analysis," *American Journal of Health Promotion* 29, no. 5 (2015) explain that "A conditional payment rewards individuals with a fixed monetary amount if behavior change is successfully achieved and has been effectively used for smoking cessation. A deposit contract using a match process allows individuals to put their own money at risk; if behavior change is successfully achieved individuals get their own money back plus a one-to-one match… Regret lotteries can offer individuals frequent (e.g., daily) and variable rewards. For example, a combined regret lottery might offer higher odds of winning a lower amount (e.g., 18% chance of winning $10) and lower odds of winning a higher amount (e.g., 1% chance of winning $100). Individuals who win the lottery are eligible to collect their winnings only if they completed the desired study behavior (e.g., took their medication) the previous day, and those who did not complete the desired outcome are told what they would have won if they had achieved the goal."

[265] See the spreadsheet "Strength of Evidence Assessments."

[266] See the spreadsheet "Effect Size Estimates."

[267] See the spreadsheet "Strength of Evidence Assessments."

[268] See the spreadsheet "Effect Size Estimates."

[269] See the spreadsheet "Strength of Evidence Assessments."

[270] See the spreadsheet "Effect Size Estimates."

[271] Eleni Mantzari, Florian Vogt, Ian Shemilt, Yinghui Wei, Julian P. T. Higgins, Theresa M. Marteau, "Personal financial incentives for changing habitual health-related behaviors: A systematic review and meta-analysis," *Preventive Medicine* 75 (2015), 75-85 summarize that, "[a]uthors of relevant existing systematic reviews (Jochelson, 2007, Kane et al.,

recipients of financial incentives who successfully make behavioral change tend to rely on continued access to the incentives in order to maintain their new behavior.[272] One included meta-analysis found that behavioral effects were very small after withdrawal of the incentives, with CIs ranging from small negative to moderate positive effects. Indirect comparison in the same meta-analysis suggested moderately smaller behavioral effects in follow-up where the incentives had been withdrawn than in follow-up where the incentives had not been withdrawn, with CIs suggesting a wide range of possibilities.[273]

Some of the included research items cited research from outside of the health behavior literature on the effectiveness of incentives to motivate behavior change. This wider literature raises concerns that financial incentives may undermine intrinsic motivation.[274] This literature review did not identify evidence of negative effects from incentives in the health behavior literature.

It seems that the costs of incentives used in interventions to discourage smoking are higher than would likely be considered by the farmed animal movement.[275] There is weak evidence from the health behavior literature

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2004, Sutherland et al., 2008, Cahill and Perera, 2011, Paul-Ebhohimhen and Avenell, 2008) have concluded that achieved changes to habitual health-related behaviors are not sustained after removal of financial incentives. However, these reviews have assessed effects over time, without explicitly focusing on or systematically analysing impacts after incentive removal. This distinction is important since in some studies payment of the final incentive has coincided with the final follow-up assessment (Donatelle et al., 2000a, Donatelle et al., 2000b, Gallagher et al., 2007, Jeffery et al., 1990, Klesges et al., 1987, Rand et al., 1989)... Some evidence suggests that under the right conditions financial incentives could lead to sustained changes (Cahill and Perera, 2011, Troxel and Volpp, 2012, Volpp et al., 2009), highlighting the need for research to move beyond the question of whether incentives work, to elucidate the circumstances under which they are most effective in achieving and sustaining changes (Marteau et al., 2009)."

[272] See the spreadsheet "Strength of Evidence Assessments."

[273] See the spreadsheet "Effect Size Estimates."

[274] Jason D. Shaw and Nina Gupta, "Let the evidence speak again! Financial incentives are more effective than we thought," *Human Resource Management Journal* 25, no. 3 (July 2015), 281-93, a summary of the meta-analytic and qualitative evidence for incentives in behavior change, draws on psychological, medical, educational, and business academic literature to argue that there is strong evidence for the effectiveness of financial incentives, and that the "myth" that financial incentives erode intrinsic motivation "has been debunked quantitatively." The authors also note the various forms of poor incentive implementation that may bias study results, such as arbitrarily cutting off incentives despite behavioral improvements. Some of the evidence relevant to health behavior cited in the paper is included elsewhere in this literature review, such as Emma L. Giles, Shannon Robalino, Elaine McColl, Falko F. Sniehotta, and Jean Adams, "The Effectiveness of Financial Incentives for Health Behaviour Change: Systematic Review and Meta-Analysis," *PLoS ONE* (March 2014).

Not all papers in the scientific literature beyond the health behavior literature are as optimistic about incentives, however; some quite recent research continues to find indirect evidence that incentives undermine intrinsic motivation. For example, Tina Strombach, Marco Hubert, and Peter Kenning, "The neural underpinnings of performance-based incentives," *Journal of Economic Psychology* 50 (2015), 1-12 found that, "incentives induce changes in reward-related brain regions, but not in task-related neural representations. Interestingly, when monetary incentives are introduced, blood oxygenation level dependent activity increases in the ventral striatum, being sensitive to reward, and decreases in the ventromedial prefrontal cortex, representing the subjective value." They note that, "[t]he observed neural activation patterns also support the behavioral model of Deci et al. (1999), who propose that the introduction of monetary incentives crowd out the intrinsic motivation to perform, thus decreasing the inherent value of a specific action."

[275] Floor A. van den Brand, Gera E. Nagelhout, Ayalu A. Reda, Bjorn Winkens, Silvia M. A. A. Evers, Daniel Kotz, Onno C. P. van Schayck, "Healthcare financing systems for increasing the use of tobacco dependence treatment," *Cochrane Database of Systematic Reviews* 9 (September 2017; first published 2005) included information on cost-effectiveness. Depending on the study, each additional quitter had costs ranging from 716 to 7,646 USD).

Although not reporting cost-effectiveness, Emma L. Giles, Shannon Robalino, Elaine McColl, Falko F. Sniehotta, and Jean Adams, "The Effectiveness of Financial Incentives for Health Behaviour Change: Systematic Review and Meta-

that higher value incentives are likely to have a larger impact on behavioral outcomes of interest to the farmed animal movement than lower value incentives would.[276] Two included meta-analyses found very small or no differences in behavioral effects from increased incentive value. Indirect comparison in one meta-analysis suggests that increases in incentive value lead to small improvements in effectiveness, with CIs suggesting a wide range of possibilities.[277]

The health behavior literature provides very weak evidence that cash incentives are likely to be more effective in the farmed animal movement than other forms of incentives.[278] Indirect comparison in one included meta-analysis suggested that small increases in behavioral effects from using cash over other incentives would be most typcal, with CIs suggesting a wide range of possibilities.[279] However, there are theoretical reasons to suggest that for some individuals, groups, or specific situations, non-cash incentives may be superior.[280]

Population-level and large group interventions

Taxes, subsidies, and prices

There are not many reviews of experimental evidence on the effectiveness of taxes and subsidies for modifying health behavior, although there are numerous studies that use purchasing data or survey data to inform economic models. This section includes studies and reviews referring explicitly to taxes, subsidies, and population-level price changes. There may be some overlap with the previous section on "Direct financial incentives"; for example, some reviews consider food vouchers to be a form of subsidy, though some of the reviews included in the previous section also include studies of food vouchers.

There is strong evidence from the health behavior literature that taxes, subsidies, and price changes are likely to be effective at changing behavior in the farmed animal movement.[281] Two included meta-analyses suggested moderate effects, with the mid-points of estimates suggesting that a 10% increase in the price of undesired products would result in a decrease in consumption of 6%.[282]

Analysis," *PLoS ONE* (March 2014) notes that, "[t]he total value of certain financial incentives that study participants could receive for successful behaviour change, over and above any payments for study participation, ranged from $5.16 to $786 (in 2011 $US)."

[276] See the spreadsheet "Strength of Evidence Assessments."

[277] See the spreadsheet "Effect Size Estimates."

[278] See the spreadsheet "Strength of Evidence Assessments."

[279] See the spreadsheet "Effect Size Estimates."

[280] See, for example, the introduction to Nancy Haff, Mitesh S. Patel, Raymond Lim, Jingsan Zhu, Andrea B. Troxel, David A. Asch, and Kevin G. Volpp, "The Role of Behavioral Economic Incentive Design and Demographic Characteristics in Financial Incentive-Based Approaches to Changing Health Behaviors: A Meta-Analysis," *American Journal of Health Promotion* 29, no. 5 (2015).

[281] See the spreadsheet "Strength of Evidence Assessments."

[282] See the spreadsheet "Effect Size Estimates."

The reviewed models suggest that a change in price of 10% has an effect on consumption ranging from as low as 2.3% (from a review of smoking[283]) to as high as 12% (from a review of dietary behavior[284]). It is unsurprising that models of dietary behaviors suggest greater price elasticity than models of smoking, where the addictiveness of nicotine means that many smokers will presumably continue to buy cigarettes regardless of price increases.

A review focused on food price changes found double the effect on consumption amounts from price decreases for healthy foods than from price increases for unhealthy foods.[285] This provides very weak evidence that subsidies for animal-free food products are likely to have a larger impact on the consumption of those products than taxes would on animal products.[286]

Taxes on specific animal products may increase the consumption of other animal products, due to substitution effects. This could lead to an increase in animal suffering, if it led to increased consumption of chicken, fish, or eggs, since these products cause greater suffering per animal and per pound.[287] One paper's modelling of price elasticities found evidence that such effects would likely be small,[288] but an older paper found that substitution effects would be large.[289]

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[283] David P. Hopkins, Peter A. Briss, Connie J. Ricard, Corinne G. Husten, Vilma G. Carande-Kulis, Jonathan E. Fielding, Mary O. Alao, Jeffrey W. McKenna, Donald J. Sharp, Jeffrey R. Harris, Trevor A. Woollery, and Kate W. Harris, "Reviews of Evidence Regarding Interventions to Reduce Tobacco Use and Exposure to Environmental Tobacco Smoke," *American Journal of Preventive Medicine* 20, no. 2 (2001), 25.

[284] Ashkan Afshin, José L. Peñalvo, Liana Del Gobbo, Jose Silva, Melody Michaelson, Martin O'Flaherty, Simon Capewell, Donna Spiegelman, Goodarz Danaei, and Dariush Mozaffarian, "The prospective impact of food pricing on improving dietary consumption: A systematic review and meta-analysis," *PLoS ONE* (March 2017).

[285] See the tab "Direct tests individual reviews" in the spreadsheet "Effect Size Estimates."

[286] See the spreadsheet "Strength of Evidence Assessments."

[287] For comparisons of the suffering of different farmed animals, see Brian Tomasik, "How Much Direct Suffering Is Caused by Various Animal Foods?" last updated Jul 14, 2018, https://reducing-suffering.org/how-much-direct-suffering-is-caused-by-various-animal-foods/ and Joey Savoie, "Is it better to be a wild rat or a factory farmed cow? A systematic method for comparing animal welfare?" (September 2018), https://forum.effectivealtruism.org/posts/cimFBQbpjntoBAKCq/is-it-better-to-be-a-wild-rat-or-a-factory-farmed-cow-a.

[288] Johanna-Katharina Schönbach, SilkeThiele, and Stefan K. Lhachimi, "What are the potential preventive population-health effects of a tax on processed meat? A quantitative health impact assessment for Germany," *Preventive Medicine* 118 (January 2019), 325-31 found that, "a 10% price increase for processed meat results in a 6.99% (95% CI 7.56% to 6.42%) consumption decrease;" although there would be a "0.31% increase of red meat, a 0.27% increase of white meat," it would lead to a "1.61% decrease of fish intake."

They used a consumer dataset of "all food purchases of 13,125 representative German households, which were asked to document their purchases for at least ten months per year using a bar code scanner." They operated under the assumption, based on evidence from other countries, that, "food taxes were fully passed onto consumers."

[289] Joeri Veul, "Interventions to reduce meat consumption in OECD countries: a systematic review to understand differences in success," (master's thesis, August 2018), https://theses.ubn.ru.nl/bitstream/handle/123456789/6391/Veul%2c_Joeri_1.pdf?sequence=1 summarizes that, "the modelling study conducted by Wirsenius et al. (2011) showed that even though a €60/ton CO2 eq. tax would lead to a decrease in beef consumption in Europe by fifteen per cent, it would lead to respectively a seven and one per cent rise of the amount of poultry and pork sold."

Taxes can generate government revenue, decrease health costs and potentially improve productivity in the workplace.[290] These economic benefits of taxation interventions may make their implementation more tractable. However, meat taxes may be unpopular[291] and may affect people with lower incomes more than those with higher incomes.[292]

Packaging and labelling

The use of packaging and labelling for encouraging change in health behaviors varies substantially. For diet and nutrition, the labels evaluated through included research items tend to contain information to support individuals to make healthier choices when choosing between food options, whereas tobacco health warning labels tend to seek to discourage smoking altogether. The labelling on alcohol products uses a combination of these approaches to challenge excessive drinking. Research evaluating the effectiveness of labelling for encouraging these sorts of health behavior changes tends to use observational study designs and indirect outcome measures such as self-reported intentions. The literature on "reminder packaging" for medication adherence is quite different; one review explains that, "[p]ackaging interventions provide a physical assembly of medications into an object that indicates the day and/or time medications should be administered."[293]

Overall, there is weak evidence from the health behavior literature suggesting that packaging or labelling interventions are likely to be effective at changing behavior in the farmed animal movement.[294] The evidence from research relating to diet and nutrition, smoking, and medication adherence tends to suggest that packaging interventions would be effective, whereas the research relating to alcohol suggests that labelling has no effect. Three included meta-analyses focused on diet suggest that labelling might reduce calories consumed by about 6%, although CIs ranged from nearly double this to very small negative effects.[295] There is very weak evidence of long-term effects.[296]

A variety of studies suggest that including pictures on cigarette packaging increases the effectiveness of health warnings on the packaging at influencing determinants of smoking behavior such as attitude and intention.[297]

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[290] See, for example, Kara A. Contreary, Sajal K.Chattopadhyay, David P. Hopkins, Frank J. Chaloupka, Jean L. Forster, Victoria Grimshaw, Carissa B.Holmes, Ron Z.Goetzel, and Jonathan E. Fielding, "Economic Impact of Tobacco Price Increases Through Taxation: A Community Guide Systematic Review," *American Journal of Preventive Medicine* 49*,* Np. 5 (November 2015), 800-8.

[291] See, for example, John J. Hyland, Maeve Henchion, Mary McCarthy, and Sinéad N. McCarthy, "The role of meat in strategies to achieve a sustainable diet lower in greenhouse gas emissions: A review," Meat Science 132 (February 2017), 189-95. They note that "it has been shown that consumers respond unfavourably to such taxation measures," citing Filiep Vanhonacker, Ellen J. Van Loo, Xavier Gellynck, and Wim Verbeke, "Flemish consumer attitudes towards more sustainable food choices," *Appetite* 62, no. 1 (March 2013), 7-16, a survey of 221 consumers.

[292] See the section on "Effectiveness of interventions varying by demographic characteristics."

[293] Vicki S. Conn, Todd M. Ruppar, Keith C. Chan, Jacqueline Dunbar-Jacob, Ginette A. Pepper, and Sabina De Geest, "Packaging interventions to increase medication adherence: systematic review and meta-analysis," *Current Medical Research and Opinion* 31, no. 1 (2015), 145-60.

[294] See the spreadsheet "Strength of Evidence Assessments."

[295] See the spreadsheet "Effect Size Estimates."

[296] See the spreadsheet "Strength of Evidence Assessments."

[297] Seth M. Noar, Marissa G. Hall, Diane B. Francis, Kurt M. Ribisl, Jessica K. Pepper, and Noel T. Brewer, "Pictorial cigarette pack warnings: a meta-analysis of experimental studies," *Tobacco Control* 25 (May 2015), 341, 347, a systematic review of 37 RCTs found that, "[p]ictorial warnings were more effective than text-only warnings for 12 of 17 effectiveness outcomes (all $p<0.05$). Relative to text-only warnings, pictorial warnings (1) attracted and held attention

better; (2) garnered stronger cognitive and emotional reactions; (3) elicited more negative pack attitudes and negative smoking attitudes and (4) more effectively increased intentions to not start smoking and to quit smoking." On intentions, their meta-analysis found lower willingness to pay (SMD 0.26, 95% CI 0.02 to 0.50, 580 participants, p value = 0.04), more frequent intention to not start smoking (SMD 1.82, 95% CI 0.15 to 3.49, 5016 participants, p value = 0.03), and more frequent intention to quit smoking (SMD 0.54, 95% CI 0.29 to 0.79, 16,671 participants, p value = 0.001). On attitudes, they found significant effects on "[n]egative pack/brand attitudes" (SMD 0.79, 95% CI 0.50 to 1.07, 1260 participants, p value = 0.0001) and on "[n]egative smoking attitudes" (SMD = 0.55, 95% CI 0.28 to 0.83, 489 participants, p value = 0.001). Each meta-analysis included between 2 and 11 studies. Heterogeneity was high in most. Although there was insufficient information to conduct GRADE analyses, most included meta-analyses likely had low or very low quality evidence. This review gains an AMSTAR 2 rating of "critically low."

Noel T. Brewer, Marissa G. Hall, Seth M. Noar, Humberto Parada, Al Stein-Seroussi, Laura E. Bach, Sean Hanley, and Kurt M. Ribisl, "Effect of Pictorial Cigarette Pack Warnings on Changes in Smoking Behavior: A Randomized Clinical Trial," *JAMA Internal Medicine* 176, no. 7 (June 2016) found in an RCT of 2149 participants that, "smokers whose packs had pictorial warnings were more likely than those whose packs had text-only warnings to attempt to quit smoking during the 4-week trial (40% vs 34%; odds ratio [OR], 1.29; 95% CI, 1.09-1.54). The findings did not differ across any demographic groups. Having quit smoking for at least the 7 days prior to the end of the trial was more common among smokers who received pictorial than those who received text-only warnings (5.7% vs 3.8%; OR, 1.53; 95% CI, 1.02-2.29). Pictorial warnings also increased forgoing a cigarette, intentions to quit smoking, negative emotional reactions, thinking about the harms of smoking, and conversations about quitting."

Seth M. Noar, Diane B. Francis, Christy Bridges, Jennah M. Sontag, Kurt M. Ribisl, and Noel T. Brewer, "The impact of strengthening cigarette pack warnings: Systematic review of longitudinal observational studies," *Social Science and Medicine* 164 (September 2016), 118-29, considering evidence from longitudinal observational studies on strengthening cigarette warnings, found that, "[q]uitline calls increased in four of six studies, while foregoing of cigarettes did not increase. Cigarette consumption decreased in three of eight studies; quit attempts increased in four of seven studies; and short-term cessation increased in two of three studies. Smoking prevalence decreased in six of nine studies." On page 118 the authors explain that, "[s]tudies commonly examined changes from text to pictorial warnings (64%); the remainder examined strengthened text or strengthened pictorial warnings" and on page 119 they add that "Strengthened warnings are nearly always larger in size, are typically on the front and back of the cigarette pack."

Most interestingly, on page 125 they explain that, "[a]mong the eight studies assessing cigarette consumption, three found a decrease. For example, cigarette consumption decreased from 22.0 to 20.5 cigarettes per day after Australia strengthened text warnings in 1995, while it decreased from 28.9 cigarettes per week in 2005 to 22.1 in 2006 after Australia implemented pictorial warnings. An additional two studies found what appear to be meaningful decreases, but did not provide significance tests. One study found that cigarette consumption decreased from 24.2 cigarettes per week in 2000 to 22.1 in 2001 after Canada implemented pictorial warnings, while the other found that the percentage of those who smoked 10 or more cigarettes per day dropped from 24% in 2010 to 22% after implementation of pictorial warnings in Mexico in 2011. Additional studies such as those conducted in England and Taiwan found no evidence of a reduction in cigarette consumption." Given the lack of control groups, it seems plausible that confounding variables such as increased public discussion help to explain these results, although given a mean follow-up interval of 12.11 months, it also seems possible that short-term effects from increased public discussion would have died out.

Noel T. Brewer, Marissa G. Hall, and Seth M. Noar, "Pictorial cigarette pack warnings increase quitting: A comment on Kok et al.," *Health Psychology Review* 12, no. 2 (2018), 129-32 note that, "[a] recent modeling paper also estimated that implementing pictorial warnings in the US would prevent over 650,000 deaths over the next 50 years (Levy, Mays, Yuan, Hammond & Thrasher, 2016)."

Additionally, Emily Brennan, Erin K. Maloney, Yotam Ophir, and Joseph N. Cappella, "Potential Effectiveness of Pictorial Warning Labels That Feature the Images and Personal Details of Real People," *Nicotine & Tobacco Research* 19, no. 10 (October 2017), 1138-48 found that non-testimonial picture warning labels (PWL) had a significantly greater effect than non-testimonial text warning labels (TWL) on self-reported negative emotion, intentions to quit, intentions to forgo, and intentions to avoid smoking. The effects on the number who requested quitting info, who made quit attempts, and who quit successfully were in the expected direction, but were not statistically significant.

Some studies focused on diet and nutrition have found evidence that including additional information or imagery to aid understanding of labels likely increases its effectiveness. Additionally, some of the research items that failed to find significant effects of labelling on dietary behaviors were those focusing on simple calorie labeling.[298] Overall, there is weak evidence from the health behavior literature that pictorial or interpretive labels are likely to be more effective at changing behavior in the farmed animal movement than text-only labels.[299] Indirect comparisons from two included meta-analyses focused on diet suggest large differences in behavioral effects in favor of pictorial or interpretive labels over text-only labels, though CIs suggest that anything from very small to very large differences are possible.[300]

There is also indirect evidence that "shocking" or "graphic" images are more effective than non-graphic images on cigarette packaging at influencing the determinants of smoking behavior, which provides weak evidence that graphic labels are likely to be more effective at changing behavior in the farmed animal movement than non-graphic labels.[301] One study summarizes that researchers have generally classified picture health warnings on tobacco packaging "into three main categories: (1) graphic: vivid depiction of negative health consequences or physical effects of smoking; (2) suffering: portrayal of personal experiences living with smoking-related diseases, including negative impacts on quality of life; and (3) symbolic: abstract or metaphorical representations of the negative effects of smoking."[302] The three studies included in this literature review that commented on the effectiveness of all three types of imagery found little difference between "graphic" and "suffering" imagery.[303] The evidence in the section on "Fear appeals" is also relevant to this issue.

Emily Brennan, Erin Maloney, Yotam Ophir, and Joseph N. Cappella, "Designing Effective Testimonial Pictorial Warning Labels for Tobacco Products," *Health Communication* (2018) summarize that, "1255 adult smokers in the United States were randomly assigned to one of six experimental conditions (2 [identifier: none/identifier] × 3 [explanatory statement: none/non-testimonial/testimonial]), or a control condition (text only warning labels that currently appear on packs in the United States). In each condition, participants were exposed to multiple labels each focused on a different health effect. Effectiveness was assessed using emotional responses, engagement and behavioral intentions measured immediately post-exposure, and quit attempts measured at five-week follow up. Testimonial PWLs were more effective than the text only labels. However, there was little evidence that adding identifiers or the explanatory statements enhanced effectiveness; rather, there was some evidence that testimonial explanatory statements reduced effectiveness."

An earlier narrative review, David Hammond, "Health warning messages on tobacco products: a review," *Tobacco Control* 20 (2011), 327-37, summarizes that, "[a] wide variety of research has demonstrated the effectiveness of using pictures and imagery in health communications." Hammond only identified 3 studies that failed to show any statistically significant differences on the outcomes measured.

[298] Reviews noting this included Jana Sisnowski, Jackie M. Street, and Tracy Merlin, "Improving food environments and tackling obesity: A realist systematic review of the policy success of regulatory interventions targeting population nutrition," *PLoS ONE* (August 2017) and Jamie Hartmann-Boyce, Filippo Bianchi, Carmen Piernas, Sarah Payne Riches, Kerstin Frie, Rebecca Nourse, and Susan A Jebb, "Grocery store interventions to change food purchasing behaviors: a systematic review of randomized controlled trials," *American Journal of Clinical Nutrition* 107, no. 6 (June 2018), 1013.

[299] See the spreadsheet "Strength of Evidence Assessments."

[300] See the spreadsheet "Effect Size Estimates."

[301] See the spreadsheet "Strength of Evidence Assessments."

[302] Dien Anshari, Hua-Hie Yong, Ron Borland, David Hammond, Kamala Swayampakala, and Jim Thrasher, "Which type of tobacco product warning imagery is more effective and sustainable over time? A longitudinal assessment of smokers in Canada, Australia and Mexico," *BMJ Open* 8, no. 7 (2018)

[303] Roger D. Newman-Norlund, James F. Thrasher, Johann Fridriksson, William Brixius, Brett Froeliger, David Hammond, and Michael K. Cummings, "Neural biomarkers for assessing different types of imagery in pictorial health warning labels for cigarette packaging: a cross-sectional study," *BMJ Open* 4, no. 12 (November 2014), 4 tested 50 smokers' responses to three different (experimenter-categorized) image conditions: "graphic health effect," "human suffering," and "symbolic." Participants rated graphic images (mean > 5 out of 9) as making them more feel more afraid

There is some evidence that standardizing packaging to remove branding increases the effectiveness of cigarette health warning labels, as do a variety of other packaging variations.[304] One study suggests that some of these findings may transfer to alcohol labelling.[305]

Nudges and environmental interventions

Choice architecture is "the environments within which people make choices." Nudges are "any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or

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than suffering images (mean > 4 out of 9) and symbolic images (mean < 3 out of 9). Summarizing their results overall, including from various brain scanning tests, they note that, "[r]esults from the current study were generally consistent with prior research using self-reported responses to HWL [health warning labels] stimuli. This research consistently indicates that smokers report stronger responses to HWLs with graphic imagery than to symbolic imagery. Results suggesting the greater impact of imagery of suffering than graphic imagery are not necessarily inconsistent with this research. Indeed, a number of the suffering images included graphic elements, and HWLs that combine the two may be most effective."

Linda D. Cameron, Jessica K. Pepper, and Noel T. Brewer, "Responses of young adults to graphic warning labels for cigarette packages," *Tobacco Control* 24 (2015), e19, one of the studies cited by Newman-Norlund as part of the "prior research," tested the effects of 7 (experimenter-coded) image themes on 325 smokers and non-smokers. It found that the greatest effects on discouragement from wanting to smoke were for "diseased body parts," followed by "suffering or dead people."

Dien Anshari, Hua-Hie Yong, Ron Borland, David Hammond, Kamala Swayampakala, and Jim Thrasher, "Which type of tobacco product warning imagery is more effective and sustainable over time? A longitudinal assessment of smokers in Canada, Australia and Mexico," *BMJ Open* 8, no. 7 (2018), a study of three types of picture health warnings (PHWs; "symbolic representations of risk, suffering from smoking and graphic depictions of bodily harm") for 6,565 participants across 3 countries, found that, "[f]or all outcomes, symbolic PHWs were rated lower than suffering and graphic PHWs in Canada (the only country with symbolic PHWs)." Results were more mixed when comparing "graphic" to "suffering" PHWs.. It is possible, however, that confounding variables affect the results, with the authors noting that, "[w]ith only a few examples of each class of warnings, our findings could be due to the quality of the textual content or other message features."

[304] "WHO Framework Convention on Tobacco Control. Guidelines for implementation Article 5.3; Article 8; Articles 9 and 10; Article 11; Article 12; Article 13; Article 14," World Health Organization (2013), http://apps.who.int/iris/bitstream/handle/10665/80510/9789241505185_eng.pdf, 56-61 recommends several characteristics of packaging for increasing their effectiveness: Clear location of the messages on the packaging; larger size of the warning messages; use of pictorials in addition to text warnings; the use of color; rotation by "having multiple health warnings and messages appearing concurrently or by setting a date after which the health warning and message content will change;" "[u]sing a range of health warnings and messages... as different health warnings and messages resonate with different people;" the use of the principal language of the audience; unobtrusive attribution of the information to a credible source.

The evidence supporting some of these recommendations is unclear, though some are supported by research items included in this literature review, such as David Hammond, "Health warning messages on tobacco products: a review," *Tobacco Control* 20 (2011), 327-37. For example Hammond summarizes that, "whereas obscure text-only warnings appear to have little impact, prominent health warnings on the face of packages serve as a prominent source of health information for smokers and non-smokers, can increase health knowledge and perceptions of risk and can promote smoking cessation." Hammond summarizes other studies as suggesting that, "[h]ealth warnings that are new or periodically updated are likely to have greater impact than 'older' warnings, even in the absence of changes in size and position."

[305] Mohammed Al-Hamdani and Steven M. Smith, "Alcohol Warning Label Perceptions: Do Warning Sizes and Plain Packaging Matter?" *Journal of Studies on Alcohol and Drugs* 78, no. 1 (January 2017), 79-87.

significantly changing their economic incentives."[306] Nudges can influence behavior in a variety of ways, such as through priming (subconscious clues) and changing the default options.[307] Although not necessarily meeting this definition of nudges, other forms of environmental interventions might support behavior changes without requiring individuals to consciously alter their decision-making. These include changes to the food supply, modification of cultural practices and policies, or professional development for involved staff.

Reviews consistently suggest that nudges and environmental interventions seem likely to be effective. Results are mixed within qualitative reviews that consider nudge interventions that seem most comparable to plausible interventions in the farmed animal movement, with some reviews only finding significant positive effects in a narrow majority of studies. Given the reliance on observational studies in these reviews, there is only moderate evidence suggesting that nudges and environmental interventions are likely to be effective at changing behavior in the farmed animal movement, despite the overall positive findings of most included reviews.[308] Small effects seem most typical from three included meta-analyses , with CIs ranging from very small negative to moderate positive behavioral effects.[309]

More specifically, there is strong evidence that modifying the size of portions, packaging, or tableware affects the amounts consumed.[310] For other conclusions relating to specific nudge types, the evidence is less clear. One recent meta-analysis explored the moderating effects of several variations, finding, for example, that

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[306] Richard H. Thaler and Cass R. Sunstein, *Nudge: Improving Decisions about Health, Wealth and Happiness* (New Haven, CT: Yale University Press, 2008), cited in Ivo Vlaev, Dominic King, Paul Dolan, and Ara Darzi, " The Theory and Practice of "Nudging": Changing Health Behaviors," *Public Administration Review* 76, no. 4 (July 2016), 550-61.

[307] For a recent review, see Ivo Vlaev, Dominic King, Paul Dolan, and Ara Darzi, "The Theory and Practice of 'Nudging': Changing Health Behaviors," *Public Administration Review* 76, no. 4 (July 2016), 550-61.

[308] See the spreadsheet "Strength of Evidence Assessments."

[309] See the spreadsheet "Effect Size Estimates."

[310] In L. R. Skov, S. Lourenço, G. L. Hansen, B. E. Mikkelsen, and C. Schofield, "Choice architecture as a means to change eating behaviour in self-service settings: a systematic review," *Obesity Reviews* 14, no. 3 (September 2012), 187-96, four out of five container and cutlery size interventions found significant effects on quantity of food consumed in at least one outcome or intervention measured, but several of these found mixed results among interventions. All of these studies had small numbers of participants and various methodological flaws.

Gareth J. Hollands, Ian Shemilt, Theresa M. Marteau, Susan A. Jebb, Hannah B. Lewis, Yinghui Wei, Julian P. T. Higgins, David Ogilvie, "Portion, package or tableware size for changing selection and consumption of food, alcohol and tobacco," *Cochrane Database of Systematic Reviews* 9 (September 2015) note that their "meta-analysis of 86 independent comparisons from 58 studies (6603 participants) found a small to moderate effect of portion, package, individual unit or tableware size on consumption of food (SMD 0.38, 95% CI 0.29 to 0.46), providing moderate quality evidence that exposure to larger sizes increased quantities of food consumed among children (SMD 0.21, 95% CI 0.10 to 0.31) and adults (SMD 0.46, 95% CI 0.40 to 0.52)." Of all these studies, none had a significant negative effect, whereas 27 had significant positive effects. They also note some comparisons in which effect sizes were larger, such as for studies of less healthy or more energy dense food products.

Romain Cadario and Pierre Chandon, "Which Healthy Eating Nudges Work Best? A Meta-Analysis of Field Experiments," *Marketing Science* (Unpublished; September 2018) found that size enhancements were the nudge with the largest effect size (d = .59).

Filippo Bianchi, Emma Garnett, Claudia Dorsel, Paul Aveyard, and Susan A. Jebb, "Restructuring physical micro-environments to reduce the demand for meat: a systematic review and qualitative comparative analysis," *The Lancet Planetary Health* 2, no. 9 (September 2018), e384-e397 found that "interventions reducing portion sizes of meat servings" offered some of "the most promise to reduce meat demand," since all three included RCTs that measured these interventions found significant effects.

"behaviorally-oriented nudges" were the most effective, that nudges in grocery stores were less effective than in cafeterias or eateries, and that nudges discouraging unhealthy eating were more effective than those encouraging healthy eating.[311]

There is very weak evidence from a single study of long-term effects from nudges.[312] Several reviewers highlight the weakness of the evidence base for understanding the effects of nudges, including regarding long-term effectiveness.[313]

While few of the overviews, reviews, or studies included in this literature review noted the resource requirements or cost-effectiveness of nudge interventions, it seems likely that nudges and environmental

[311] Romain Cadario and Pierre Chandon, "Which Healthy Eating Nudges Work Best? A Meta-Analysis of Field Experiments," *Marketing Science* (Unpublished; September 2018), a meta-analysis of 299 effect sizes from 96 field studies, found significant effects overall ($d = 0.22$, $p < 0.001$, CIs not reported). The authors classified nudges "according to whether they are 1) cognitively-oriented, such as 'descriptive nutritional labeling,' 'evaluative nutritional labeling,' or 'visibility enhancements;' 2) affectively-oriented, such as 'hedonic enhancements' or 'healthy eating calls;' or 3) behaviorally-oriented, such as 'convenience enhancements' or 'size enhancements.'" In multivariate analysis, they found highest effects for behaviorally-oriented nudges ($d = 0.39$, $p < .05$, 82 effect sizes) and lowest effects for cognitively-oriented nudges ($d = .12$, $p < .05$, 116 effect sizes), with affectively-oriented nudges in the middle ($d = 0.24$, $p < .05$, 49 effect sizes). In direct comparisons, they found that behaviorally-oriented nudges were significantly more effective than both cognitively-oriented nudges and affectively-oriented nudges, and that cognitively-oriented nudges were significantly less effective than affectively-oriented nudges. Interestingly, "effect sizes are significantly higher for unhealthy eating than for healthy eating ($\beta = .08$, $z = 2.39$, $p = .02$)"; respectively the effect sizes were d = 0.35, calculated from 79 effect sizes, and $d = .27$, from 180 effect sizes. They also found that, "effect sizes are significantly lower for grocery stores compared to offsite eateries ($\beta = -.20$, $z = -2.55$, $p = .01$) or onsite eateries ($\beta = -.14$, $z = -2.05$, $p = .04$)" and that, "[a]s expected, and contrary to the univariate results, effect sizes are significantly higher in the US than in other countries ($\beta = .10$, $z = 2.03$, $p = .04$)." They also found that, "effect sizes are unrelated to study duration ($\beta = -.002$, $z = -1.22$, $p = .22$), contrary to the univariate results." They calculate that the overall meta-analytic effect size of $d = .23$ and the effect size for behaviorally-oriented nudges of $d = .39$ translate into a reduction in daily kcal intake of 124 and 209 respectively.

[312] See the spreadsheet "Strength of Evidence Assessments."

[313] Denise de Ridder, Floor Kroese, Catherine Evers, Marieke Adriaanse, and Marleen Gillebaart, "Healthy diet: Health impact, prevalence, correlates, and interventions," *Psychology & Health* 32 (April 2017), 23-4, referring to four qualitative reviews included in this literature review, note that, "[a]ll reviews stress that the quality of studies included was suboptimal, and in some cases even weak... although nudging shows promise when considering health behaviour interventions, as a low-cost, effective way of increasing healthy choices, caution is needed due to the lack of population-based long-term effectiveness."

These concerns are not limited to studies of diet and nutrition, though according to Barnabas Szaszi, Anna Palinkas, Bence Palfi, Aba Szollosi, and Balazs Aczel, "A Systematic Scoping Review of the Choice Architecture Movement: Toward Understanding When and Why Nudges Work," *Behavioral Decision Making* 31, no. 3 (July 2018), 355-66, a review of 422 choice architecture interventions in 156 studies, "health-related research dominates the movement with a special focus on eating-related and drinking-related behaviors." The authors of this review "observed that only 7% of the studies applied power analysis, 2% used guidelines aiming to improve the quality of reporting, no study in our database was preregistered, and the used intervention nomenclatures were non-exhaustive and often have overlapping categories."

interventions would be more cost-effective than many individual or small group educational or behavioral interventions,[314] especially given that effect sizes for nudge interventions do not seem to be clearly smaller.[315]

Mass media

Many reviews focus explicitly on mass media interventions. These tend to be interventions directed at the entire population of an area, though they are sometimes targeted at specific demographic groups. Such interventions can use a variety of media types, such as television, radio, online adverts, signage, or leaflets. Some of the results from the sections below on social marketing and month-long campaigns could also be included as examples of mass media interventions, though they have been evaluated separately.

Although results were mostly positive, many of the included research items relied on observational study design. The main exceptions to this were in reviews focusing on social media, which could arguably be reclassified as social marketing (see below). There is weak evidence from the health behavior literature that mass media interventions are likely to be effective at changing behavior in the farmed animal movement.[316] One study focused on drug use found significant negative effects on predictors of behavior.[317] Included meta-analyses suggest that very small or small behavioral effects are most typical, with CIs ranging from small negative to moderate positive effects.[318]

Four qualitative reviews suggest that combining mass media campaigns with other intervention types increases their effectiveness. There is also some evidence of positive effects on knowledge and attitudes.[319]

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[314] Anneliese Arno and Steve Thomas, "The efficacy of nudge theory strategies in influencing adult dietary behaviour: a systematic review and meta-analysis," *BMC Public Health* 16, no. 676 (July 2016) notes that "While there are several intensive [individual] interventions which have shown success in altering individuals' body-mass indices (BMI) as well as their nutritional choices, these are largely short-term successes. Moreover, they require massive time and monetary resources for each individual targeted. Many only function at a small scale, in isolated and easily tracked communities. Hence, these previously tested interventions are highly inefficient and would be too costly to implement at a national or population level. Moreover, a less costly population-level intervention would enable under-resourced government bodies an affordable option, and encourage better health equity in the long term."

[315] From the direct tests included in the "Effect Size Estimates" spreadsheet, nudges and environmental interventions most typically seem to have small effects. Among the reviewed types of individual and small group interventions, only "direct financial incentives," "convincing alternatives," "group interventions," "action planning, coping planning, problem solving, and implementation intentions," and "counselling or therapy" typically seem to have moderate or large effects.

[316] See the spreadsheet "Strength of Evidence Assessments."

[317] Robert Hornik, Lela Jacobsohn, Robert Orwin, Andrea Piesse, and Graham Kalton, "Effects of the National Youth Anti-Drug Media Campaign on Youths," *American Journal of Public Health* 98, no. 12 (December 2008), 2229–36. Measuring self-reported marijuana use, they note that, "[m]ost analyses showed no effects from the campaign. At one round, however, more ad exposure predicted less intention to avoid marijuana use ($\gamma = -0.07$; 95% confidence interval [CI] = −0.13, −0.01) and weaker antidrug social norms ($\gamma = -0.05$; 95% CI = −0.08, −0.02) at the subsequent round. Exposure at round 3 predicted marijuana initiation at round 4 ($\gamma = 0.11$; 95% CI = 0.00, 0.22)."

[318] See the spreadsheet "Effect Size Estimates."

[319] Ben Young, Sarah Lewis, Srinivasa Vittal Katikireddi, Linda Bauld, Martine Stead, Kathryn Angus, Mhairi Campbell, Shona Hilton, James Thomas, Kate Hinds, Adela Ashie, and Tessa Langley, "Effectiveness of Mass Media Campaigns to Reduce Alcohol Consumption and Harm: A Systematic Review," *Alcohol and Alcoholism* 53, no. 3 (May 2018), 302-16 found that only 2 of 13 included studies found significant differences in alcohol consumption. However, the reviewers note that, "[t]here was some evidence that mass media campaigns generated increases in treatment seeking or

One review found that behavioral effect size was not significantly correlated with the number of media vehicles used.[320] Another review warns that, "almost all assessed mass media campaigns have included multiple programme components (eg, other community, school, and worksite interventions) and, therefore, the effects of mass media campaigns are difficult to isolate."[321] Accordingly, the evidence is very weak that more complex mass media interventions that use multiple intervention components are likely to be more effective than purely mass media interventions that utilize equivalent amounts of resources.[322]

There is very weak evidence from the health behavior literature that more intensive mass media interventions are likely to be more effective than less intensive mass media interventions.[323] Two meta-analyses focused on sexual health found differing effects of increases in campaign duration, with one finding no effect and the other finding a moderate-sized effect.[324] Despite increasing the total effect, increases in intensity may not be cost-effective; one study found that, "[a]n increase in mass media expenditure of 10% of the monthly average was associated with a 0.51% increase (of the average) in success rates of quit attempts (95% CI 0.10% to 0.91%, p=0.014)."[325]

information seeking, from a total of four studies reporting this outcome (all weak quality)" and that, "[m]ass media health campaigns about alcohol are often recalled by individuals, have achieved changes in knowledge, attitudes and beliefs about alcohol." Some of these effects may be important; the authors note that, "[m]ost campaigns that aimed to improve knowledge were shown to be effective. This was particularly evident in areas where knowledge was initially low, for example, knowledge of unit consumption guidelines and of the link between alcohol and cancer. Mass media can yield sustained knowledge, which may lay the groundwork for reductions in consumption that are achieved using other public health measures."

320 Dana Rogers, "The Impact of Mass Media-Delivered Family Planning Campaigns in Developing Countries- A Meta-analysis" (2018), http://works.bepress.com/dana-rogers/1/, 44-53.

321 Melanie A. Wakefield, Barbara Loken, and Robert C. Hornik, "Use of mass media campaigns to change health behaviour," *Lancet* 376, no. 9748 (2010), 1261-71. Each of these quotes is supported by 6 and 3 citations respectively, although they are a mixture of primary studies and other reviews.

322 See the spreadsheet "Strength of Evidence Assessments."

323 See the spreadsheet "Strength of Evidence Assessments."

324 See the spreadsheet "Effect Size Estimates."

325 Mirte A. G. Kuipers, Emma Beard, Robert West, and Jamie Brown, "Associations between tobacco control mass media campaign expenditure and smoking prevalence and quitting in England: a time series analysis," *Tobacco Control* 27, no. 4 (2018), 455-62. They add that, "[m]onthly spending on mass media campaigns ranged from nothing to £2.4 million, with a mean of £465 054… No clear association was detected between changes in mass media expenditure and changes in quit attempt prevalence (β=–0.03, 95% CI –2.05% to 2.00%, p=0.979) or smoking prevalence (β=–0.03, 95% CI –0.09% to 0.03%, p=0.299)."

The authors of some studies have been optimistic about the overall cost-effectiveness of mass media campaigns for reducing smoking,[326] though costs may still be high.[327]

A review of smoking found evidence from several studies suggesting that mass media campaigns delivered by television have greater effects than those delivered via newspaper or radio.[328] A review of family planning

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[326] Edwinah Atusingwize, Sarah Lewis, and Tessa Langley, "Economic evaluations of tobacco control mass media campaigns: a systematic review," *Tobacco Control* 24, no. 4 (2015) concluded that, "[f]ew studies on the cost-effectiveness of tobacco control mass media campaigns have been conducted" but that, "[e]xisting studies are of acceptable quality and consistently suggest that such campaigns offer good value for money." As one example, "a study based on a campaign targeting adolescents found that using optimistic assumptions the campaign was cost saving; in the pessimistic case, the ICER [incremental cost effectiveness ratio] was $4302/QALY [quality-adjusted life year]."

Kristin V Carson-Chahhoud, Faisal Ameer, Kourosh Sayehmiri, Khin Hnin, Joseph E. M. van Agteren, Fatemeh Sayehmiri, Malcolm P. Brinn, Adrian J. Esterman, Anne B. Chang, and Brian J. Smith, "Mass media interventions for preventing smoking in young people," *Cochrane Database of Systematic Reviews* 4 (June 2017; first published 1998) reported that one of the studies they examined found that, "[t]he cost of developing and broadcasting the [1997] campaign was USD 759,436 and the cost per student potentially exposed was USD 41." They add that, "[t]he cost per student averted was USD 754 (95% CI USD 531 to USD 1296) and the cost per life-year gained discounted at 3% was USD 696 (95% CI USD 445 to USD 1296). This cost per life-year gained was reported to compare favourably with other preventive and therapeutic strategies." However, only 3 out of 8 studies examined found statistically significant effects and that the quality of evidence was seen as "very low" by GRADE criteria.

[327] For example, Jessica M. LaCroix, Leslie B. Snyder, Tania B. Huedo-Medina, Blair T. Johnson, "Effectiveness of Mass Media Interventions for HIV Prevention, 1986–2013: A Meta-analysis," *Journal of Acquired Immune Deficiency Syndrome* 66 (August 2014) found that the mean campaign duration in included studies was 362 days, with a range of 1 to 1,456 days and that 83% of included campaigns "used 2 or more channels including signage (72%), radio (70%), television (57%), educational literature (51%), newspapers or magazines (33%), and promotional materials (21%)."

Dana Rogers, "The Impact of Mass Media-Delivered Family Planning Campaigns in Developing Countries- A Meta-analysis" (2018), http://works.bepress.com/dana-rogers/1/, 20 notes that, "[t]he cost to run a 30-second television commercial in South Africa for example is roughly 3000 South African Rand (approximately $230)."

[328] Sarah Durkin, Emily Brennan, and Melanie Wakefield, "Mass media campaigns to promote smoking cessation among adults: an integrative review," *Tobacco Control* 21 (February 2012), 127-38 note that, "[t]he NCI review of 47 MMCs found 98% used television, 94% radio, 89% print and 87% billboards. Only two reviewed studies examined comparative effects of different media types, finding television adverts were recalled by twice as many respondents as radio adverts. This review highlighted another US national adult population survey that found that television provides the greatest exposure among smokers, and that smokers are more likely to be heavier users of television and radio and less likely than non-smokers to be magazine or newspaper readers."

They add that, "[s]ince the NCI review, two studies have examined the relative effectiveness of different MMC [mass media campaign] channels on quitline calls. Farrelly and colleagues found for each 10% increase in expenditure on television, radio and newspaper advertising, calls increased by 1.51%, 0.037% and 0.022% respectively, with the latter only a marginally significant association [Note, however, that the number of participants or quitline calls is unclear in the study, so it is unclear if the study would have been sufficient to detect such small effects]. Mosbaek and colleagues examined a range of different adverts aired on television and on radio and found the 10 most cost effective adverts were aired on television, while the most cost effective radio advert was ranked 11th overall. It is difficult to determine whether the reduced effectiveness of non-televised messages is due to the channel, to lower population reach, or to differences in message effectiveness."

They cite one more study which found that, "a MMC message broadcast on radio generated similar levels of concern about smoking and motivation to quit as a similar message shown on television. Although this study indicates radio messages can be effective, it was broadcast concurrently with a televised version of the campaign, and so part of its effectiveness may be due to smokers bringing to mind the images associated with the televised advert. Future research should examine the effects of a standalone radio campaign. Despite radio's lower costs its reduced population reach

mass media campaigns also found in meta-regression that campaigns including television, newspapers, and magazines all had positive correlations with intervention effectiveness, whereas radio, brochures, and posters did not.[329] The latter review also found that interpersonal communication with a healthcare worker in addition to the mass media campaign had a small positive correlation with effectiveness of the intervention at improving family planning behavior ($\beta = 0.15$, $p = 0.025$, 10 effects).[330] Other reviews suggest a variety of other potential moderators of effectiveness in mass media campaigns.[331]

Some evidence from mass media focused on smoking suggests that anti-industry messaging may be similarly effective to other messaging strategies for discouraging smoking, at least when used in combination.[332]

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means that it is unlikely to be a good substitute for television in influencing population-wide smoking, and could be considered a reinforcing adjunct."

[329] Dana Rogers, "The Impact of Mass Media-Delivered Family Planning Campaigns in Developing Countries- A Meta-analysis" (2018), http://works.bepress.com/dana-rogers/1/, 52 notes that, "[c]ampaigns that included television either on its own or in combination with other media vehicles (k = 21), were positively related to campaign effects, $\beta = .088$, p = .009. Campaigns that used newspapers in combination with other media vehicles (k = 10), were also positively related to campaign effects, $\beta = .116$, p = .020, and so were campaigns that used magazines in combination with other media vehicles (k = 5), $\beta = .126$, p = .015."

[330] Dana Rogers, "The Impact of Mass Media-Delivered Family Planning Campaigns in Developing Countries- A Meta-analysis" (2018), http://works.bepress.com/dana-rogers/1/.

[331] Jane Appleyard Allen, Jennifer C. Duke, Kevin C. Davis, Annice E. Kim, James M. Nonnemaker, and Matthew C. Farrelly, "Using Mass Media Campaigns to Reduce Youth Tobacco Use: A Review," *American Journal of Health Promotion* 30, no. 2 (November 2015) summarize a survey of 32,000 youth "that showed that youth were substantially more likely to recall tobacco control advertisements that had sound saturation (OR = 1.87); intense images (OR = 1.76); loud, fast music (OR = 1.73); a second-half 'punch' or surprise twist (OR = 1.44); a number of discrete camera shots (OR = 1.05); and a number of unrelated camera cuts (OR = 1.05) (all $p < .001$)." Combined, these doubled recall rates, although a related study found effects of suspenseful features on youth aged 16 to 18 but not aged 12 to 15.

Johannes Thrul, Alexandra B. Klein, and Danielle E. Ramo, "Smoking Cessation Intervention on Facebook: Which Content Generates the Best Engagement?" *Journal of Medical Internet Research* 17, no. 11 (November 2015), e244 found that in a smoking cessation intervention on Facebook, engagement of the 79 participants varied by their stage of change (precontemplation, contemplation, or preparation) and by the content type.

Romain Guignard, Karine Gallopel-Morvan, Ute Mons, Karin Hummel, and Viêt Nguyen-Thanh, "Impact of a negative emotional antitobacco mass media campaign on French smokers: a longitudinal study," *Tobacco Control* (2018), 1 summarize that, "[s]elf-reported recall was associated with an increase in perceived susceptibility and with use of cessation services. Campaign recall was also associated with higher 7-day quitting immediately after the campaign (OR=1.8 (1.0 to 3.2), P<0.05)." On page 5 they note that, "[a]mong respondents with low self-efficacy at baseline (n=1024), there was no association between campaign recall and self-efficacy at T1, but those who recalled the campaign were less likely to report high self-efficacy at T2 (26.1% vs 37.3% among the ones who did not recall the campaign, P=0.009). After adjustment for sociodemographic characteristics, HSI and frequency of TV viewing, campaign recall was no more significantly associated with change in self-efficacy 6 months after the campaign (aOR=0.7; 95%CI 0.5 to 1.1)."

[332] Jane Appleyard Allen, Jennifer C. Duke, Kevin C. Davis, Annice E. Kim, James M. Nonnemaker, and Matthew C. Farrelly, "Using Mass Media Campaigns to Reduce Youth Tobacco Use: A Review," *American Journal of Health Promotion* 30, no. 2 (November 2015) cite a variety of mixed or unclear evidence about the effectiveness of health consequences messaging without supporting messaging about industry manipulation or secondhand smoke. Summarizing various studies, they note that, "[a]n industry manipulation theme is effective for reducing youth smoking when combined with a health consequences theme, but it may not be effective when used alone." In contrast, they conclude that, "[e]vidence is insufficient to recommend an SHS message theme for reducing youth smoking" and that, "[e]vidence is insufficient to recommend a social norms theme for reducing youth smoking."

In Jeff Niederdeppe, Maxwell Kellogg, Christofer Skurka, and Rosemary J. Avery, "Market-level exposure to state antismoking media campaigns and public support for tobacco control policy in the United States, 2001–2002," *Tobacco*

It is possible that mass media could be useful for contributing to social norms and motivating institutional changes through a "third-person effect," where individuals perceive that mass media is having a greater effect on others than it is on themselves.[333]

Social marketing

Most reviews included in this literature review that analyse social marketing use the definition provided by Alan Andreasen: "Social marketing is the application of commercial marketing technologies to the analysis, planning, execution and evaluation of programs designed to influence the voluntary behaviour of target audiences in order to improve their personal welfare and that of society."[334] Health-focused social marketing programs share some similarities with mass media campaigns in that they sometimes use the same sorts of media channels to promote healthier behaviors. However, they may incorporate additional elements, such as selling subsidized products or distributing free products.[335] This section includes any research items that refer explicitly to social marketing as part of their inclusion criteria, although several reviews warn that the term social marketing is sometimes misrepresented or applied too widely.[336]

Two reviews focused on diet or PA and diet combined examined health promotion communications that adhered at least in part to Alan Andreasen's six criteria for social marketing interventions: "the aim to change behaviours (and factors known to influence behaviour change in the longer term), distinct formative research to inform the intervention, market segmentation to increase the effectiveness of the intervention, clearly identified exchange, the use of marketing mix and consideration of competition reported."[337] Both reviews advocate for fuller adoption of Andreasen's principles of social marketing, with one noting that they found an association between fuller adoption of these principles and stronger behavioral effects.[338]

Control 27, no. 2 (2018), 177-84, logistic regression comparing across messaging themes used in anti-smoking media campaigns suggested that anti-industry appeals were similarly independently effective to other messaging themes on increasing support for indoor bans. Here, messaging about health consequences to others seemed slightly more effective than general addiction appeals. They summarize that, "[m]odel 5 appears to be the most parsimonious model without high multicollinearity, revealing that market-level volume of exposure to adult/general ads on health consequences to others (B=0.11, $p<0.001$), anti-industry appeals (B=0.09, $p<0.001$) and irrationality/addiction appeals (B=0.08, $p<0.001$) are independent and positive predictors of increased support for comprehensive indoor smoking bans… The predicted probability of supporting a ban increased by 2.0 to 2.2 percentage points per one-unit increase in adult/general-targeted state ads on health consequences of smoking to others, 1.7 to 1.8 percentage points per one-unit increase in ads using anti-industry appeals and 1.5 percentage points per one-unit increase in ads using irrationality/addiction appeals (Model 5)."

333 See, for example, Martin Eisend, "The Third-Person Effect in Advertising: A Meta-Analysis," *Journal of Advertising* 46, no. 3 (2017), 377-94.

334 A. Andreasen, *Marketing Social Change: Changing Behavior to Promote Health, Social Development, and the Environment*,(San Francisco, CA: Jossey-Bass, 1995).

335 Rebecca Firestone, Cassandra J. Rowe, Shilpa N. Modi, and Dana Sievers, "The effectiveness of social marketing in global health: a systematic review," *Health Policy and Planning* 32, no. 1 (February 2017), 110-24.

336 See, for example, Martine Stead, Ross Gordon, Kathryn Angus, and Laura McDermott, "A systematic review of social marketing effectiveness," *Health Education* 107, no. 2 (2007), 126-91.

337 Krzysztof Kubacki, Sharyn Rundle-Thiele, Ville Lahtinen, and Joy Parkinson, "A systematic review assessing the extent of social marketing principle use in interventions targeting children (2000-2014)," *Young Consumers* 16, no. 2 (2015), 141-58, citing Alan R. Andreasen, "Marketing Social Marketing in the Social Change Marketplace," *Journal of Public Policy & Marketing* 21, no. 1 (2002), 3-13.

338 Julia E. Carins and Sharyn R. Rundle-Thiele, "Eating for the better: a social marketing review (2000–2012)," *Public Health Nutrition* 17, no. 7 (July 2014), 1628 explain that, "[t]he sixteen studies that met the definition of social marketing

There is weak evidence from the health behavior literature that social marketing is likely to be effective at changing behavior in the farmed animal movement.[339] Two included meta-analyses found a wide range of possible behavioral effect sizes, from very small to large; small or moderate effects seem most typical.[340] There is very weak evidence of long-term effects.[341]

Month-long campaigns

Some organizations in the farmed animal movement utilize pledges to make dietary change for approximately one month, which are supplemented by motivational or behavioral support. These include Veganuary, Challenge 22, and Animal Aid's Summer Vegan Pledge. Some similar campaigns of approximately one month in length have been utilized to improve health behavior. They share similar characteristics, including mass media advertisement of the campaigns. This section includes a small number of studies identified through non-systematic means that seemed comparable to the month-long campaigns in the farmed animal movement.

There is weak evidence from the health behavior literature that month-long campaigns are likely to be effective at changing behavior in the farmed animal movement. There is very weak evidence that those who use this intervention to assist behavioral change will maintain their new behavior after the end or withdrawal of the intervention.[342]

The available evidence from the health behavior campaigns differs to that available for campaigns in the farmed animal movement. For example, one analysis of the month-long "Stoptober" campaign against smoking in England found no evidence that Stoptober brought forward quit attempts from other months, despite tests to check whether this had happened.[343] There is also evidence that unofficial participation in the campaigns may be much higher than official participation. A paper on Dry January (where participants avoid

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used significantly more of Andreasen's (2002) criteria and were more effective in achieving behavioural change than the eighteen studies in subset 2." On page 1630 they explain the difference between these subsets, noting that, "[s]tudies in subset 1 (typically) commenced with consumer-oriented research to produce an intervention involving a full marketing mix, in contrast to studies that were not consumer-oriented (subset 2). Studies in subset 2 developed their intervention through other means, often starting with a needs assessment and erroneously viewing social marketing as social advertising/health promotion. While aspects of Andreasen's social marketing benchmark criteria could be applied to studies in this subset, the reality is that audience research was restricted to message testing and a consumer-oriented approach was not evident in the development of a marketing mix." On page 1631 they add that, "[s]ubset 2 (eighteen studies) contained six studies that did not assess behaviour change ('not reported'), eight that reported positive change to at least some behaviour measures and four that reported no change. The proportion of studies that found change on at least some measures was higher in subset 1 than subset 2 (100 % v. 67 %, respectively; $P = 0.04$)."

[339] See the spreadsheet "Strength of Evidence Assessments."

[340] See the spreadsheet "Effect Size Estimates."

[341] See the spreadsheet "Strength of Evidence Assessments."

[342] See the spreadsheet "Strength of Evidence Assessments."

[343] Jamie Brown, Daniel Kotz, Susan Michie, John Stapleton, Matthew Walmsley, and Robert West, "How effective and cost-effective was the national mass media smoking cessation campaign 'Stoptober'?" *Drug Alcohol Dependence* 135, no. 100 (February 2014), 52-8 note that, "[i]n a logistic regression model of the effect of the year of the survey (2012 vs. 2007–2011) on the weighted percentage of past-month quit attempts during the months of November and December, there was no evidence that Stoptober 'brought forward' quitting by reducing quit attempts in November and December 2012 as compared with November and December 2007–2011 (6.5% vs. 6.3%; OR = 1.03, 95% CI = 0.75–1.40)." However, the CI is wide here so does not exclude the possibility that Stoptober "brought forward" quitting attempts.

alcohol for a month) noted that the 2016 campaign had 60,000 official participants but adds that 7% and 11% of respondents to surveys of "population-representative samples of drinkers" in 2015 and 2016 respectively reported participating unofficially.[344] Given that vegan pledge campaigns seem comparable both in terms of official participation (there were 59,500 official Veganuary participants in 2017 compared to 60,000 Dry January participants in the same year) and budget (£130,000 was spent on Veganuary's January campaign in 2017[345] compared to £500,000 on Dry January in 2016), it seems reasonable to infer that national awareness[346] and unofficial participation rates may be similar, though differences between animal product consumption and alcohol consumption mean that the results cannot be seen as directly transferable.[347]

Comparing the results of the first Stoptober study to a study of a "No Smoking Day" campaign suggests that using resources to promote a campaign for a single day may be similarly or more cost-effective than a month-long pledge campaign.[348]

A paper on surveys of participants in Dry January campaigns notes that "[m]ultivariate analyses revealed that success during Dry January was best predicted by a lower frequency of drunkenness in the month prior to

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[344] Richard O. de Visser, Emily Robinson, Tom Smith, Gemma Cass, and Matthew Walmsley, "The growth of 'Dry January': promoting participation and the benefits of participation," *European Journal of Public Health* 27, no. 5 (October 2017), 929-31.

[345] Veganuary, "Did Veganuary 2017 Help Animals?," accessed January 16, 2019 https://veganuary.com/blog/did-veganuary-2017-help-animals/. Note that participation rates and budget have both increased significantly in subsequent years.

[346] R. O. de Visser, E. Robinson, and R. Bond, "Voluntary temporary abstinence from alcohol during "Dry January" and subsequent alcohol use," *Health Psychology* 35, no. 3 (March 2016), 281-9 note that awareness of Dry January in survey participants was 64% of all drinkers in 2015 and 78% in 2016.

[347] Richard O. de Visser, Emily Robinson, Tom Smith, Gemma Cass, and Matthew Walmsley, "The growth of 'Dry January': promoting participation and the benefits of participation," *European Journal of Public Health* 27, no. 5 (October 2017), 929-31.

[348] Jamie Brown, Daniel Kotz, Susan Michie, John Stapleton, Matthew Walmsley, and Robert West, "How effective and cost-effective was the national mass media smoking cessation campaign 'Stoptober'?" *Drug Alcohol Dependence* 135, no. 100 (February 2014), 52-8 note that, "[s]imple effects revealed that in 2012 there was an increase in past-month quitting during October as compared with all other months (9.6% vs. 6.6%; OR = 1.50, 95%CI = 1.05–2.15), whereas in 2007–2011 there was a non-significant decrease during October (6.4% vs. 7.5%; OR = 0.84, 95%CI = 0.70–1.00). Thus, by subtracting the difference between the weighted percentage of all smokers reporting a past-month quit attempt in October 2012 and all other months in 2012 from the equivalent figure for 2007–2011, the overall estimate of additional past-month quitting attributed to Stoptober was calculated to be 4.15% (95%CI = 0.94–7.37)." With an estimated cost-effectiveness of "less than £415 per DLY [discounted life years] in the modal age group," the authors of the study note that, "the cost effectiveness of Stoptober compared favourably with other estimates concerning UK anti-tobacco campaigns, which have ranged between £40 and £2000 per discounted life year gained."

D. Kotz, J. A. Stapleton, L. Owen, and R. West, "How cost-effective is 'No Smoking Day'?" *Tobacco Control* 20, no. 4 (2011), 302-4 found an equivalent cost-effectiveness estimate of £82.24 (95% CI 49.7 to 231.6) for a "No Smoking Day" (NSD). Although they compared quit attempts in April (when NSD occurred) to April and May, the NSD study did not conduct an analysis comparing quit attempts in the month of April in years before and after No Smoking Day was introduced. Intuitively, it seems more likely that a single quitting day would bring forwards quit attempts that smokers were otherwise intending to make, and so the large difference in estimated cost-effectiveness between the studies of NSD and Stoptober seems likely to be exaggerated. Nevertheless, the estimates in this paper suggest that using resources to promote a campaign for a single day may be similarly—or more—cost-effective than a month-long pledge campaign.

Dry January."[349] There are several limitations to the evidence of the effectiveness of Dry January, as well as theoretically plausible negative effects.[350]

Advertising and advertising bans

Some research items evaluate the impact of advertising on health behavior or its predictors, usually with a focus on the effects of industry advertising on encouraging unhealthy products. The included studies use almost exclusively observational study designs. Other research items evaluate the effectiveness of bans of these forms of harmful advertising, relying mostly on observational data. Sometimes, the effects of bans are modelled using observational data on the effects of advertising.

The health behavior literature provides weak evidence that the advertising of products increases consumption of them, but very weak evidence that bans of advertisements for undesirable products are likely to be ineffective at changing behavior in the farmed animal movement.[351] Included meta-analyses suggest small or very small behavioral effects of advertising are most typical, with CIs suggesting a range of possibilities from very small effects in the opposite direction to intended through to moderate effects in the intended direction. Included meta-analyses suggested no effect or very small effects from advertising bans, with CIs from very small negative effects through to small positive effects.[352]

One reason for the lack of evidence of the effectiveness of advertising bans, despite evidence that advertising does affect behavior, may be that some regulation (such as industry self-regulation) fails to decrease exposure to advertising. Such concerns are highlighted by two reviews of regulation on food and beverage advertising to children.[353]

It is possible that using regulation to support mass media interventions that encourage particular behaviors may be more effective than advertising bans on the undesired behavior.[354] However, there is some evidence

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[349] R. O. de Visser, E. Robinson, and R. Bond, "Voluntary temporary abstinence from alcohol during "Dry January" and subsequent alcohol use," *Health Psychology* 35, no. 3 (March 2016), 281-9.

[350] See, for example, Ian Hamilton and Ian Gilmore, "Could campaigns like Dry January do more harm than good?" *BMJ* 352 (January 2016), i143.

[351] See the spreadsheet "Strength of Evidence Assessments."

[352] See the spreadsheet "Effect Size Estimates."

[353] S. Galbraith-Emami and T. Lobstein, "The impact of initiatives to limit the advertising of food and beverage products to children: a systematic review," *Obesity Reviews* 14 (December 2013), 960-74 and Stephanie A.Chambers, Ruth Freeman, Annie S. Anderson, and Steve MacGillivray, "Reducing the volume, exposure and negative impacts of advertising for foods high in fat, sugar and salt to children: A systematic review of the evidence from statutory and self-regulatory actions and educational measures," *Preventive Medicine* 75 (June 2015), 32-43 conclude that statutory regulation may reduce children's exposure to advertising, but that the evidence for the effectiveness of self-regulatory approaches is less promising.

[354] Malgorzata M. Bala, Lukasz Strzeszynski, Roman Topor-Madry, "Mass media interventions for smoking cessation in adults," *Cochrane Database of Systematic Reviews* 11 (November 2017) note that, "[m]ass media tobacco control campaigns in the USA began in 1967, following the publication of the 1964 Surgeon General's report on smoking and health (Surgeon General 1964). The Federal Communications Commission enforced the Fairness Doctrine, obliging radio and television stations to broadcast one tobacco control message for every three cigarette commercials (equivalent to a media value today of USD 300 million (WHO 2001)). This policy lasted until 1970, when a ban on broadcast cigarette advertising came into effect. Cigarette consumption had declined by 37% during the campaign, but began to rise again after the advertising ban ended free access to broadcast time for tobacco control messages (Warner 1977; USDHHS 1991)."

that legislation compelling the alcohol industry to promote drinking safety messages has been circumvented or misused.[355]

Bans on the risk behavior

Some reviews evaluate whether banning risk behaviors leads to improvements in health behavior. Unsurprisingly, for those reviews that focus on the effects of behavior within a specific evaluated context (such as a reduction of smoking in a particular workplace after a ban was implemented on smoking in that workplace), evidence fairly consistently suggests positive effects on behavior. One included meta-analysis focused on smoking found evidence of small or moderate behavioral effects.[356] Although the research items included in this literature review provide surprisingly weak evidence that localized bans of risk behaviors are effective at reducing those risk behaviors in those contexts,[357] intuitively the case is much stronger. Behavior change in such cases is a matter of enforcement of the policies, although this may in itself be difficult in some contexts, as shown by a review considering smoking bans in prisons,[358] an overview of restrictions on tobacco sales to minors,[359] and a study on the effects of an intervention to better enforce booster seat legislation.[360]

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[355] Cécile Knai, Mark Petticrew, Mary Alison Durand, Elizabeth Eastmure, and Nicholas Mays, "Are the Public Health Responsibility Deal alcohol pledges likely to improve public health? An evidence synthesis," *Addiction* 110, no. 8 (2015), 1239-41 note that, "Barry & Goodson note responsible drinking messages' strategically ambiguous nature, reporting that brewer-sponsored responsible drinking messages often had an underlying pro-drinking theme, assumed that the recipient of the message was drinking and did not mention situations in which individuals should not drink. Agostinelli et al. echoed these findings… Anderson et al. report that industry-funded alcohol prevention campaigns (such as Drinkaware) tend to lead to positive views about alcohol and the alcohol industry. Moss et al. evaluated the effects of the Drinkaware 'Why let the good times go bad?' campaign, reporting at a conference that Drinkaware posters seem to have the opposite result to that which is intended, with participants drinking more when the Drinkaware posters were on display."

Robyn Burton, Clive Henn, Don Lavoie, Rosanna O'Connor, Clare Perkins, Kate Sweeney, Felix Greaves, Brian Ferguson, Caryl Beynon, Annalisa Belloni, Virginia Musto, John Marsden, and Nick Sheron, "A rapid evidence review of the effectiveness and cost-effectiveness of alcohol control policies: an English perspective," *The Lancet* 389, no. 10078 (April 2017), 8 also found that labelling and "drink responsibly" messaging requirements for companies in England have been circumvented and that, "the OECD concludes that "the delivery of education messages by private sponsors [is found to] have no significant public health effects," a view echoed by the British Medical Association and confirmed by empirical evidence." The quality of this evidence is unclear from the review, however.

[356] See the spreadsheet "Effect Size Estimates."

[357] See the spreadsheet "Strength of Evidence Assessments."

[358] Dominique de Andrade and Stuart A. Kinner, "Systematic review of health and behavioural outcomes of smoking cessation interventions in prisons," *Tobacco Control* 26, no. 5 (2017), 495-501 note that, "[w]hile one study reported no significant change to prisoner smoking behaviour postban, the remaining two studies found that when prisoners still have access to tobacco (ie, indoor bans), many will breach prison rules with 51% and 93% of prisoners (respectively) continuing to smoke indoors following the ban. According to authors, this was largely due to smokers among prison staff not enforcing the ban. Despite these negative outcomes, these studies found a significant reduction in the average number of cigarettes smoked per day compared with preban and preadmission consumption. In one study, participants also reported perceived improvements in overall health."

[359] Steven J. Hoffman and Charlie Tan, "Overview of systematic reviews on the health-related effects of government tobacco control policies," *BMC Public Health* 15, no. 1 (August 2015). See the section "Restrict sales to minors."

[360] John E. Ehiri, Henry O. D. Ejere, Lesley Magnussen, Donath Emusu, William King, and Scott J. Osberg, "Interventions for promoting booster seat use in four to eight year olds travelling in motor vehicles," *Cochrane Database of Systematic Reviews* 1 (January 2006) notes that "Only one study (Bowman 1987) compared enforcement of [use of booster seat] law with no intervention. This study showed no marked difference in use of booster seats among the intervention 158/252 (63%) and control groups 161/268 (60%), RR 1.04; 95% CI 0.91 to 1.20 (n = 520)."

One study finding significant effects of a ban on trans fats had follow-up at 20 months after the policy change,[361] and this provides very weak evidence that these localized policies will have long-term positive effects.[362] Again, however, significant positive benefits seem intuitively likely, as long as enforcement is maintained.

Less intuitively clear is whether bans on undesired behaviors in specific contexts will lead affected individuals to change their behavior in other contexts as well, or whether they will just behave in the undesired manner in other contexts where the ban is not operational. The health behavior literature provides weak evidence that bans will have positive effects on behavioral outcomes, even after allowing for such a displacement effect.[363]

Other legislation

Beyond taxation and subsidies, labelling laws, and bans on risk behaviors, a variety of other policy types can be used to alter health behavior, although these are not consistently tested across different health behaviors. For example, two reviews found evidence suggesting that policies making vaccination or immunization compulsory increase uptake rates.[364] One of these reviews was a meta-analysis which suggests that moderate behavioral effects are most typical, with CIs suggesting that anything from small to large effect sizes were possible.[365] There is some evidence that dietary policies and restrictions on certain food types are effective.[366] There is also some evidence that restrictions on the accessibility of alcohol, such as by regulating the opening

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[361] S. Y. Angell, L. K. Cobb, C. J. Curtis, K. J. Konty, and L. D. Silver, "Change in trans fatty acid content of fast-food purchases associated with New York City's restaurant regulation: a pre-post study," *Ann Intern Med.* 157 (2012), 81–6, cited in S. L. Mayne, A. H. Auchincloss, and Y. L. Michael, "Impact of policy and built environment changes on obesity-related outcomes: a systematic review of naturally occurring experiments," *Obesity Reviews* 16, no. 5 (March 2015), 362-75.

[362] See the spreadsheet "Strength of Evidence Assessments."

[363] See the spreadsheet "Strength of Evidence Assessments."

[364] Cecilia Lee and Joan L. Robinson, "Systematic review of the effect of immunization mandates on uptake of routine childhood immunizations," *Journal of Infection* 72, no. 6 (June 2016), 659-66, a review of 21 before-and-after and observational studies of immunization mandates (policies making immunization compulsory) found that, "[a]ll but two studies showed at least a trend towards increased uptake with mandates" and that, "[h]igher uptake was associated with a more long-standing mandate." The reviewers only report on statistical significance in 8 studies; 5 found significant effects, 2 found significant effects in one intervention group but not the other, and the other found insignificant effects.

Subgroup analysis in Jai K. Das, Rehana A. Salam, Ahmed Arshad, Zohra S. Lassi, and Zulfiqar A. Bhutta, "Systematic Review and Meta-Analysis of Interventions to Improve Access and Coverage of Adolescent Immunizations," *Journal of Adolescent Health* 59, no. 4 (July 2016), S40-S48, a review focused on adolescents, included 7 vaccination requirement interventions in schools; pooled, these had a statistically significant effect (RR 1.94, 95% CI 1.39 to 2.71).

[365] See the spreadsheet "Effect Size Estimates."

[366] Dariush Mozaffarian, Ashkan Afshin, Neal L. Benowitz, Vera Bittner, Stephen R. Daniels, Harold A. Franch, David R. Jacobs, William E. Kraus, Penny M. Kris-Etherton, Debra A. Krummel, Barry M. Popkin, Laurie P. Whitsel, and Neil A. Zakai, "AHA Scientific Statement Population Approaches to Improve Diet, Physical Activity, and Smoking Habits A Scientific Statement From the American Heart Association," *HHS Author Manuscripts* 126, no. 12 (September 2012) summarizes that "quasi-experimental experiences" from Finland and Mauritius "demonstrate that regulatory policies to reduce particular nutrients in foods are highly effective for improving population dietary habits." Finland instituted "legislative restrictions on the maximum salt content of certain foods in the 1990s and percentage of milk fat in whole and low-fat milk in the 1980s and 1990s" which may have contributed to the decline in salt consumption of "4 to 15 g in men (unknown in women) to about 11 g in men and 7 g in women; mean diastolic blood pressure declined by 5% in men and 13% in women; and mean total blood cholesterol declined by almost 20%" from the 1970s to late 1990s. In Mauritius, a multicomponent intervention including "regulatory policy for general cooking oil to limit the content of palm oil and replace it with soybean oil… is estimated to have reduced consumption of saturated fat by about 3.5% energy and increased consumption of polyunsaturated fat by about 5.5% energy by 1992."

hours of shops, reduces alcohol consumption.[367] Interestingly, an overview notes a lack of evidence that drinking guidelines affect consumption levels[368] and a Cochrane review found no evidence to support the use of school tobacco policies in preventing smoking initiation.[369]

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[367] Puru Panchal, Kerry Waddell, and Michael G.Wilson, *Rapid synthesis: Examining the costs and cost-effectiveness of policies for reducing alcohol consumption* (Hamilton, Canada: McMaster Health Forum, 2018), 8, notes that, "[t]wo reviews included in a recent overview of systematic reviews found that restricting opening hours is effective for reducing alcohol consumption when implemented regionally, nationally or in isolated communities, however, two other reviews found that these policies had mixed effects when implemented in less isolated areas. Another recent overview of systematic reviews supported this finding, reporting conflicting evidence on the effect of limiting hours of operation, as the effectiveness of these policies depends largely on the availability and hours of operation in surrounding jurisdictions. One recent overview of systematic reviews and an older rapid synthesis found that government monopolies significantly benefit consumption-related harm, however the older rapid synthesis suggests that when a monopoly is not possible, implementing a licensing system for selling alcohol (with the collection of fees) may have similar benefits. One older medium-quality systematic review and a recent rapid synthesis found an association between hours of sale of alcohol and increases in alcohol-related harms, including drinking and driving and road accidents. However the association is less clear for the effects on alcohol consumption or health harms."

Timothy S. Naimi, Jason Blanchette, Toben F. Nelson, Thien Nguyen, Nadia Oussayef, Timothy C. Heeren, Paul Gruenewald, James Mosher, and Ziming Xuan, "A New Scale of the U.S. Alcohol Policy Environment and Its Relationship to Binge Drinking," *American Journal of Preventive Medicine* 46, no. 1 (January 2014), 10-16, a study using a scale of 29 policies other than tax and pricing controls, including licencing laws, accessibility restrictions, and minimum legal drinking age laws, noted correlations between higher scores on the scale and reducing binge drinking prevalence.

Ziming Xuan, Jason Blanchette, Toben F. Nelson, Timothy Heeren, Nadia Oussayef, and Timothy S. Naimi, "The Alcohol Policy Environment and Policy Subgroups as Predictors of Binge Drinking Measures Among US Adults," *American Journal of Public Health* 105, no. 4 (April 2015), 816-22, a paper using "generalized estimating equations regression models to relate the alcohol policy environment based on data from 29 policies in US states from 2004 to 2009," found that, "[a] 10 percentage point higher alcohol policy environment score, which reflected increased policy effectiveness and implementation, was associated with an 8% lower adjusted odds of binge drinking and binge drinking 5 or more times, and a 10% lower adjusted odds of consuming 10 or more drinks." There were small differences between different policy types. Pricing policies (n = 3) resulted in AOR 0.96 (95% CI 0.96 to 0.97) on binge drinking and physical availability policies (n = 13) resulted in AOR 0.96 (95% CI 0.95 to 0.97). Other policies (n = 13) together resulted in AOR 0.99 (95% CI 0.98 to 1.00), and so pricing and physical availability policies may be some of the most effective. Although some aspects of the methodology are unclear, it involved subjective judgement calls and demonstrates correlations at the state level. It therefore does not necessarily show the existence of causal relationships, and lurking variables like state culture and the level of public discussion or media attention could explain some of the correlations seen.

[368] Cécile Knai, Mark Petticrew, Mary Alison Durand, Elizabeth Eastmure, and Nicholas Mays, "Are the Public Health Responsibility Deal alcohol pledges likely to improve public health? An evidence synthesis," *Addiction* 110, no. 8 (2015), 1237-9 note that, "[t]here are no systematic or other reviews on the effect of publicizing drinking guidelines… Babor et al. concluded that disseminating guidelines may be considered appropriate because it provides information to consumers, but there is no evidence that guidelines have any effect on alcohol consumption. Kerr & Stockwell highlight a 2007 Scottish work-place-based study where participants were asked about their drinking in relation to the UK Sensible Drinking daily guidelines; 20% reported using the guidelines to guide drinking."

[369] Alessandro Coppo, Maria Rosaria Galanti, Livia Giordano, Daria Buscemi, Sven Bremberg, and Fabrizio Faggiano, "School policies for preventing smoking among young people," *Cochrane Database of Systematic Reviews* 10 (October 2014). They note that school tobacco policies "inform whether and where pupils can smoke, to set penalties for pupils caught smoking, and to regulate adult smoking in school." The authors "found only one study which was eligible for inclusion in the review. It was judged to be at high risk of bias. The study compared two 'middle schools' from two different regions in China. The experimental conditions included the introduction of a tobacco policy, environmental changes, and communication activities, while the control condition was no intervention. After a year's follow-up the study found no differences in smoking prevalence between intervention and control schools."

The health behavior literature provides weak evidence that policies other than taxation, bans, or labelling are likely to be effective at changing behavior in the farmed animal movement and very weak evidence of long-term effects.[370]

Other intervention types or points of interest

Gradual or abrupt transition

It seemed possible that research items might have evaluated the effects of varying the suddenness or gradualness with which health behavior changes were implemented. However, few such research items were identified in this review.[371] The health behavior literature provides weak evidence that there is likely to be little difference in effectiveness between interventions that encourage gradual behavior change in the farmed animal movement and those that encourage abrupt behavior change. If anything, the evidence very weakly leans in favor of more abrupt behavior change strategies.[372]

Researchers focused on smoking have hypothesized that those who attempt to quit gradually may be less successful either due to lower motivation, or to a lack of structuring in their efforts at gradual reduction. There is some empirical evidence for the former claim, since an RCT found that, "[p]articipants who preferred gradual cessation were significantly less likely to be abstinent at 4 weeks than those who preferred

[370] See the spreadsheet "Strength of Evidence Assessments."

[371] Two identified small-scale studies on the implementation of the ketogenic diet to address epilepsy (A. G. Christina Bergqvist, Joan I. Schall, Paul R. Gallagher, Avital Cnaan, and Virginia A. Stallings, "Fasting versus Gradual Initiation of the Ketogenic Diet: A Prospective, Randomized Clinical Trial of Efficacy," *Epilepsia* 46, no. 11 (November 2005), 1810-9 and Seema Bansal, Laura Cramp, Dan Blalock, Tesfaye Zelleke, Jessica Carpenter, and Amy Kao, "The Ketogenic Diet: Initiation at Goal Calories Versus Gradual Caloric Advancement," *Pediatric Neurology* 50, no. 1 (January 2014), 26-30) did not seem very comparable to the goals of dietary interventions in the farmed animal movement.

Although Nicola Lindson-Hawley, Paul Aveyard, and John R. Hughes, "Reduction versus abrupt cessation in smokers who want to quit," *Cochrane Database of Systematic Reviews* 11 (November 2012; first published 2010) found insignificant differences, they note that this finding contrasts to previous observational studies. Nicola Lindson-Hawley, Miriam Banting, Robert West, Susan Michie, Bethany Shinkins, and Paul Aveyard, "Gradual Versus Abrupt Smoking Cessation A Randomized, Controlled Noninferiority Trial," *Annals of Internal Medicine* 164, no. 9 (May 2016) also provide evidence that abrupt smoking cessation is more effective than gradual smoking cessation.

Though the evidence seems less comparable, Silvia Minozzi, Laura Amato, Cristina Bellisario, and Marina Davoli, "Detoxification treatments for opiate dependent adolescents," *Cochrane Database of Systematic Reviews* 4 (April 2014; first published 2009) found one study comparing detoxification treatments to maintenance treatments (i.e. comparing complete withdrawal from the drug to gradual withdrawal, but where both groups were assisted with buprenorphine). The detoxification treatment performed worse on most metrics. Marica Ferri, Marina Davoli, and Carlo A. Perucci, "Heroin maintenance for chronic heroin-dependent individuals," *Cochrane Database of Systematic Reviews* 12 (December 2011; first published 2003) found that meta-analysis of four studies that "compared supervised injected heroin plus flexible dosages of methadone treatment to oral methadone only… showed that heroin helps [heroin-dependent] patients to remain in treatment" (RR 1.44, 95% CI 1.19-1.75). However, this does not necessarily show that doing so improves eventual cessation rates, and the difference in mortality was statistically insignificant (RR 0.65, 95% CI 0.25 to 1.69).

[372] See the spreadsheet "Strength of Evidence Assessments."

abrupt cessation (38.3% vs 52.2%; P = 0.007)," regardless of their allocation to intervention or control groups.[373]

Effectiveness of interventions varying by demographic characteristics

Some reviews in the health behavior literature compare subanalyses or conduct regression analyses to note whether the reviewed interventions have effects of different sizes on participants with different demographic characteristics. Other reviews consider the effects of reviewed interventions on various markers of inequality, usually using qualitative methods. The most frequently assessed demographic variable is socioeconomic status (SES, sometimes referred to as socioeconomic position or SEP), which variously includes measures such as class, occupation, education, income, and deprivation. Sometimes effects are considered by ethnicity, gender, and age. The included research items in this section more frequently relied on qualitative evidence than was the case in the other examined moderators of intervention effectiveness. The categorizations used in this section are more subjective than elsewhere in this literature review. In some cases, reviews have been categorized as providing evidence of effects that differ by certain demographic characteristics even if less than half of the included studies support that finding, because the evidence is generally weak or mixed. All findings are listed in the final tab of the "Moderator Analyses" spreadsheet.

Many health behavior studies focus on delivering interventions specifically to groups that face inequalities in health outcomes or in their health behavior when compared to more privileged groups. For example, an intervention might target an educational campaign specifically at a low SES group. Unsurprisingly, such interventions tend to find either no effect on decreasing inequality (if the intervention failed) or successfully decrease inequality (if the targeted intervention had significant positive effects). Results such as these do not suggest, however, that these interventions are especially effective among certain demographic groups and are not included in this section.

There is evidence that education or information only interventions are less effective amongst people with low SES. The evidence for mass media interventions is less consistent; two reviews note some evidence of weaker effects on people with low SES, although other reviews found that SES does not moderate mass media effectiveness or found mixed and unclear evidence from different studies. There is also evidence that bans on risk behaviors have weaker effects on those of low SES.

In contrast, there was fairly consistent evidence that taxes, subsidies, and interventions affecting price had greater effects on those of low SES. However, even though they reduce inequalities, they may be perceived as being harmful to disadvantaged individuals, by curtailing their freedom to choose more than is the case for wealthier individuals who can still afford expensive products.[374]

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[373] Nicola Lindson-Hawley, Miriam Banting, Robert West, Susan Michie, Bethany Shinkins, and Paul Aveyard, "Gradual Versus Abrupt Smoking Cessation A Randomized, Controlled Noninferiority Trial," *Annals of Internal Medicine* 164, no. 9 (May 2016).

[374] Anne Marie Thow, Stephen Jan, Stephen Leeder, and Boyd Swinburn, "The effect of fiscal policy on diet, obesity and chronic disease: a systematic review," *Bulletin of the World Health Organization* 88, no. 8 (2010), 609-14 note some evidence that price increases increase the costs for those on lower incomes more than they reduce consumption and see such policies as "regressive."

There is some evidence that multi-component interventions do not differ in their effectiveness by SES and are more effective among ethnic minority groups. There is some evidence that food labelling is more effective among females than males.

Beyond these conclusions, the research items included in this literature review do not provide consistent evidence for how the effects of particular interventions differ by demographic characteristics.

One theory, discussed in several reviews, posits that interventions that require individuals to use a high level of agency in order to make behavioral changes (that is, interventions that seek to support change through improved knowledge or skills, as opposed to through structural, financial, or environmental means) will widen inequalities in health outcomes by having a lower effect on disadvantaged groups.[375] Although most of the evidence described above provides support for this theory, the finding that bans on risk behaviors are less effective among those of low SES is contrary to this. Additionally, one review focused on obesity found that, "[m]ost policies had neutral impacts on obesity-related inequities regardless of whether they were agentic (60% neutral), agento-structural (68% neutral) or structural (67% neutral). The proportion of positive impacts was similar across policy types (10% agentic, 18% agento-structural and 11% structural), with some differences for negative impacts (30% agentic, 14% agento-structural and 22% structural)."[376] Overall, there seems to be weak evidence in support of this theory; it may be a useful rule of thumb in the absence of better information, but may not be consistently true.

There are theoretical reasons to believe that peer mentoring may be more effective among disadvantaged populations[377] but this literature review only identified indirect support for this suggestion. Two reviews show that peer mentoring does have effects among disadvantaged groups, but do not show that they are larger

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375 See, for example, Jean Adams, Oliver Mytton, Martin White, and Pablo Monsivais, "Why Are Some Population Interventions for Diet and Obesity More Equitable and Effective Than Others? The Role of Individual Agency," *PLOS Medicine* (April 2016).

376 D. L. Olstad, M. Teychenne, L. M. Minaker, D. R. Taber, K. D. Raine, C. I. J. Nykiforuk, and K. Ball, "Can policy ameliorate socioeconomic inequities in obesity and obesity-related behaviours? A systematic review of the impact of universal policies on adults and children," *Obesity Reviews* 17, no. 12 (2016), 1198-1217. They explain that, "[a]gentic interventions aim to increase individual knowledge or skills to make healthier choices, leaving the environment unchanged. Structural interventions, by contrast, change the environmental context within which individual behaviours occur, thereby diminishing individual agency. Agento-structural interventions are situated between the two, as they address structural aspects of environments, while leaving individual choice largely intact."

Using the Cochrane risk of bias tool, "[t]en studies were rated as weak, 18 as moderate and eight as strong." In sensitivity analyses, they note that, "overall results for each type of policy remained unchanged when we excluded the eight studies that examined policies that were classified into multiple categories (50.0–75.0% neutral), studies of weak quality (61.5–75.0% neutral) or cross-sectional studies (66.7– 80.0% neutral), with little change in the proportion of positive or negative impacts."

377 Pauline Ford, Anton Clifford, Kim Gussy, and Coral Gartner, "A Systematic Review of Peer-Support Programs for Smoking Cessation in Disadvantaged Groups," *International Journal of Environmental Research and Public Health* 10, no. 11 (2013) discussed some of the possible benefits of peer-support for ethnic minority populations which have been identified in previous literature, such as noting that, "[p]eer-support programs may be particularly suitable for supporting behaviour change among indigenous people as peer-support programs have a strong emphasis on social empowerment and align with cultural approaches and values such as the mentoring role of elders." They hypothesized that, "peer-support may be more useful in groups where social support may not be readily available or where social networks may act to promote rather than to discourage smoking behaviours"; that is, peer support may be especially useful for disadvantaged groups where that group is more engaged in a risk behavior than more advantaged populations.

among these populations than more advantaged populations.[378] The evidence suggesting that interventions where the patient and deliverer are matched on demographic characteristics are likely to be more effective at changing behavior in the farmed animal movement than interventions without demographic matching (see the section on "Other variations") is relevant here; if ethnic minority participants respond better to intervention deliverers with the same ethnicity as them, then some peer mentoring programs may increase the likelihood that they are demographically matched to the intervention deliverer. However, the evidence for the effectiveness of peer-led interventions in general is weaker than the evidence for the effectiveness of some other intervention types.

Other intervention types

There is some weak direct evidence that food preparation interventions and demonstrations can have significant effects on diet.[379] This is indirectly supported by the broadly positive evidence for the effectiveness of the BCTs "Provide instruction," "Prompt practice," and "Model or demonstrate the behavior," although only the first of these has supporting evidence from multiple reviews specifically for dietary behaviors.[380]

One Cochrane review of smoking found "insufficient evidence to support the use of any specific behavioural intervention to help smokers who have successfully quit for a short time to avoid relapse."[381]

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[378] R. L. Petosa and Laureen H. Smith, "Peer Mentoring for Health Behavior Change: A Systematic Review," *American Journal of Health Education* 45, no. 6 (2014), 352 and 354 note that, "much of this literature employed rigorous, randomized control designs and has yielded favorable changes in health behavior." They also note that, "[p]eer mentoring has been effective for both adult and adolescent populations. It has also been useful for promoting health behavior change among hard-to-reach and disadvantaged populations," such as "HIV-positive adults, injection drug users, and homeless people," and has been found to be "effective for increasing health screenings and breastfeeding among low socioeconomic status women." Each of these results is supported by a single study.

Alison O'Mara-Eves, Ginny Brunton, Sandy Oliver, Josephine Kavanagh, Farah Jamal, and James Thomas, "The effectiveness of community engagement in public health interventions for disadvantaged groups: a meta-analysis," *BMC Public Health* 15, no. 129 (February 2015), a review of 131 studies of interventions with "community engagement in public health interventions for disadvantaged groups," found small, significant effects in meta-analysis. They note that, "[i]nterventions were most commonly delivered by peers (n = 49, 37.4%) and by community members (n = 58, 44.3%)." Interventions with involvement of the community in intervention delivery and interventions with community involvement in their design both had statistically significant effects and the authors note several reasons to expect that these variations are unlikely to explain differences in effect size between interventions.

[379] Marla Reicks, Megan Kocher, and Julie Reeder, "Impact of Cooking and Home Food Preparation Interventions Among Adults: A Systematic Review (2011–2016)," *Journal of Nutrition Education and Behavior* 50, no. 2 (February 2018), 20 noted mixed but potentially positive evidence on the effectiveness of food preparation interventions (such as cooking classes) among adults for modifying diet.

Derek Hersch, Laura Perdue, Teresa Ambroz, and Jackie L. Boucher, "The Impact of Cooking Classes on Food-Related Preferences, Attitudes, and Behaviors of School-Aged Children: A Systematic Review of the Evidence, 2003–2014," *Preventing Chronic Disease* 11 (November 2014), a review of cooking classes for children, found that of those studies that measured the treatment effect in relation to fruit and vegetable consumption and preference, all found positive results, although improvements were significant in only 4 out of the 6. The review also found positive results on less directly relevant outcomes that were measured. They note that, "because study measurements varied widely, determining best practices was difficult," and there are a variety of methodological concerns with the included studies that should greatly reduce confidence in the results.

[380] See the tab "BCT analysis by health behavior" on the spreadsheet "Moderator Analyses."

[381] Peter Hajek, Lindsay F. Stead, Robert West, Martin Jarvis, Jamie Hartmann-Boyce, and Tim Lancaster, "Relapse prevention interventions for smoking cessation," *Cochrane Database of Systematic Reviews* 8 (August 2013; first published

There is some evidence that mindfulness-based interventions can affect eating behaviors[382]although evidence is less positive for its effectiveness in addressing illicit drug use.[383]

There is some evidence from the medication adherence literature that suggests that contracts (sometimes including rewards upon successful completion of the contract's terms) can be effective in modifying behavior.[384]

2005). They summarize that, "[u]pon looking at studies of behavioural interventions that randomly assigned abstainers, we detected no benefit of brief and 'skills-based' relapse prevention methods for women who had quit smoking because of pregnancy, or for smokers undergoing a period of enforced abstinence during hospitalisation or military training. We also failed to detect significant effects of behavioural interventions in trials in unselected groups of smokers who had quit on their own or through a formal programme. Amongst trials randomly assigning smokers before their quit date and evaluating the effects of additional relapse prevention components, we found no evidence of benefit of behavioural interventions or combined behavioural and pharmacotherapeutic interventions in any subgroup. Overall, providing training in skills thought to be needed for relapse avoidance did not reduce relapse, but most studies did not use experimental designs best suited to the task and had limited power to detect expected small differences between interventions."

[382] K. Carrière, B. Khoury, M. M. Günak, and B. Knäuper, "Mindfulness-based interventions for weight loss: a systematic review and meta-analysis," *Obesity Reviews* 19 (February 2018; first published 2017), 164-77 found that mindfulness-based interventions "are effective in reducing weight and improving obesity-related eating behaviours among individuals with overweight and obesity." Shawn N. Katterman, Brighid M. Kleinman, Megan M. Hood, Lisa M. Nackers, and Joyce A. Corsica, "Mindfulness meditation as an intervention for binge eating, emotional eating, and weight loss: A systematic review," *Eating Behaviors* 15, no. 2 (2014), 197-204 summarize that their results "suggest that mindfulness meditation effectively decreases binge eating and emotional eating in populations engaging in this behavior," but that ultimately, "evidence for its effect on weight is mixed."

[383] Pawel Posadzki, Mohamed MK Khalil, Abdullah MN AlBedah, Olena Zhabenko, and Josip Car, "Complementary and alternative medicine for addiction: an overview of systematic reviews," *Focus on Alternative and Complementary Therapies* 21, no. 2 (June 2016), 69-81, an overview of 27 systematic reviews of complementary and alternative medicine (CAM) for addictions, including "acupuncture (and related techniques), herbal medicine, hypnotherapy, meditative/mindfulness techniques, music therapy, spirituality and yoga," found "highly ambiguous or negative" evidence for its effectiveness.

Geoff Bates, Lisa Jones, Michelle Maden, Madeleine Cochrane, Marissa Pendlebury, and Harry Sumnall, *The effectiveness of interventions related to the use of illicit drugs: prevention, harm reduction, treatment and recovery: A 'review of reviews.' HRB Drug and Alcohol Evidence Reviews* (Dublin: Health Research Board, 2017), 68 found that, "[e]vidence on the effectiveness of mindfulness-based interventions on any drug use and cocaine use was inconclusive."

Marta Sancho, Marta De Gracia, Rita C. Rodríguez, Núria Mallorquí-Bagué, Jéssica Sánchez-González, Joan Trujols, Isabel Sánchez, Susana Jiménez-Murcia, and Jose M. Menchón, "Mindfulness-Based Interventions for the Treatment of Substance and Behavioral Addictions: A Systematic Review," *Frontiers in Psychiatry* (March 2018) found evidence of mindfulness' effects on "addiction-related symptoms" but note a "lack of studies showing the maintenance of the effect over time."

Sean Grant, Benjamin Colaiaco, Aneesa Motala, Roberta Shanman, Marika Booth, Melony Sorbero, and Susanne Hempel, "Mindfulness-based Relapse Prevention for Substance Use Disorders: A Systematic Review and Meta-analysis," *Journal of Addiction Medicine* 11, no. 5 (September 2017), 385-96 note mixed effects on various secondary outcome measures.

[384] Xavier Bosch-Capblanch, Katharine Abba, Megan Prictor, and Paul Garner, "Contracts between patients and healthcare practitioners for improving patients' adherence to treatment, prevention and health promotion activities," *Cochrane Database of Systematic Reviews* 2 (April 2007), a review of contracts where "[e]xplicit rewards (like tokens, cash or social benefits) may or may not have been present," found that, "[f]ifteen trials reported at least one outcome that showed statistically significant differences favouring the contracts group, six trials reported at least one outcome that showed differences favouring the control group and 26 trials reported at least one outcome without differences between groups. Effects on adherence were not detected when measured over longer periods."

Two meta-analyses suggest that using self-affirmation — focusing on the positive aspects of the self — can have a small positive effect on health behaviors.[385] The self-affirmation methods used in experiments require the audience to elaborate on their values or past acts. It is unclear whether abbreviated versions of this technique would have similar effects, smaller effects, or no effect on behavior.

Two Cochrane reviews found that traffic cameras modified behavior and improved safety.[386]

S. J. C. Taylor, H. Pinnock, E. Epiphaniou et al., "Chapter 15, Additional meta-review: self-management support for people with hypertension," *A rapid synthesis of the evidence on interventions supporting self-management for people with long-term conditions: PRISMS – Practical systematic Review of Self-Management Support for long-term conditions* (Southampton: NIHR Journals Library, 2014) note that "Bosch-Capblanch et al.'s systematic review, which was of higher quality, looked at the effects of using contracts to improve adherence in the management of hypertension. There was significantly better adherence to relaxation practices in one review but worse adherence to treatment in another review. Similarly, one RCT showed no difference in BP outcomes, whereas one RCT showed statistically improved DBP only. The authors therefore concluded that 'the evidence from the included trials supporting the use of contracts for hypertension was very weak."

[385] By using self-affirmation — focusing on the positive aspects of the self — Allison M. Sweeney and Anne Moyer, "Self-Affirmation and Responses to Health Messages: A Meta-Analysis on Intentions and Behavior," *Health Psychology* 34, no. 2 (2015), 149-59, a review of 16 studies comparing "participants who self-affirmed prior to reading a threatening health message to those who did not self-affirm," found that, "[t]he aggregate effect size for health intentions was d .26, 95% CI .04 –.48… For health behavior, the aggregate effect size was d .27, 95% CI .11–.43."

Tracy Epton, Peter R. Harris, Rachel Kane, Peter R. Harris, Guido M. van Koningsbruggen, "The Impact of Self-Affirmation on Health-Behavior Change: A Meta-Analysis," *Health Psychology* 34, no. 3 (March 2015), 187-96 summarize that, "[a]cross 34 tests of message acceptance (N 3,433), 64 tests of intentions (N 5,564), and 46 tests of behavior (N 2,715), random effects models indicated small but reliable positive effects of self-affirmation on each outcome: acceptance, d = .17(CI = .03 to.31); intentions, d = .14 (CI = .05 to .23); behavior, d = .32 (CI = .19 to .44). Findings held across a range of health problems and behaviors."

[386] Cecilia Wilson, Charlene Willis, Joan K. Hendrikz, Robyne Le Brocque, and Nicholas Bellamy, "Speed cameras for the prevention of road traffic injuries and deaths," *Cochrane Database of Systematic Reviews* 11 (November 2010; first published 2006) note that, "[t]hirty five studies met the inclusion criteria. Compared with controls, the relative reduction in average speed ranged from 1% to 15% and the reduction in proportion of vehicles speeding ranged from 14% to 65%. In the vicinity of camera sites, the pre/post reductions ranged from 8% to 49% for all crashes and 11% to 44% for fatal and serious injury crashes. Compared with controls, the relative improvement in pre/post injury crash proportions ranged from 8% to 50%."

Amy Aeron-Thomas and Stephane Hess, "Red-light cameras for the prevention of road traffic crashes," *Cochrane Database of Systematic Reviews* 2 (April 2005) found some evidence that "Red-light cameras are effective in reducing total casualty crashes." They note that for total casualty crashes, the only study that adjusted for both "regression to the mean (RTM) and spillover effects… reported a rate ratio of 0.71 (95% CI to 0.55, 0.93); for three that partially adjusted for RTM but failed to consider spillover, rate ratio was 0.87 (95% CI to 0.77, 0.98); one that made no adjustments had a rate ratio of 0.80 (95% CI 0.58 to 1.12)." They note, however, that "The evidence is less conclusive on total collisions, specific casualty collision types and violations, where reductions achieved could be explained by the play of chance. Most evaluations did not adjust for RTM or spillover, affecting their accuracy. Larger and better controlled studies are needed."

Other points of interest

Two reviews suggest that encouraging healthy eating is more tractable than discouraging unhealthy eating, though a third review suggests the opposite.[387] Two reviews had contrasting implications for whether encouraging changes in the quantity of consumption is more or less tractable than encouraging changes in the food selected.[388]

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[387] Marieke A. Adriaanse, Charlotte D. W. Vinkers, Denise T. D. De Ridder, Joop J. Hox, and John B. F. De Wit, "Do implementation intentions help to eat a healthy diet? A systematic review and meta-analysis of the empirical evidence," *Appetite* 56, no. 1 (February 2011), 183-93 found weak evidence that implementation intentions are more effective at increasing health promoting behaviors like fruit consumption (d = 0.51, 14 studies) than decreasing health risk behaviors like consumption of unhealthy snacks (d = 0.29, 8 studies). They note that "the difference in effect size between the two categories was marginally significant, p = .09. As only a limited number of studies are available in each category (N = 15 and N = 9), and the average sample size in each study is relatively small (median = 126), the power to detect even such a relatively large difference in effect size is low."

In Ashkan Afshin, José L. Peñalvo, Liana Del Gobbo, Jose Silva, Melody Michaelson, Martin O'Flaherty, Simon Capewell, Donna Spiegelman, Goodarz Danaei, and Dariush Mozaffarian, "The prospective impact of food pricing on improving dietary consumption: A systematic review and meta-analysis," *PLoS ONE* (March 2017), a review of 30 studies (where, "[f]or pooling, each study-specific effect was standardized to a 10% price change, assuming a linear dose-response relationship"), "a 10% decrease in price (i.e. subsidy) increased consumption of healthful foods by 12% (95% CI = 10–15%; N = 22 studies/intervention arms) whereas a 10% increase price (i.e. tax) decreased consumption of unhealthful foods by 6% (95% CI = 4–8%; N = 15)." The authors note that, "[s]tatistically significant larger effects were identified in studies with price decreases (subsidies) vs. increases (taxes)"; this comparison was between 22 subsidies and 15 taxes, with a *p* value of 0.04.

Romain Cadario and Pierre Chandon, "Which Healthy Eating Nudges Work Best? A Meta-Analysis of Field Experiments," *Marketing Science* (Unpublished; September 2018), a meta-analysis of 299 effect sizes from 96 field studies evaluating various types of nudges found in multivariate analysis that "effect sizes are significantly higher for unhealthy eating than for healthy eating (β = .08, z = 2.39, p = .02)." The effect sizes were d = 0.35, from 79 effect sizes, and d = .27, from 180 effect sizes, respectively.

[388] Eric Robinson, Jason Thomas, Paul Aveyard, and Suzanne Higgs, "What Everyone Else Is Eating: A Systematic Review and Meta-Analysis of the Effect of Informational Eating Norms on Eating Behavior," *Journal of the Academy of Nutrition and Dietetics* 114, no. 3 (2014), a meta-analysis of 15 experimental studies reviewing "whether providing information about other people's eating habits influences food intake or choices" found significant effects from both high intake norms (SMD 0.41, 95% CI 0.20 to 0.63, 6 studies) and low intake norms (SMD –0.35, 95% CI –0.59 to –0.10) on the quantities of food eaten. However, with regard to the type of food selected, "[f]our studies tested whether information about others choosing a food influenced actual or intended choice" and none of these found significant differences between a norms intervention and the control, although significant differences were found between high norms and low norms conditions in some. In contrast, "[t]hree studies tested the effect of providing information that a socially undesirable group ate a lot of junk food," all three of which found significant effects.

M. Cecchini and L. Warin, "Impact of food labelling systems on food choices and eating behaviours: a systematic review and meta-analysis of randomized studies," *Obesity Reviews* 17, no. 3 (March 2016; first published 2015), 201–10 found significant effects of labeling schemes on a measure of "selecting a healthier option" for all three types of labeling considered, but insignificant findings for a pooled analysis of reducing calorie intake. Overall, they found that food labeling decreased "calorie intake/choice by about 3.59% (confidence interval: −8.90% to +1.72%), but results are not statistically significant." Additionally, they found that, "[f]ood labelling would increase the amount of people selecting a healthier food product by about 17.95% (confidence interval: +11.24% to +24.66%)."

Many of the evaluated interventions included in this literature review use willing participants. One review suggested that compulsory treatment could be ineffective or counter-productive.[389]

One review found that most of the included programs that successfully reduced obesity were not conceptualized primarily as obesity reduction programs, instead being framed as interventions for wider health issues.[390] Several reviews suggest that interventions using both dietary and PA aspects are likely to be more effective but other reviews did not find evidence of a similar effect.[391] One review of communication

[389] D. Werb, A. Kamarulzaman, M. C. Meacham, C. Rafful, B. Fischer, S. A. Strathdee, E. Wood, "The effectiveness of compulsory drug treatment: A systematic review," *International Journal of Drug Policy* 28 (February 2016), 1-9 summarize that, "[t]hree studies (33%) reported no significant impacts of compulsory treatment compared with control interventions. Two studies (22%) found equivocal results but did not compare against a control condition. Two studies (22%) observed negative impacts of compulsory treatment on criminal recidivism. Two studies (22%) observed positive impacts of compulsory inpatient treatment on criminal recidivism and drug use." These treatments are not very comparable to those available to the farmed animal movement, since they considered "inpatient treatment, community-based treatment, group-based outpatient treatment, and prison-based treatment."

[390] Eric Stice, Heather Shaw, and C. Nathan Marti, "A Meta-Analytic Review of Obesity Prevention Programs for Children and Adolescents: The Skinny on Interventions That Work," *Psychological Bulletin* 132, no. 5 (2006), 681-2.

[391] David J. Johns, Jamie Hartmann-Boyce, Susan A.Jebb, and Paul Aveyard, "Diet or Exercise Interventions vs Combined Behavioral Weight Management Programs: A Systematic Review and Meta-Analysis of Direct Comparisons," *Journal of the Academy of Nutrition and Dietetics* 114, no. 10 (October 2014), 1557-1568 note that, "six studies met the inclusion criteria for combined BWMP [combined behavioral weight management programs] vs diet-only. Pooled results showed no significant difference in weight loss from baseline or at 3 to 6 months between the BWMPs and diet-only arms (–0.62 kg; 95% CI –1.67 to 0.44). However, at 12 months, a significantly greater weight-loss was detected in the combined BWMPs (–1.72 kg; 95% CI –2.80 to –0.64). Five studies met the inclusion criteria for combined BWMP vs physical activity-only. Pooled results showed significantly greater weight loss in the combined BWMPs at 3 to 6 months (–5.33 kg; 95% CI –7.61 to –3.04) and 12 to 18 months (–6.29 kg; 95% CI –7.33 to –5.25)."

Lin Feng, Dong-Mei Wei, Shen-Ting Lin, Ralph Maddison, Cliona Ni Mhurchu, Yannan Jiang, Yang Gao, and Hai-Jun Wang, "Systematic review and meta-analysis of school-based obesity interventions in mainland China," *PLoS ONE* (September 2017) found that, "meta-analyses showed comprehensive interventions involving physical activity and health education had larger effect on the change of BMI than physical activity only interventions (treatment studies: -1.80 kg/m² (95% CI: -2.15,-1.44) vs. -0.91 kg/m² (95% CI: -1.15,-0.67); prevention studies: -0.19 kg/m² (95% CI: -0.27, -0.11) vs. +0.05 kg/m² (95% CI: -0.04, +0.15)).

Kevin A. Cradock, Gearóid ÓLaighin, Francis M. Finucane, Heather L. Gainforth, Leo R. Quinlan, and Kathleen A. Martin Ginis, "Behaviour change techniques targeting both diet and physical activity in type 2 diabetes: A systematic review and meta-analysis," *The International Journal of Behavioral Nutrition and Physical Activity* 14 (2017) found that, "[d]iet and physical activity interventions produced superior results in our review (-0.53 %) and other reviews (-0.58 %) compared to physical activity only, dietary treatment only, computer based interventions and psychological interventions." They also note that, "changing multiple behaviours simultaneously rather than changing behaviours individually has been found to be more effective in changing at least one behaviour. The mechanistic basis for this is unclear. The extent to which diet and physical activity interventions interact synergistically is also unclear."

However, Lena Al-Khudairy, Emma Loveman Jill L. Colquitt, Emma Mead, Rebecca E. Johnson, Hannah Fraser, Joan Olajide, Marie Murphy, Rochelle Marian Velho, Claire O'Malley, Liane B. Azevedo, Louisa J Ells, Maria-Inti Metzendorf, and Karen Rees, "Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years," *Cochrane Database of Systematic Reviews* 6 (June 2017) and Emma Mead, Tamara Brown, Karen Rees, Liane B. Azevedo, Victoria Whittaker, Dan Jones, Joan Olajide, Giulia M. Mainardi, Eva Corpeleijn, Claire O'Malley, Elizabeth Beardsmore, Lena Al-Khudairy, Louise Baur, Maria-Inti Metzendorf, Alessandro Demaio, and Louisa J. Ells, "Diet, physical activity and behavioural interventions for the treatment of overweight or obese children from the age of 6 to 11 years," *Cochrane Database of Systematic Reviews* 6 (June 2017), both focusing on a broad range of interventions either for children or adolescents, found significant effects of the included interventions overall and both

between sexual partners found larger effect sizes for communication specifically about condom use (r = .34) than about personal sexual history (r = .15) or general safer sex topics (r = .14).[392]

Some reviews indicate that specific patient groups are especially hard to reach with effective health behavior interventions, such as adults in substance abuse treatment or recovery,[393] or "marginalized populations such as women, Latinos, or patients with a past history of alcoholism."[394]

Reviews of smoking[395] and illicit drug use[396] suggest that tailoring and other modifications may improve recruitment and engagement with programs.

noted that there were no subgroup differences between the "majority" that focused on diet and PA combined and those that focused on one or the other.

[392] Laura Widman, Seth M. Noar, Sophia Choukas-Bradley, and Diane B. Francis, "Adolescent Sexual Health Communication and Condom Use: A Meta-Analysis," *Health Psychology* 33, no. 10 (2014), 1113 and 1116.

[393] Sarah L. Thurgood, Ann McNeill, David Clark-Carter, and Leonie S. Brose, "A Systematic Review of Smoking Cessation Interventions for Adults in Substance Abuse Treatment or Recovery," *Nicotine & Tobacco Research* 18, no. 5 (May 2016), 993-1001.

[394] Sergio Rueda, Laura Y. Park-Wyllie, Ahmed Bayoumi, Anne-Marie Tynan, Tony Antoniou, Sean Rourke, and Richard Glazier, "Patient support and education for promoting adherence to highly active antiretroviral therapy for HIV/AIDS," *Cochrane Database of Systematic Reviews* 3 (July 2006; first published 2000).

[395] Joanna Milward, Colin Drummond, Stephanie Fincham-Campbell, and Paolo Deluca, "What makes online substance-use interventions engaging? A systematic review and narrative synthesis," *Digital Health* (February 2018) found that, "tailoring, multimedia delivery of content and reminders are potential techniques for promoting engagement. The evidence for social support was inconclusive and negative for incentives."

[396] José S. Marcano Belisario, Michelle N. Bruggeling, Laura H. Gunn, Serena Brusamento, and Josip Car, "Interventions for recruiting smokers into cessation programmes," *Cochrane Database of Systematic Reviews* 12 (December 2012) considered different strategies for recruiting smokers onto cessation programs. Though the heterogeneity in study design made comparison difficult, the limited evidence "suggests that the following elements may improve the recruitment of smokers into cessation programmes: personal, tailored interventions; recruitment methods that are proactive in nature; and more intensive recruitment strategies (i.e., those strategies that require increased contact with potential participants)." On tailoring, they note that, "[w]e identified three studies that made head-to-head comparisons of different types of recruitment strategies. Of these, only one study detected a significant effect, finding that a personal phone call was more effective than a generic invitation letter (RR 40.73, 95% CI 2.53 to 654.74). Five studies compared interventions using the same delivery modes but different content. Results showed that tailored messages through an interactive voice response system resulted in a higher recruitment rate than assessment of smoking status alone using the same system (RR 8.64, 95% CI 4.41 to 16.93)." This conclusion was in "agreement with the conclusion drawn by [an earlier non-Cochrane review] McDonald 1999: interpersonal strategies appear to have a positive effect on the recruitment of participants into smoking cessation programs."