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Mental Contrasting With Implementation Intentions (MCII) Improves Physical Activity and Weight Loss Among Stroke Survivors Over One Year

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Objective: Stroke is the most common cause of physical impairment, and having already had a stroke dramatically increases the risk of having another one. Although greater physical activity lowers rates of stroke recurrence, patients often fail to act in line with this recommendation. The present intervention tested whether teaching the self-regulation strategy of mental contrasting (MC) with implementation intentions (II; MCII) improves stroke patients' physical activity and weight loss over 1 year compared with 2 information-only, control interventions. ***Research Method:*** Participants were 183 stroke survivors who were capable of adhering to physical activity recommendations (age: $M = 57$ years; body mass index (BMI): $M = 30$). Patients were randomized to 3 conditions: unstructured information ($n = 61$), structured information ($n = 62$), and structured information plus MCII ($n = 60$). Patients' physical activity was assessed 50 weeks after they had left the rehabilitation hospital using the Baecke Inventory (Baecke, Burema, & Frijters, 1982), and by diaries provided at 2 consecutive weekends after 0, 10, 20, 30, 40, and 50 weeks. Diaries were also used to assess weight change. ***Results:*** MCII participants were more physically active after the 50 weeks (Baecke Inventory: 2.74 vs. 2.59, $p < .05$; diary: 62.45 vs. 54.11, $p = .03$) and lost more weight (2.15 kg, $p = .02$) compared with participants in the control conditions. ***Conclusions:*** Teaching the MCII self-regulation strategy enhanced long-term physical activity in stroke patients relative to health information on its own. MCII thus qualifies as an effective intervention technique to improve secondary stroke prevention.

Impact and Implications

Stroke is the fourth most common cause of death and is a major cause of physical impairment (Towfighi & Saver, 2011). People who already experienced a stroke have a 15 times higher risk of another stroke than the general population (Croquelois & Bogousslavsky, 2006). After surviving a first stroke, it is thus especially critical to prevent further strokes. Pharmaceutical therapies for biological risk factors such as arterial hypertension, diabetes mellitus, and high cholesterol levels are standard for secondary prevention. The appearance of secondary strokes can be further reduced by 50–70% also by addressing behavioral risk factors (i.e., lifestyle) such as physical inactivity, poor diet, overweight/obesity, drug use (e.g., alcohol, nicotine), and ineffective coping with stress (e.g., Field et al., 2001; Gerischer, Flöel, & Endres, 2015; Hankey & Warlow, 1999; Kulshreshtha et al., 2013; Redfern, McKevitt, Dundas, Rudd, & Wolfe, 2000). However, to change people's lifestyles, simply educating them on risk behavior factors is not sufficient and thus more sophisticated treatments are required to effectively support patients' behavior change (e.g., Johnston, 1999; Marcus et al., 2000; Milne, Orbell, & Sheeran, 2002; Sheeran, Webb, & Gollwitzer, 2005). Mental

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contrasting (MC) with implementation intentions (II; MCII) is a self-regulatory technique that draws on people's imagery and has been shown to foster behavior change in the short-term and long-term (Oettingen & Gollwitzer, 2010, 2015). The procedure of MC entails, first, naming a most important concern in a certain area (e.g., becoming physically more active). Second, mentally elaborating the desired future of having successfully addressed this concern (e.g., being fit). Third, elaborating the critical inner obstacle of present reality standing in the way of realizing the desired future (e.g., feeling tired after work; Oettingen, 2000, 2014). II are "if-then" plans that specify when, where, and how a goal intention ("I want to be physically active") should be implemented (e.g., "If I come home tired after work, then I will put on my sneakers and go for a walk!"; Gollwitzer, 1993, 2014). Both strategies combined enable successful behavior change and encompass committing to, and effectively pursuing, goals, as well as planning how to overcome obstacles to goal attainment. The present research focuses on physical activity and weight loss. Recent meta-analyses indicate that stroke survivors undertake fewer than 4,500 steps per day on average (Field, Gebruers, Shanmuga Sundaram, Nicholson, & Mead, 2013) and that physical activity decreases the risk of secondary strokes (Billinger et al., 2014; Gordon et al., 2004; also see Autenrieth et al., 2013). However, interventions to promote stroke survivors' physical activity are few, methodologically weak, and mostly ineffective (Morris, MacGillivray, & MacFarlane, 2014). The present study shows that the self-regulation strategy of MCII can augment health education approaches in order to effectively promote physical activity and weight loss among stroke survivors over 1 year. Given the incidence of cardiovascular disease, cancer, and other diseases where physical activity and weight loss are recommended for secondary prevention, the present findings suggest that MCII is a time- and cost-effective behavior change intervention that warrants further testing by researchers in behavioral medicine.

Keywords: health-behavior change, mental contrasting, implementation intentions, secondary stroke prevention, self-regulation

Introduction

Much empirical evidence indicates that stroke reoccurrence rates are reduced by engaging in relevant health behaviors such as smoking cessation, improved diet, greater physical activity, and weight loss (e.g., Goldstein et al., 2006). However, many stroke patients do not receive appropriate secondary prevention interventions geared at changes in health behavior (Girot et al., 2005). Kothari and colleagues (1997) found that 43% of stroke patients could not generate a single factor affecting the risk of stroke recurrence (see also Croquelois & Bogousslavsky, 2006; Nicol & Thrift, 2005). Accordingly, many secondary prevention interventions try to create awareness of behavioral risk factors in stroke patients and to provide patients with recommendations for appropriate health behaviors.

However, merely offering information on risk factors and how to reduce risk may not be sufficient, as people often fail to translate their acquired knowledge into action (e.g., Johnston, 1999; Marcus et al., 2000; Milne et al., 2002; Sheeran et al., 2005). A recent meta-analysis compared 11 intervention studies using different approaches to improve physical activity among stroke survivors (e.g., motivational interviewing, setting specific goals, supervised exercise programs; Morris et al., 2014). The success of the interventions was modest; only three of the 11 studies showed any effects favoring the intervention group. The authors stress that individualized tailored counseling, per se or in conjunction with tailored exercise programs, were the most effective in heightening participation in physical activity after stroke. Importantly, increased levels of physical exercise are found to effectively decrease the risk for secondary strokes (Billinger et al., 2014; Gordon et al., 2004; also see Autenrieth et al., 2013). In the present research, we therefore aimed to test a psychological self-regulation technique that has been found to allow people to improve their physical activity by acting as their own counselors (Christiansen, Oettingen, Dahme, & Klinger, 2010; Stadler, Oettingen, & Gollwitzer, 2009).

To help people translate relevant information into health behavior change, secondary prevention interventions should not content themselves with educating stroke survivors about risk factors and giving respective behavioral recommendations. Rather, they should teach self-regulatory strategies that people can use autonomously to translate the acquired knowledge into actual behavior change. MCII qualifies as such a strategy (Oettingen, 2012, 2014; Oettingen & Gollwitzer, 2010). MCII encompasses two self-regulation strategies, MC (Oettingen, 2000, 2012; Oettingen, Pak, & Schnetter, 2001) and II (Gollwitzer, 1999; Gollwitzer & Sheeran, 2006) and leads to greater behavior change compared with deployment of either strategy on its own (e.g., Adriaanse et al., 2010; Kirk, Oettingen, & Gollwitzer, 2011). MCII proved highly effective in increasing physical activity among healthy adults (Stadler et al., 2009) and patients with chronic back pain (Christiansen et al., 2010) and thus warrants testing with stroke survivors.

Improving Self-Regulation: MCII

Successful behavior change encompasses committing to, and effectively pursuing, goals, as well as planning how to overcome obstacles to goal attainment. MCII is a self-regulation strategy that targets both goal commitment and goal implementation. MCII combines the benefits of MC with those of forming II. MC entails three steps. Individuals first name their most important concern in a certain area (e.g., becoming physically active). Second, participants imagine and elaborate the desired future of having successfully addressed this concern (e.g., being fit). Lastly, they imagine and elaborate the present reality standing in the way of realizing the desired future (e.g., feeling tired after work). Realizing that the desired future is not yet attained, expectations of success become activated and when these expectations are high, people become energized and actively pursue their desired future (Oettingen, 2012).

MC benefits rates of goal attainment via cognitive and motivational mechanisms. MC of feasible wishes forges a strong mental association between the desired future and the obstacles of reality, as well as between the obstacles of present reality and the instrumental means to overcome these obstacles (Kappes & Oettingen, 2014; Kappes, Singmann, & Oettingen, 2012). These mental associations in turn induce energization (Oettingen et al., 2009) and a readiness to plan how to overcome the obstacles and attain the goal (Kappes, Wendt, Reinelt, & Oettingen, 2013; Oettingen et al., 2001). The effectiveness of MC in facilitating goal attainment has been demonstrated in many studies pertaining to various life domains such as health, achievement, and social interactions (e.g., Oettingen, 2000; Oettingen, Marquardt, & Gollwitzer, 2012; Oettingen, Mayer, & Thorpe, 2010; Oettingen et al., 2001; Oettingen, Stephens, Mayer, & Brinkmann, 2010; Sheeran, Harris, Vaughan, Oettingen, & Gollwitzer, 2013; see reviews by Oettingen, 2012, 2014).

Although MC on its own can successfully induce determined goal pursuit and attainment, people often stumble en route to the goal when difficult or complex hindrances are encountered (e.g., when the goal involves changing a habitual behavior; Adriaanse, Gollwitzer, De Ridder, de Wit, & Kroese, 2011; Webb & Sheeran, 2006). Forming II facilitates overcoming such hurdles. II are "if-then" plans that specify when, where, and how a goal intention ("I want to be physically active") should be implemented (e.g., "If I come home tired after work, then I will put on my sneakers and go for a walk!"; Gollwitzer, 1993, 1999, 2014). Forming an implementation intention induces a perceptual readiness to recognize the critical situation specified in the if-part (e.g., Achtziger, Bayer, & Gollwitzer, 2012; Parks-Stamm, Gollwitzer, & Oettingen, 2007; Webb & Sheeran, 2007), and it links this situation to a goal-directed response specified in the then-part of the plan. In this way, control over the specified response is delegated to the selected critical situational cue and the response is enacted swiftly and effortlessly (i.e., automatically) as soon as the critical situation is encountered (e.g., Bayer, Achtziger, Gollwitzer, & Moskowitz, 2009; Brandstätter, Lengfelder, & Gollwitzer, 2001; Gollwitzer & Brandstätter, 1997; Miles & Proctor, 2008; Webb & Sheeran, 2007, 2008). The effectiveness of forming II has been demonstrated in numerous goal domains (for reviews, see Gollwitzer, 2014; Gollwitzer & Oettingen, 2016; Gollwitzer & Sheeran, 2006) including physical activity (see Bélanger-Gravel, Godin, & Amireault, 2013, for a meta-analysis).

The MCII intervention is different from motivational interviewing, which is a well-known intervention that focuses on enhancing people's motivation to change a problematic behavior (e.g., procrastination; Miller & Rollnick, 2002). Motivational interviewing draws upon the transtheoretical model of behavior change which specifies five stages of behavior change (Prochaska, DiClemente, & Norcross, 1992): the precontemplation stage (people still lack the desire to change their behavior), the contemplation stage (people do have the desire to change but they are only deliberating the pros and cons of change), the preparation stage (people have committed themselves and may have already taken a few steps), the action phase (individuals take time and exert energy into changing their critical behavior), and finally the maintenance stage (people uphold their changed behavior and shelter themselves from relapse). Critical ingredients of motivational interviewing are (a) to clarify the stage a person sees herself regarding her problematic behavior, and (b) to continuously climb to the next stage. In motivational interviewing the mentor deploys certain rules to guide the mentee through the stages of change (e.g., showing empathy through reflective listening, rolling with resistance) in order to trigger and support change talk in the mentee. Change talk means talking about the pros and cons of change, the goals of changing one's behavior, and, in addition, the self-efficacy to be able to change the critical behavior. MCII, in contrast, tries to help people who are highly motivated to make a change to translate their good intentions into respective actions. Specifically, it assists people to intensely imagine and mentally experience the desired future to then switch to discovering and imagining the most critical inner obstacle that stands in the way of moving forward. Finally, people make if-then plans (i.e., II) that specify how these obstacles are to be overcome when they are encountered.

The Present Research

The current study tests the effectiveness of teaching MCII to stroke patients in order to improve their physical activity and promote weight loss. Participants were randomly assigned to three conditions. In the unstructured information condition, participants received a traditional secondary stroke prevention intervention (i.e., treatment as usual). Specifically, specialists employed by the hospitals provided health information on the topics of their expertise (e.g., stroke and stress). In the structured information condition, the participants learned the same health information; however, trained interventionists used standardized materials to provide the information. In the structured information plus MCII condition, patients received the structured information intervention and were also taught how to apply the MCII self-regulation strategy. As two out of every three stroke survivors are overweight (Kesarwani, Perez, Lopez, Wong, & Franklin, 2009) and increased physical activity engenders weight loss (Garrow & Summerbell, 1995), both physical activity and weight loss were used as outcomes here. The study had a primary and a secondary goal. The primary goal was to test whether the information plus MCII condition would lead to greater physical activity and weight loss compared with the two information conditions. The secondary goal was to test whether the structured information condition would lead to greater physical activity and weight loss compared with the unstructured information condition.

Method

Design

The study was a single-blinded, longitudinal randomized controlled trial and had a hierarchical design. The overarching factor was MCII intervention (MCII: present vs. absent) and the nested factor was type of control condition (unstructured information vs. structured information). All interventions were implemented in parallel in each of three neurological rehabilitation hospitals called Kliniken Schmieder (located in Allensbach, Gailingen, and Konstanz; Germany). The trial was registered in Gesis: Sofis (No. 20110883).

Participants and Recruitment

During the first week of rehabilitation, hospital physicians checked patients who had a stroke of arteriosclerotic origin for eligibility. Physicians excluded patients who were unable to follow instructions or exercise guidelines (e.g., patients with aphasia, apraxia, dementia, or severe depression) and patients with physical constraints that would hinder engagement in physical exercise (e.g., patients with severe hemiparesis). Eligible patients were informed about the purpose of the study and given a consent form. All patients arriving within a week (i.e., between Monday and Sunday) were randomly assigned to one of three conditions (group size ranged between 4 and 8 patients) following a fixed randomization plan.

Procedure

All interventions began the second week after patients arrived at the hospitals and lasted for three weeks. The interventions each consisted of two separate 1-hr lessons per week (6 lessons in total). The number of sessions and the time per session was the same for all conditions. Participants received their respective intervention in groups of at least three but no more than 12 people. In all conditions, interventionists and experts educated patients about behavioral risk factors for stroke (i.e., lack of physical activity, unhealthy diet, use of drugs like alcohol and nicotine, high blood pressure, obesity, and ineffective coping with stress), and provided recommendations for risk reduction (concerning physical activity, healthy diet, weight loss for overweight persons, and coping with stress). Recommendations for physical activity specified walking for 30 min each day, and engaging in 1 hr of endurance sports three to four times a week. Participants were encouraged to undertake endurance sports rather than other sports with load peaks (e.g., soccer or volleyball) or only minimal load (e.g., billiards or golf). Dietary recommendations were based on the guidelines of the World Health Organization (Ness, 2004). Recommendations to cope with stress focused on preventing the occurrence of stress and reappraising stressors, as well as decreasing stress through taking breaks, engaging in physical activity (i.e., walking and endurance sports), and improving one's time management. After each lesson, a multiple-choice test was distributed to ensure that participants had processed the information provided.

Unstructured information condition. Participants were educated by experts in stroke-related topics: medical doctors covered strokes, blood pressure, obesity, and drugs; dieticians covered diet; physical therapists covered regular physical activity and sports; and psychologists covered stress coping. The experts each followed their own didactic style using their own materials. Participants were encouraged to raise questions they had concerning behavior change and to openly discuss them. This type of program is in line with traditional secondary prevention interventions and can be considered a treatment as usual control condition.

Structured information condition. In this second control condition, the experts' lessons from the unstructured information intervention were standardized. That is, all lessons were conducted by one-and-the-same interventionist who covered the whole curriculum. The interventionist followed a standardized teaching manual, delivered PowerPoint presentations, and handed out information brochures at the end of each lesson. Lessons had the following sequence: general information on strokes and risk factors (Lesson 1), specific information on blood pressure (Lesson 2), specific information on physical activity and obesity (Lesson 3), specific information on healthy diet (Lesson 4), specific information on stress and coping (Lesson 5), and specific information on drug (ab)use (Lesson 6). Two trained psychologists led the structured interventions. They were both trained how to teach patients about risk factors and answer all critical questions by the experts who conducted the unstructured information intervention.

Structured information plus MCII condition. In the MCII intervention condition, participants received the structured information intervention and were also taught how to apply MCII to their health-related wishes and concerns. This intervention was also conducted by the interventionists who provided the structured information intervention. The structured information plus MCII intervention also consisted of six lessons. However, to save time for teaching MCII, the lessons on stroke and blood pressure, and the lessons on stress coping and drug (ab)use were each merged into single lessons, resulting in four health information lessons altogether. Importantly, none of the health information was left out, but time for discussion was shortened. Participants were taught how to use the MCII self-regulation strategy and they practiced applying it to two concerns, one pertaining to being physically more active (e.g., cycling three times a week) and the other to eating more healthy foods (e.g., eating several portions of fruit and vegetables a day), each in a separate lesson.[1]

The interventionist taught the MCII self-regulation strategy using a scripted manual based on research summarized by Oettingen (2012, 2014). The MCII training to become more physically active invited participants to first jot down their most important wish (i.e., concern) about improving their regular physical activity with respect to endurance sports that was both challenging and feasible (e.g., "cycling regularly"). Second, the most important positive outcome of realizing this wish was identified (e.g., "reducing the risk for further strokes"), and participants imagined events and experiences associated with this positive outcome. Third, the most critical personal obstacle in themselves that prevents them from realizing their wish was specified by participants (e.g., "being distracted by things that seem more important"), and they imagined events and experiences associated with this obstacle. Fourth, participants were requested to form at least one out of three possible if-then plans (Stadler, Oettingen, & Gollwitzer, 2010) using their answers to the following questions: (a) "When and where does the obstacle occur, and what can I do to overcome or circumvent the obstacle?"; (b) "When and where is an opportunity to prevent the obstacle from occurring, and what can I do to prevent it from occurring?"; and (c) "When and where is a good opportunity for me to act in a goal-directed way, and what would

[1] Data on participants' healthy eating are not addressed in the present study.

the goal-directed action be?" For instance, a participant who has identified the obstacle of having better things to do might form the implementation intention, "If I feel there are better things to do, then I will change my outfit and go jogging anyway!" To prevent the obstacle from occurring, this participant could use the implementation intention, "And when I plan out my day in the morning, then I will make an appointment at the gym at 5pm!" To use a good opportunity to do sports, the implementation intention could be: "If I have free time in the morning, then I will instantly change and go jogging!" Participants were then handed out cards (about the size of a credit card) listing the four steps of the MCII procedure, and were encouraged to use the MCII self-regulation strategy as often as possible during the coming weeks.

Measures

Information on demographic characteristics, blood pressure, weight, height, BMI, the Baecke Inventory (Baecke et al., 1982), the 12-Item Short-Form Health Survey (Ware, Kosinski, & Keller, 1996), and the Social Desirability Scale-17 (Stöber, 2001) were each obtained at baseline (before lessons began).

Health knowledge. Immediately after each of the six information lessons, participants answered a knowledge test with multiple-choice questions regarding the information provided in the respective lesson (e.g., "How long and how often should you go for a walk?"). The mean of the six test scores formed participants' health knowledge score.

Physical activity: Baecke Inventory. The Baecke Inventory (i.e., the short questionnaire for habitual physical activity) provided two measures of physical activity. Participants completed the inventory at baseline (i.e., immediately after agreeing to participate in the study and before the lessons had started), and a second time 50 weeks after they had left the rehabilitation hospital as follow up. The Baecke Inventory comprises three subscales measuring (a) *sports activities* during leisure time (i.e., 4 items; the two most practiced sports are coded with respect to their physical load and frequency), (b) *other physical activity* during leisure time (i.e., 7 items; e.g., "During leisure time I sweat," 5-point scale, *never* to *always*), and (c) *physical activity at work* (i.e., 8 items; e.g., "During work I sit," 5-point scale, *never* to *always*). Subscale scores were the mean of the respective items. The present study used the Sports Activities and the Other Physical Activity subscales, but not the Physical Activity at Work subscale as many patients did not work anymore or had a highly varied workload due to the stroke.

Physical activity and weight loss: Diary measures. Diaries were administered right after the patients left the hospital and then every 10 weeks covering a time period of 50 weeks (i.e., six diaries at 0, 10, 20, 30, 40, and 50 weeks after participants had left the hospital). Each diary was filled out on two consecutive weekends (i.e., each diary included two sheets to be filled out, one for each weekend). Participants rated "How well did you follow the recommendations for physical activity in the last week?" on a 10-cm line ranging from 0% to 100%. Participants also recorded their current weight in the diaries by entering the number of kilograms in a box.

Data Analyses

The first three steps of the analyses involved tests of attrition and randomization, and manipulation checks. First, to test whether attrition was random, frequencies of lost participants were entered into a repeated-measures analysis of variance (ANOVA) with condition (i.e., unstructured information vs. structured information vs. structured information plus MCII) and rehabilitation hospital (i.e., Hospital 1 vs. Hospital 2 vs. Hospital 3) as between-participants factors and the six follow-up times as within-persons factor. Second, to verify that randomization yielded comparable samples, we computed ANOVAs with condition and rehabilitation hospital as between-participants factors and baseline characteristics as the dependent variables. Third, to test intervention effects on health knowledge we computed an ANOVA with condition and rehabilitation hospital as between-participants factors.

The next set of analyses tested the effect of MCII and type of control condition on physical activity and weight loss outcomes. Both intention to treat and explanatory analyses were undertaken. The first two indices of physical activity were the Sports Activities and Other Physical Activity subscales of the Baecke Inventory that were taken at both baseline and 50 weeks after participants had left the rehabilitation hospital. To assess change in sports activity and other physical activity, hierarchical analyses of covariance (ANCOVAs) were undertaken with MCII (present vs. absent) as the overarching factor, type of control condition (unstructured information vs. structured information) as the nested factor, and baseline scores as the covariate. In the intention to treat analyses, baseline scores were imputed when values were missing at 50 weeks. The third index of physical activity was participants' diary entries at 0, 10, 20, 30, 40, and 50 weeks after leaving the hospital. In the intention to treat analysis, we replaced missing physical activity scores with those of the previous diary, and computed the mean physical activity across the six diaries. These data were then submitted to a hierarchical ANOVA with MCII (present vs. absent) as the overarching factor, and type of control condition (unstructured information vs. structured information) as the nested factor. Weight loss was computed by subtracting the weight reported in each diary entry from baseline weight. In intention to treat analyses, missing weight values were replaced either with those of the previous diary entry or the baseline value if participants did not fill out the first diary. Mean weight loss across the six diaries was submitted to a hierarchical ANOVA with MCII (present vs. absent) as the overarching factor and type of control condition as the nested factor. Explanatory analyses were conducted on the data from participants who completed the measures at all time points. Again, hierarchical ANCOVAs were used to analyze scores on the two Baecke Inventory subscales, and hierarchical ANOVAs were used to analyze scores on the physical activity and weight loss diaries.

Results

Attrition Analyses

Of the 316 patients who were contacted, 183 agreed to participate (Figure 1). The attrition analyses revealed a significant Rehabilitation Hospital × Time interaction, $F(12, 1044) = 3.95$, $p <$

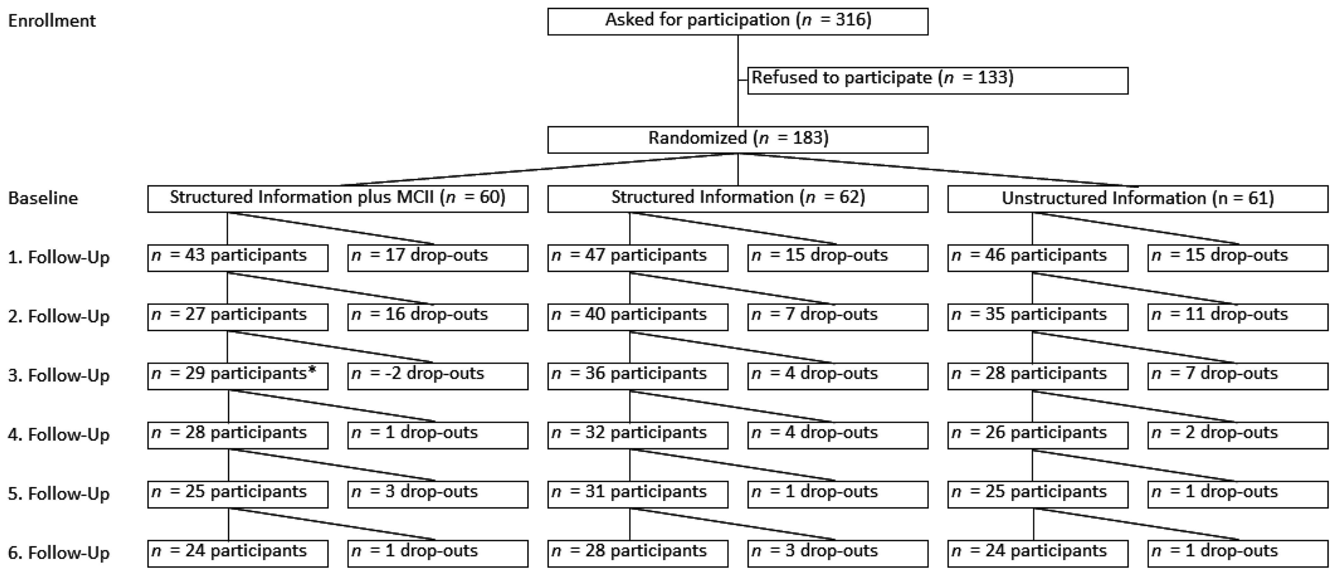

Figure 1. Flow of participants through the phases of the study. * Two patients reentered the study at Follow-Up 3 (i.e., they did not send back Diary 2).

.001, $\eta_p^2 = 0.04$, indicating a difference in dropout rate across rehabilitation hospitals. We therefore included hospital as factor in all subsequent analyses. No main effects of condition or interactions with condition were observed, all Fs ≤ 1.41, indicating that attrition was random with respect to all other variables. Intervention effects were not due to selective dropout (see Figure 1).

Randomization Check

The three conditions did not differ on any of the baseline characteristics, with the single exception of time from stroke to rehabilitation hospital admission, $F(2, 164) = 3.05$, $p = .05$, $\eta_p^2 = 0.04$ (Table 1). Participants in the structured information condition delayed longer than participants in the other two conditions. However, as this variable was not related to physical activity or weight loss, randomization can be considered successful.[2]

Health Knowledge

As expected, the three conditions differed on health knowledge in the wake of the interventions, $F(2, 123) = 14.68$, $p < .001$, $\eta_p^2 = 0.19$. Planned comparisons showed that participants in the structured information plus MCII condition ($M = 0.32$, $SE = 0.10$) and the structured information condition ($M = 0.23$, $SE = 0.09$) had a better health knowledge than participants in the unstructured information condition ($M = -0.38$, $SE = 0.10$), both ps $< .001$. No difference was observed between the structured information plus MCII condition and the structured information-only condition.

Effects on Physical Activity and Weight Loss: Intention to Treat Analyses

Table 2 shows the means and standard errors for physical activity and weight loss outcomes. The hierarchical ANCOVAs conducted on the two subscales of the Baecke Inventory (Sports Activities and Other Physical Activity during leisure time) showed reliable effects of the covariates (both ps $< .001$, $\eta_p^2 = 0.68$ and 0.63, for sports and other activities, respectively). Notwithstanding these powerful effects of the covariates, the overarching MCII factor had a significant effect on sport activities ($p < .05$, $\eta_p^2 = 0.02$). Participants in the MCII condition undertook more sporting activities than participants in the two information-only, control conditions. MCII had no effect on the Other Physical Activities subscale. Type of control condition (unstructured vs. structured information) had no significant effects on either of the Baecke Inventory subscales.

MCII had a significant effect on the diary measure of physical activity ($p = .03$, $\eta_p^2 = 0.04$) with participants in the MCII condition undertaking greater physical activity than control participants. MCII also had a significant effect on weight loss in intention to treat analyses ($p = .02$, $\eta_p^2 = 0.03$). Participants who completed the MCII exercise lost more weight (−2.15 kg) compared with controls (−0.67 kg). Type of control condition had no significant effects on the diary measures of physical activity and weight loss.

Effects on Physical Activity and Weight Loss: Explanatory Analyses

A similar pattern of findings was observed in explanatory analyses (see Table 2). Compared with information-only controls, participants in the MCII condition undertook significantly greater physical activity according to the sports and other activity subscales of the Baecke Inventory, and the diary measure. MCII participants also lost significantly more weight compared with

[2] There were significant interactions between condition and rehabilitation hospital for age, weight, BMI, and other physical activity as measured by the Baecke Inventory. As no significant interactions between rehabilitation hospital and MCII or type of control condition were observed in any of these analyses, the findings for rehabilitation hospital are not discussed further.

Table 1
Sample Characteristics at Baseline by Condition

Characteristic	All (n = 201)	Structured information plus MCII (n = 60)	Structured information (n = 62)	Unstructured information (n = 61)
Age, years	56.82 (9.74)	56.68 (8.43)	57.03 (9.20)	56.74 (11.47)
Male (%)	74.77 (44.11)	75.00 (43.67)	79.03 (41.04)	67.21 (47.33)
Without partner (%)	16.57 (37.29)	15.52 (36.52)	12.07 (32.81)	22.03 (41.80)
Employed (%)	47.62 (50.02)	50.85 (50.42)	48.33 (50.39)	40.68 (49.55)
Time in the rehabilitation hospital (days)	31 (10)	32 (9)	33 (12)	29 (8)
Time from stroke to hospital admission (days)	43 (62)	36 (38)	55 (85)	38 (52)
Weight (kg)	85.53 (15.80)	87.63 (18.99)	84.76 (14.90)	84.22 (13.02)
BMI	29.67 (15.50)	31.46 (519.08)	29.88 (18.34)	27.63 (3.93)
Blood pressure				
Systolic pressure	128.89 (15.71)	129.42 (15.38)	127.22 (14.53)	133.10 (16.93)
Diastolic pressure	78.08 (10.19)	79.24 (7.74)	75.71 (11.12)	79.08 (11.30)
Baecke inventory				
Sports activities	2.57 (.83)	2.57 (.86)	2.62 (.85)	2.52 (.81)
Other physical activity	2.85 (.69)	2.80 (.70)	2.78 (.67)	2.95 (.70)
SDS 17	.70 (.19)	.71 (.15)	.72 (.20)	.67 (.22)
SF-12				
Physical condition	40.80 (9.67)	39.41 (9.12)	40.82 (10.20)	42.19 (9.61)
Mental condition	45.06 (12.42)	46.61 (12.54)	44.36 (12.48)	44.23 (12.32)

Note. Standard deviations are in parentheses. MCII = mental contrasting with implementation intentions; BMI = body mass index; SDS 17 = Social Desirability Scale-17; SF-12 = 12-Item Short-Form Health Survey.

control participants. Type of control condition had no significant effects on any of the outcomes.

Discussion

Teaching the self-regulation strategy of MCII to stroke patients increased their physical activity and weight loss over the course of one year. We compared participants receiving MCII training plus health-relevant information to participants in two control conditions, one providing structured health information and one providing unstructured information. In line with our hypothesis, stroke patients who received MCII training engaged more in physical activity after they had left the rehabilitation hospital as compared with patients who had received (either structured or unstructured) health information only. MCII participants also lost 2.15 kg in weight, on average, approximately 1.5 kg more than participants in the control conditions.

The present study included two information-only control conditions. In the unstructured information condition, patients were educated by various health care specialists—in line with traditional secondary prevention interventions (i.e., treatment as usual). Our findings suggest that structuring such interventions by integrating them into standardized curricula conducted by trained interventionists can help patients to better learn essential health behavior information. However, this improved knowledge did not lead to improved physical activity or weight loss. There were no significant differences between the structured versus unstructured information conditions for any of the outcomes in either intention to treat or explanatory analyses. Apparently, the self-regulation strategy of MCII was needed to aid the translation of increased health knowledge into health behavior change.

Supporting the findings by Morris and colleagues (2014) that individualized tailored counseling is effective in promoting stroke

Table 2
Means and Standard Errors for Physical Activity and Weight Loss Outcomes by MCII and Type of Control Condition in Intention to Treat and Explanatory Analyses

Dependent variable	MCII	Control	MCII F	MCII p	MCII η_p^2	Type of control condition F	Type of control condition p	Type of control condition η_p^2
Intention to treat analyses								
Baecke Inventory—sports	2.74 (.06)	2.59 (.04)	3.99*	.047	.022	2.92	.089	.016
Baecke Inventory—other	2.98 (.06)	2.90 (.04)	1.36	.245	.008	1.77	.186	.010
Physical activity diary	62.45 (3.10)	54.11 (2.06)	5.03*	.026	.036	2.94	.089	.021
Weight loss diary	−2.15 (.53)	−.67 (.37)	5.17*	.024	.028	.42	.528	.002
Explanatory analyses								
Baecke Inventory—sports	3.33 (.17)	2.76 (.11)	8.13**	.006	.133	2.05	.158	.037
Baecke Inventory—other	3.57 (.13)	3.19 (.09)	5.60*	.022	.097	.61	.439	.012
Physical activity diary	62.58 (3.01)	54.63 (2.00)	4.85*	.029	.035	2.85	.094	.021
Weight loss diary	−3.07 (.67)	−.85 (.46)	7.45*	.007	.055	.20	.658	.002

Note. Standard errors are in parentheses. MCII = mental contrasting with implementation intentions.
* $p < .05$. ** $p < .01$.

patients' physical activity, we find that MCII is effective in heightening physical activity in stroke survivors. Our findings offer useful and new contributions to research on lifestyle interventions for stroke survivors.

The counseling in MCII is conducted by the patients themselves. The interventionists only teach the structure of the MCII self-regulation technique, and the patients fill in the individualized personal information to the four constitutive parts (wish, outcome, obstacle, plan) autonomously. Whether stroke patients in the present study applied the strategy also to change their health behaviors in related domains (e.g., stress reduction) is an open question. Indeed, in a study with students wishing for increased healthy eating, the effects of the self-regulation strategy of MC transferred across different health domains (from healthy eating to physical activity; Johannessen, Oettingen, & Mayer, 2012).

Supporting the assumption of transfer effects of MCII, in the present study the comparatively brief intervention of MCII engendered a reduction in weight that is comparable to previous, and much more time consuming and intensive, weight loss interventions. Across 17 randomized controlled trials, Franz and colleagues (2007) observed weight reduction of 3.9 kg at 1 year among adults, and Greaves and colleagues (2011) observed a 3–5 kg reduction at 1 year in 30 trials of people at risk of diabetes. However, the interventions included in these reviews were highly intensive lasting an average of 30.76 weeks (Franz et al., 2007) and involving a median of ten 60-min sessions (Greaves et al., 2011). In contrast, the MCII intervention used here was delivered over 3 weeks in two 1-hr sessions alongside four 1-hr health education sessions. This finding speaks to the utility and cost-effectiveness of MCII in promoting weight loss and suggests that MCII warrants further tests with overweight/obese participants.

MCII exhibits several advantages compared with traditional approaches that rely on educational or motivational strategies to promote health behavior change. First, MCII not only increases commitment to tackling health concerns, but also enables people to identify and appreciate the significance of the obstacles that stand in their way (Kappes et al., 2013; Oettingen et al., 2001), energizes them to overcome the identified obstacles (Oettingen et al., 2009), and promotes adaptive responses to negative feedback as people strive to overcome those obstacles (Kappes, Oettingen, & Pak, 2012). In this way, MCII goes beyond the formation of mere "good" intentions that is the target of traditional educational and motivational interventions.

Second, MCII benefits from the strategic automatization of action initiation wrought by II. Neurophysiological evidence indicates that II switch control of action from "top-down" control by goals to "bottom-up" stimulus control by the cues specified in participants' plans (Gilbert, Gollwitzer, Cohen, Oettingen, & Burgess, 2009; Hallam et al., 2015). Participants are thus less likely to fall prey to the various problems in initiating action and maintaining behavioral performance (e.g., indecision about how to act, succumbing to temptations or distractions; see Gollwitzer & Sheeran, 2006, for a review). Third, whereas traditional educational and motivational interventions are didactic and attempt to inculcate particular contents (e.g., have participants form intentions that favor performance of the behavior), MCII is a relatively brief, engaging exercise where participants themselves specify their concerns, the positive outcomes of addressing their concerns, and the idiosyncratic obstacles that stand in their way (Oettingen, 2012). These considerations suggest that MCII could prove a valuable approach in time-limited contexts (e.g., while the person is waiting to see a medical practitioner) or among samples that are reluctant to participate in more didactic interventions concerning the focal issue (e.g., teenagers undertaking sex education classes).

The present study has several limitations that should be acknowledged. First, due to the detailed instructions (i.e., health information) and the physical health behavior recommended (i.e., endurance sports) only patients with mild or no respective impairments could be included in our study. The study thus supports effectiveness of the introduced training for this select patient group only. Patients with more severe mental and physical impairments might not be able to grasp the instructions and/or enact all of the recommendations, and thus benefit less. Second, physical activity and weight loss were both measured via self-report. Although we used two methods to index physical activity (a validated self-report questionnaire [i.e., the Baecke Inventory] and diary measures at 6 time points), it remains possible that participants' reports were inaccurate. Further tests using objective measures (e.g., pedometers) would be desirable to corroborate the present findings. Similarly, objective assessment of weight loss will be important in future studies. Third, the retention rate in the present study was modest with only 42% of the original sample completing the assessment at 50 weeks. This retention rate is far from atypical, however. A review of attrition in weight loss interventions observed a median retention rate of only 31% in studies with 12-month follow-ups (Moroshko, Brennan, & O'Brien, 2011). We used intention-to-treat analyses to test MCII effects on outcomes in the present studies but acknowledge that testing the impact of the last value carried forward versus multiple imputation strategies for missing data would have benefited the research. An improved retention rate would have afforded a stronger test of the efficacy of MCII. Use of incentives or other procedures to reduce attrition may be important in future interventions with stroke survivors.

Conclusion

Notwithstanding these limitations, the present study provides new evidence that the effectiveness of health information approaches for secondary prevention in stroke patients is enhanced by training patients to use the MCII self-regulation strategy. The findings obtained here also are in line with previous tests demonstrating that MCII promotes physical activity in adult (Stadler et al., 2009) and patient samples (Christiansen et al., 2010). Given the incidence of cardiovascular disease, cancer, and other diseases where physical activity and weight loss are recommended for secondary prevention, the present findings suggest that MCII is a time- and cost-effective behavior change intervention that warrants further testing by researchers in behavioral medicine.

References

Achtziger, A., Bayer, U. C., & Gollwitzer, P. M. (2012). Committing to implementation intentions: Attention and memory effects for selected situational cues. *Motivation and Emotion, 36,* 287–300. http://dx.doi.org/10.1007/s11031-011-9261-6

Adriaanse, M. A., Gollwitzer, P. M., De Ridder, D. T. D., de Wit, J. B. F., & Kroese, F. M. (2011). Breaking habits with implementation intentions: A test of underlying processes. *Personality and Social Psychology Bulletin, 37,* 502–513. http://dx.doi.org/10.1177/0146167211399102

Adriaanse, M. A., Oettingen, G., Gollwitzer, P. M., Hennes, E. P., De Ridder, D. T. D., & De Wit, J. B. F. (2010). When planning is not enough: Fighting unhealthy snacking habits by mental contrasting with implementation intentions (MCII). *European Journal of Social Psychology, 40,* 1277–1293. http://dx.doi.org/10.1002/ejsp.730

Autenrieth, C. S., Evenson, K. R., Yatsuya, H., Shahar, E., Baggett, C., & Rosamond, W. D. (2013). Association between physical activity and risk of stroke subtypes: The atherosclerosis risk in communities study. *Neuroepidemiology, 40,* 109–116. http://dx.doi.org/10.1159/000342151

Baecke, J. A., Burema, J., & Frijters, J. E. (1982). A short questionnaire for the measurement of habitual physical activity in epidemiological studies. *American Journal of Clinical Nutrition, 36,* 936–942.

Bayer, U. C., Achtziger, A., Gollwitzer, P. M., & Moskowitz, G. B. (2009). Responding to subliminal cues: Do if-then plans facilitate action preparation and initiation without conscious intent? *Social Cognition, 27,* 183–201. http://dx.doi.org/10.1521/soco.2009.27.2.183

Bélanger-Gravel, A., Godin, G., & Amireault, S. (2013). A meta-analytic review of the effect of implementation intentions on physical activity. *Health Psychology Review, 7,* 23–54. http://dx.doi.org/10.1080/17437199.2011.560095

Billinger, S. A., Arena, R., Bernhardt, J., Eng, J. J., Franklin, B. A., Johnson, C. M., . . . the American Heart Association Stroke Council, & the Council on Cardiovascular and Stroke Nursing, & the Council on Lifestyle and Cardiometabolic Health, & the Council on Epidemiology and Prevention, & the Council on Clinical Cardiology. (2014). Physical activity and exercise recommendations for stroke survivors. *Stroke, 45,* 2532–2553. http://dx.doi.org/10.1161/STR.0000000000000022

Brandstätter, V., Lengfelder, A., & Gollwitzer, P. M. (2001). Implementation intentions and efficient action initiation. *Journal of Personality and Social Psychology, 81,* 946–960. http://dx.doi.org/10.1037/0022-3514.81.5.946

Christiansen, S., Oettingen, G., Dahme, B., & Klinger, R. (2010). A short goal-pursuit intervention to improve physical capacity: A randomized clinical trial in chronic back pain patients. *Pain, 149,* 444–452. http://dx.doi.org/10.1016/j.pain.2009.12.015

Croquelois, A., & Bogousslavsky, J. (2006). Risk awareness and knowledge of patients with stroke: Results of a questionnaire survey 3 months after stroke. *Journal of Neurology, Neurosurgery & Psychiatry, 77,* 726–728. http://dx.doi.org/10.1136/jnnp.2005.078618

Field, A. E., Coakley, E. H., Must, A., Spadano, J. L., Laird, N., Dietz, W. H., . . . Colditz, G. A. (2001). Impact of overweight on the risk of developing common chronic diseases during a 10-year period. *Archives of Internal Medicine, 161,* 1581–1586. http://dx.doi.org/10.1001/archinte.161.13.1581

Field, M. J., Gebruers, N., Shanmuga Sundaram, T., Nicholson, S., & Mead, G. (2013). Physical activity after stroke: A systematic review and meta-analysis. *ISRN Stroke, 2013,* 1–13. http://dx.doi.org/10.1155/2013/464176

Franz, M. J., VanWormer, J. J., Crain, A. L., Boucher, J. L., Histon, T., Caplan, W., . . . Pronk, N. P. (2007). Weight-loss outcomes: A systematic review and meta-analysis of weight-loss clinical trials with a minimum 1-year follow-up. *Journal of the American Dietetic Association, 107,* 1755–1767. http://dx.doi.org/10.1016/j.jada.2007.07.017

Garrow, J. S., & Summerbell, C. D. (1995). Meta-analysis: Effect of exercise, with or without dieting, on the body composition of overweight subjects. *European Journal of Clinical Nutrition, 49,* 1–10.

Gerischer, L. M., Flöel, A., & Endres, M. (2015). Schlaganfall—Lifestyle und Umwelt [Stroke—lifestyle and environment]. *Der Nervenarzt, 86,* 947–953. http://dx.doi.org/10.1007/s00115-014-4250-0

Gilbert, S. J., Gollwitzer, P. M., Cohen, A.-L., Oettingen, G., & Burgess, P. W. (2009). Separable brain systems supporting cued versus self-initiated realization of delayed intentions. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 35,* 905–915. http://dx.doi.org/10.1037/a0015535

Girot, M., Mackowiak-Cordoliani, M. A., Deplanque, D., Hénon, H., Lucas, C., & Leys, D. (2005). Secondary prevention after ischemic stroke. Evolution over time in practice. *Journal of Neurology, 252,* 14–20. http://dx.doi.org/10.1007/s00415-005-0591-8

Goldstein, L. B., Adams, R., Alberts, M. J., Appel, L. J., Brass, L. M., Bushnell, C. D., . . . the American Heart Association/American Stroke Association Stroke Council, & the Atherosclerotic Peripheral Vascular Disease Interdisciplinary Working Group, & the Cardiovascular Nursing Council, & the Clinical Cardiology Council, & the Nutrition, Physical Activity, and Metabolism Council, & the Quality of Care and Outcomes Research Interdisciplinary Working Group, & the American Academy of Neurology. (2006). Primary prevention of ischemic stroke: A guideline from the American Heart Association/American Stroke Association Stroke Council. *Stroke, 37,* 1583–1633. http://dx.doi.org/10.1161/01.STR.0000223048.70103.F1

Gollwitzer, P. M. (1993). Goal achievement: The role of intentions. *European Review of Social Psychology, 4,* 141–185. http://dx.doi.org/10.1080/14792779343000059

Gollwitzer, P. M. (1999). Implementation Intentions: Strong effects of simple plans. *American Psychologist, 54,* 493–503. http://dx.doi.org/10.1037/0003-066X.54.7.493

Gollwitzer, P. M. (2014). Weakness of the will: Is a quick fix possible? *Motivation and Emotion, 38,* 305–322. http://dx.doi.org/10.1007/s11031-014-9416-3

Gollwitzer, P. M., & Brandstätter, V. (1997). Implementation intentions and effective goal pursuit. *Journal of Personality and Social Psychology, 73,* 186–199. http://dx.doi.org/10.1037/0022-3514.73.1.186

Gollwitzer, P. M., & Oettingen, G. (2016). Planning promotes goal striving. In K. D. Vohs & R. F. Baumeister (Eds.), *Handbook of self-regulation: Research, theory, and applications* (3rd ed., pp. 223–244). New York, NY: Guilford Press.

Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes. *Advances in Experimental Social Psychology, 38,* 69–119. http://dx.doi.org/10.1016/S0065-2601(06)38002-1

Gordon, N. F., Gulanick, M., Costa, F., Fletcher, G., Franklin, B. A., Roth, E. J., . . ., the American Heart Association Council on Clinical Cardiology, Subcommittee on Exercise, Cardiac Rehabilitation, and Prevention; the Council on Cardiovascular Nursing; the Council on Nutrition, Physical Activity, and Metabolism; and the Stroke Council. (2004). Physical activity and exercise recommendations for stroke survivors. *Stroke, 35,* 1230–1240. http://dx.doi.org/10.1161/01.STR.0000127303.19261.19

Greaves, C. J., Sheppard, K. E., Abraham, C., Hardeman, W., Roden, M., Evans, P. H., . . . the IMAGE Study Group. (2011). Systematic review of reviews of intervention components associated with increased effectiveness in dietary and physical activity interventions. *BMC Public Health, 11,* 119. http://dx.doi.org/10.1186/1471-2458-11-119

Hallam, G. P., Webb, T. L., Sheeran, P., Miles, E., Wilkinson, I. D., Hunter, M. D., . . . Farrow, T. F. (2015). The neural correlates of emotion regulation by implementation intentions. *PLoS ONE, 10,* e0119500. http://dx.doi.org/10.1371/journal.pone.0119500

Hankey, G. J., & Warlow, C. P. (1999). Treatment and secondary prevention of stroke: Evidence, costs, and effects on individuals and populations. *Lancet, 354,* 1457–1463. http://dx.doi.org/10.1016/S0140-6736(99)04407-4

Johannessen, K. B., Oettingen, G., & Mayer, D. (2012). Mental contrasting of a dieting wish improves self-reported health behaviour. *Psychology & Health, 27,* 43–58. http://dx.doi.org/10.1080/08870446.2011.626038

Johnston, D. W. (1999). Lifestyle changes after a myocardial infarction. *Heart (British Cardiac Society), 82,* 543–544. http://dx.doi.org/10.1136/hrt.82.5.543

Kappes, A., & Oettingen, G. (2014). The emergence of goal pursuit: Mental contrasting connects future and reality. *Journal of Experimental*

Social Psychology, 54, 25–39. http://dx.doi.org/10.1016/j.jesp.2014.03.014

Kappes, A., Oettingen, G., & Pak, H. (2012). Mental contrasting and the self-regulation of responding to negative feedback. *Personality and Social Psychology Bulletin, 38,* 845–857. http://dx.doi.org/10.1177/0146167212446833

Kappes, A., Singmann, H., & Oettingen, G. (2012). Mental contrasting instigates goal pursuit by linking obstacles of reality with instrumental behavior. *Journal of Experimental Social Psychology, 48,* 811–818. http://dx.doi.org/10.1016/j.jesp.2012.02.002

Kappes, A., Wendt, M., Reinelt, T., & Oettingen, G. (2013). Mental contrasting changes the meaning of reality. *Journal of Experimental Social Psychology, 49,* 797–810. http://dx.doi.org/10.1016/j.jesp.2013.03.010

Kesarwani, M., Perez, A., Lopez, V. A., Wong, N. D., & Franklin, S. S. (2009). Cardiovascular comorbidities and blood pressure control in stroke survivors. *Journal of Hypertension, 27,* 1056–1063. http://dx.doi.org/10.1097/HJH.0b013e32832935ce

Kirk, D., Oettingen, G., & Gollwitzer, P. M. (2011). Mental contrasting promotes integrative bargaining. *International Journal of Conflict Management, 22,* 324–341. http://dx.doi.org/10.1108/10444061111171341

Kothari, R., Sauerbeck, L., Jauch, E., Broderick, J., Brott, T., Khoury, J., & Liu, T. (1997). Patients' awareness of stroke signs, symptoms, and risk factors. *Stroke, 28,* 1871–1875. http://dx.doi.org/10.1161/01.STR.28.10.1871

Kulshreshtha, A., Vaccarino, V., Judd, S. E., Howard, V. J., McClellan, W. M., Muntner, P., . . . Cushman, M. (2013). Life's Simple 7 and risk of incident stroke: The reasons for geographic and racial differences in stroke study. *Stroke, 44,* 1909–1914. http://dx.doi.org/10.1161/STROKEAHA.111.000352

Marcus, B. H., Dubbert, P. M., Forsyth, L. H., McKenzie, T. L., Stone, E. J., Dunn, A. L., & Blair, S. N. (2000). Physical activity behavior change: Issues in adoption and maintenance. *Health Psychology, 19,* 32–41. http://dx.doi.org/10.1037/0278-6133.19.Suppl1.32

Miles, J. D., & Proctor, R. W. (2008). Improving performance through implementation intentions: Are preexisting response biases replaced? *Psychonomic Bulletin & Review, 15,* 1105–1110. http://dx.doi.org/10.3758/PBR.15.6.1105

Miller, W. R., & Rollnick, S. (2002). *Motivational interviewing: Preparing people for change* (2nd ed.). New York, NY: Guilford Press.

Milne, S., Orbell, S., & Sheeran, P. (2002). Combining motivational and volitional interventions to promote exercise participation: Protection motivation theory and implementation intentions. *British Journal of Health Psychology, 7,* 163–184. http://dx.doi.org/10.1348/135910702169420

Moroshko, I., Brennan, L., & O'Brien, P. (2011). Predictors of dropout in weight loss interventions: A systematic review of the literature. *Obesity Reviews, 12,* 912–934. http://dx.doi.org/10.1111/j.1467-789X.2011.00915.x

Morris, J. H., Macgillivray, S., & McFarlane, S. (2014). Interventions to promote long-term participation in physical activity after stroke: A systematic review of the literature. *Archives of Physical Medicine and Rehabilitation, 95,* 956–967. http://dx.doi.org/10.1016/j.apmr.2013.12.016

Ness, A. (2004). Diet, nutrition and the prevention of chronic diseases (WHO Technical Report No. Series 916). Report of a Joint WHO/FSA Expert Consultation. *International Journal of Epidemiology, 33,* 914–915. http://dx.doi.org/10.1093/ije/dyh209

Nicol, M. B., & Thrift, A. G. (2005). Knowledge of risk factors and warning signs of stroke. *Vascular Health and Risk Management, 1,* 137–147. http://dx.doi.org/10.2147/vhrm.1.2.137.64085

Oettingen, G. (2000). Expectancy effects on behavior depend on self-regulatory thought. *Social Cognition, 18,* 101–129. http://dx.doi.org/10.1521/soco.2000.18.2.101

Oettingen, G. (2012). Future thought and behaviour change. *European Review of Social Psychology, 23,* 1–63. http://dx.doi.org/10.1080/10463283.2011.643698

Oettingen, G. (2014). *Rethinking positive thinking*. New York, NY: Penguin/Random House.

Oettingen, G., & Gollwitzer, P. M. (2010). Strategies of setting and implementing goals: Mental contrasting and implementation intentions. In J. E. Maddux & J. P. Tangney (Eds.), *Social psychological foundations of clinical psychology* (pp. 114–135). New York, NY: Guilford Press.

Oettingen, G., & Gollwitzer, P. M. (2015). Self-regulation: Principles and tools. In G. Oettingen & P. M. Gollwitzer (Eds.), *Self-regulation in adolescence* (pp. 3–29). New York, NY: Cambridge University Press. http://dx.doi.org/10.1017/CBO9781139565790.002

Oettingen, G., Marquardt, M. K., & Gollwitzer, P. M. (2012). Mental contrasting turns positive feedback on creative potential into successful performance. *Journal of Experimental Social Psychology, 48,* 990–996. http://dx.doi.org/10.1016/j.jesp.2012.03.008

Oettingen, G., Mayer, D., & Thorpe, J. (2010). Self-regulation of commitment to reduce cigarette consumption: Mental contrasting of future with reality. *Psychology & Health, 25,* 961–977. http://dx.doi.org/10.1080/08870440903079448

Oettingen, G., Mayer, D., Timur Sevincer, A., Stephens, E. J., Pak, H. J., & Hagenah, M. (2009). Mental contrasting and goal commitment: The mediating role of energization. *Personality and Social Psychology Bulletin, 35,* 608–622. http://dx.doi.org/10.1177/0146167208330856

Oettingen, G., Pak, H., & Schnetter, K. (2001). Self-regulation of goal setting: Turning free fantasies about the future into binding goals. *Journal of Personality and Social Psychology, 80,* 736–753. http://dx.doi.org/10.1037/0022-3514.80.5.736

Oettingen, G., Stephens, E. J., Mayer, D., & Brinkmann, B. (2010). Mental contrasting and the self-regulation of helping behaviors. *Social Cognition, 28,* 490–508. http://dx.doi.org/10.1521/soco.2010.28.4.490

Parks-Stamm, E. J., Gollwitzer, P. M., & Oettingen, G. (2007). Action control by implementation intentions: Effective cue detection and efficient response initiation. *Social Cognition, 25,* 248–266. http://dx.doi.org/10.1521/soco.2007.25.2.248

Prochaska, J. O., DiClemente, C. C., & Norcross, J. C. (1992). In search of the structure of change. In Y. Klar, J. D. Fisher, J. M. Chinsky, & A. Nadler (Eds.), *Self change* (pp. 87–114). New York, NY: Springer. http://dx.doi.org/10.1007/978-1-4612-2922-3_5

Redfern, J., McKevitt, C., Dundas, R., Rudd, A. G., & Wolfe, C. D. (2000). Behavioral risk factor prevalence and lifestyle change after stroke: A prospective study. *Stroke, 31,* 1877–1881. http://dx.doi.org/10.1161/01.STR.31.8.1877

Sheeran, P., Harris, P., Vaughan, J., Oettingen, G., & Gollwitzer, P. M. (2013). Gone exercising: Mental contrasting promotes physical activity among overweight, middle-aged, low-SES fishermen. *Health Psychology, 32,* 802–809. http://dx.doi.org/10.1037/a0029293

Sheeran, P., Webb, T. L., & Gollwitzer, P. M. (2005). The interplay between goal intentions and implementation intentions. *Personality and Social Psychology Bulletin, 31,* 87–98. http://dx.doi.org/10.1177/0146167204271308

Stadler, G., Oettingen, G., & Gollwitzer, P. M. (2009). Physical activity in women: Effects of a self-regulation intervention. *American Journal of Preventive Medicine, 36,* 29–34. http://dx.doi.org/10.1016/j.amepre.2008.09.021

Stadler, G., Oettingen, G., & Gollwitzer, P. M. (2010). Intervention effects of information and self-regulation on eating fruits and vegetables over two years. *Health Psychology, 29,* 274–283. http://dx.doi.org/10.1037/a0018644

Stöber, J. (2001). The Social Desirability Scale-17 (SDS-17): Convergent validity, discriminant validity, and relationship with age. *European*

Journal of Psychological Assessment, 17, 222–232. http://dx.doi.org/10.1027//1015-5759.17.3.222

Towfighi, A., & Saver, J. L. (2011). Stroke declines from third to fourth leading cause of death in the United States: Historical perspective and challenges ahead. *Stroke, 42,* 2351–2355. http://dx.doi.org/10.1161/STROKEAHA.111.621904

Ware, J., Jr., Kosinski, M., & Keller, S. D. (1996). A 12-Item Short-Form Health Survey: Construction of scales and preliminary tests of reliability and validity. *Medical Care, 34,* 220–233. http://dx.doi.org/10.1097/00005650-199603000-00003

Webb, T. L., & Sheeran, P. (2006). Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychological Bulletin, 132,* 249–268. http://dx.doi.org/10.1037/0033-2909.132.2.249

Webb, T. L., & Sheeran, P. (2007). How do implementation intentions promote goal attainment? A test of component processes. *Journal of Experimental Social Psychology, 43,* 295–302. http://dx.doi.org/10.1016/j.jesp.2006.02.001

Webb, T. L., & Sheeran, P. (2008). Mechanisms of implementation intention effects: The role of goal intentions, self-efficacy, and accessibility of plan components. *British Journal of Social Psychology, 47,* 373–395. http://dx.doi.org/10.1348/014466607X267010

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