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Running Head: EXERCISE CUES

Can the Effects of Implementation Intentions on Exercise be
Enhanced Using Text Messages?

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ABSTRACT

Implementation intentions (Gollwitzer, 1993), planning in advance the situation in which one will act, have been proposed to be an effective self-regulatory technique for changing health behaviour. Encouraging people to receive text message reminders of their implementation intentions should enhance their strength and, thus, it was predicted that this combined approach would be particularly effective in increasing exercise. Participants ($N=155$) were randomly allocated to one of five conditions (implementation intentions and SMS, implementation intention, SMS, or one of two control groups) then completed self-report measures of exercise behaviour and motivation. Four weeks later, they responded to similar items. Results suggested that the combined intervention increased exercise frequency significantly more than the other strategies including the implementation intention group. It is proposed, therefore, that implementation intention effects can be enhanced via plan reminders.

Keywords: implementation intentions; environmental cues; text message; reminders.

INTRODUCTION

The importance of exercise should not be underestimated. It can lead to weight loss in some individuals (King, Hopkins, Cauldwell, Stubbs, & Blundell, 2008) and has been linked to a range of other health benefits including reduced depression (e.g., Lawlor & Hopker, 2001) and stress (e.g., Brownley et al., 2003). Despite this, the majority of individuals, including around 60% of 16-24 year olds in England fail to meet recommended physical activity levels (Office for National Statistics, 2006a). Interventions that are easy to implement and can promote exercise in young persons are needed.

According to the model of action phases (Gollwitzer, 1990; Heckhausen, 1991) forming positive intentions to act is just one phase towards the initiation of action. Planning when, where and how to perform goal-directed behaviours is needed to increase the likelihood of action when the behaviour has not become habitualized. The most effective interventions should address issues of motivation and planning.

An intention reflects one's willingness to try to perform a specific behaviour or to achieve a particular outcome ("I intend to perform/achieve X"; "I intend to exercise") and thus refers to what one wants to achieve. Implementation intentions specify the (goal-directed) behaviour and link it to a good opportunity to enact it ("If situation Y occurs then I will perform X"; "As soon as I get home I will do sit-ups in my bedroom") and thus reflect how, when, and where people will act on their intentions. Indeed past research has indicated that implementation intentions can be used to promote a number of health behaviours including exercise (e.g., Milne, Orbell, & Sheeran, 2002), healthy eating (e.g., Armitage, 2004) and cancer-related self-

examinations (e.g., Prestwich et al., 2005), and that supplementing motivational interventions with implementation intention manipulations is likely to produce larger benefits than targeting motivation or planning alone (e.g., Prestwich, Lawton & Conner, 2003; but see Luszczynska, Tryburcy, & Schwarzer, 2007).

Gollwitzer (e.g., 1993, 1999) has proposed two processes underlying the effects of implementation intentions on behaviour. First, the mental representation of the anticipated environmental cue becomes highly accessible which improves the detection of suitable opportunities to act. Therefore, the risk that these good opportunities pass by unnoticed is reduced (see Aarts, Dijksterhuis, & Midden, 1999). Second, the implementation intention strengthens the link between the planned situation and the goal-directed response (see Webb & Sheeran, 2007). According to Gollwitzer, by linking the intended response to a suitable opportunity, one does not need to deliberate whether to act, or how to act; when one encounters the planned context, action is initiated quickly, efficiently, and without need for conscious awareness. However, a number of instances have been reported where implementation intentions have no impact on behaviour (e.g., Higgins & Conner, 2003; Jackson et al., 2005; Lavin & Groarke, 2005; Michie, Dormandy, & Marteau, 2004) or only small (e.g., Armitage, 2004) effects on behaviour and thus there remains a need to strengthen these effects. Pairing implementation intentions with reminder cues might be one way to do this.

Implementation intentions might sometimes fail to change behaviour if the individual does not hold sufficiently positive intentions to perform the planned behaviour (see Gollwitzer, 1990; Prestwich et al., 2003; Sheeran, Webb, & Gollwitzer,

2005). A second reason for null effects of implementation intentions could be that the mechanisms proposed to underlie these effects (enhancing the accessibility of the anticipated environmental cue, and strengthening the link between the planned situation and the goal-directed response) might not persist in real-life settings over a period of days or weeks. Studies that have examined implementation intention mechanisms have almost exclusively been laboratory-based and examined effects on behaviour in the immediate experimental setting (Aarts et al., 1999; Webb & Sheeran, 2007). It remains unclear, therefore, whether a simple implementation intention manipulation is sufficient to change behaviour outside the laboratory via these same processes. Providing reminder cues might be one way to increase the likelihood of changing behaviour with implementation intentions. Reminders of one's goals and planned cues might enhance their accessibility. This increased accessibility could help individuals to retrieve their goal and to detect their cues to action, respectively. Reminders that reinforce the association between the environmental cue and the desired action should also help to cue an individual to implement their plans (if they have made such relevant plans). In addition, reminders might provide, or temporarily activate, the necessary motivation in order for implementation intentions to be effective (see Gollwitzer, 1993; Prestwich et al., 2003; Sheeran et al., 2005).

A flexible and easily implementable way to pair plans with cues is to combine implementation intentions with SMS text messages delivered at a time of one's choice to one's mobile phone. Although the application of SMS-based technology to change health behaviours is in its infancy, there is some supportive evidence. Rodgers, Corbett, Bramley, Riddell, Wills, Lin and Jones (2005) showed that receiving

personalized text messages for a period of six weeks led to 15% more people quitting smoking compared to those in a control condition (see also Hurling, Fairley, & Dias, 2006). Delivering strategies via mobile-phone technology is particularly appealing because of the widespread use of mobile phones. By the year 2003 88% of people in the UK, between the ages of 15 and 34, owned a mobile (Office for National Statistics, 2006b). Mobile phones thus present a means through which health behaviour can be influenced at any time.

Aims

Although it has been argued that reminding individuals' of their plans should enhance the impact of implementation intentions on behaviour (see Gollwitzer, 1999; Sheeran et al., 2005), supportive evidence is, so far, lacking. The central aim of the research is to test whether the effects of implementation intentions on exercise can be strengthened by combining them with text message reminders. Participants were randomly allocated to conditions such that they were either asked to form implementation intentions regarding their exercise or not, and they received SMS text-message reminders about exercising or did not. Baseline (0 weeks) and follow-up (4-weeks) measures of self-reported exercise were taken. In accordance with the limited evidence that text-message based strategies can be effective in changing health behaviour, it was predicted:

Hypothesis 1: Participants receiving text messages regarding their exercising will increase their exercise more than those that did not receive such messages.

The research provides an important test of whether changing behaviour via implementation intentions is more effective when they are combined with reminders.

Hypothesis 2. Participants forming implementation intentions will increase their exercise more than those that did not form implementation intentions.

Hypothesis 3. This effect of implementation intentions will be strengthened by combining them with text message reminders....

Hypothesis 4. Particularly when the text message reminded the individual of their plan.

METHOD

Participants and Procedure

Seven hundred and two students from a UK university, who had previously signed-up to a psychology experiments mailing list, were initially contacted regarding participation. The recruitment email was sent at the beginning of the project and again at intermittent points during the course of the study. Within the email, participants were told that the title of the study was 'The Physical Exercise Project' and that the study would require them to complete measures at baseline and in four weeks time. At this stage, the outlined selection criteria were that participants must: 1. exercise less than three times per week, 2. own a mobile phone, 3. be fluent in English, 4. be aged between 18-40. Two hundred and thirty-three persons expressed an interest in taking part. Of these, 29 did not meet all of the selection criteria (14 exercised too much; 8 did not own a mobile phone; 6 were too old; 1 person was not fluent in English), 45 did not attend their scheduled baseline session, and 4 participants failed a health check. One hundred and fifty-five participants were successfully recruited (mean age= 23.76 years, $SD= 4.64$; 90 women). Of these 155 participants, 62 (40%) were sedentary, having reported not exercising at all at baseline. Nineteen participants

failed to return and complete the follow-up measures reflecting a dropout rate of 12.3%. Participants received £19 plus £2 gift vouchers upon completion of the experiment.

An experimental longitudinal design was used with exercise behaviour assessed at both baseline and follow-up at 4 weeks. Prior to data collection, ethical approval was obtained and a computer-based random number generator was used to allocate participants to conditions before they completed any measures. Participants completed all measures individually in a small cubicle. All participants, except for the full control condition, first read a motivational message based on Protection Motivation Theory (PMT; Rogers, 1983) before completing PMT-based measures. Those in the full control group did not read the motivational message and immediately completed the PMT measures. After completing the PMT measures, participants read and responded to the intervention information. The information presented varied depending on these interventions only after the PMT-based measures had been completed (see Manipulations). Standardized instructions were used throughout all other parts of the study and participants were requested after completing baseline measures to refrain from discussing the study with others to minimize the risk of contamination of the manipulations. Four days before they were due to return for the second part of the study, participants received a standard email reminder. At follow-up, participants returned and responded to items assessing their exercise during the intervention period.

Manipulations

Control. Participants in this condition only completed measures of motivation. They did not read a message designed to manipulate constructs (perceived severity, perceived vulnerability, response efficacy, self-efficacy, response costs) from Protection Motivation Theory (PMT; Rogers, 1983), were not asked to form implementation intentions and did not receive any exercise-based SMS text messages.

Control 2 (PMT). Participants in this condition read a motivational message designed to manipulate each component of PMT (Rogers, 1983). It contained very similar sentences to those used by Milne et al. (2002) to successfully increase participants' intentions to exercise. Participants in the implementation intention and SMS, implementation intentions, and SMS conditions also read this motivational message before completing implementation intention or SMS manipulations. Based on a 2 (time: baseline, follow-up) x 2 (SMS: yes/no) x 2 (implementation intention: yes/no) design, this condition represents the natural control. To test whether the PMT-based manipulation changed one's motivation to exercise, we included a full control condition (see Control condition above) that did not read the motivational message. It was anticipated that those individuals reading the motivational message would have significantly increased levels of each PMT construct than those that did not read the message. However, MANOVA [$F(8,105)=1.45, p=.18$] revealed that the message failed to lead to a significant increase in any of the PMT constructs (perceived severity (split into its 2 component items due to poor reliability), response efficacy, self-efficacy, response costs, plus fear, all $p>.23$) except perceived vulnerability ($p<.04$). Most importantly, however, it did not improve motivation ($p=.62$).¹

Implementation intentions. Participants randomized to this condition read the PMT-based message and then were asked to form implementation intention(s). Specifically, they were presented with the following information: ‘If you form a definite plan of exactly when and where you will carry out an intended behaviour, you are more likely to actually do so. It would be useful for you to plan when and where you will exercise three times each week in the next 4 weeks.’ They were then asked to think carefully about the types of exercise that they would like to do three times per week for at least 20 minutes per session and the situations that they regularly encounter that could be used to guide their exercise patterns. Participants were told that their plan should state the situation and then the exercise that they will perform upon encountering it: (i.e. ‘When I’m in *situation X* then *I will do Y*’).’ They were shown two suitable examples (‘As soon as lectures end on Tuesdays, Thursdays and Fridays then I will go to the gym and workout’; ‘When I’m in my bedroom and about to watch Coronation Street on TV on Mondays, Wednesdays and Fridays then I will do squat thrusts, sit-ups and star jumps in my room whilst watching Coronation Street’) before being requested to write their plans.

To ensure the plans were sufficient, they were asked whether or not they had identified enough situations that they could use to help them to exercise three times per week for at least 20 minutes. If they answered ‘no’ to this question, they were required to write subsequent plans. Participants in this group did not receive any SMS text messages regarding their exercise.

SMS. Within this condition, participants were not asked to form implementation intentions. Instead, after reading the PMT-based motivational message, they read

information that requested them to decide when they would prefer to receive SMS text messages direct to their mobile phone to help remind them to exercise. In addition, they were asked to think about what they would like the message to say, how many messages they wanted to receive and the days and times that they wanted the message to arrive to their phone each week. We allowed participants to choose their own text-message content for a number of reasons. First, we assumed that one's intentions to act would have been strengthened by the PMT-based message and thus subsequent messages from the experimenter regarding the benefits of exercise was anticipated to be an ineffective means to change behaviour. Instead, we wanted to try to activate one's own (strong) intentions to exercise in a situation in which participants felt it would be most helpful. Intentions should be more predictive of behaviour the nearer the intention is activated in relation to an opportunity to enact the action. Second, it permitted the user to select a message that they thought would be helpful, at a time that would suit them, in order to maximize the likelihood that they would choose whatever message they personally thought was best for them. All participants were required to initially receive at least one text reminder.

After making the necessary decisions, participants left their cubicle to contact the experimenter who then directed them to the website in which they entered the text message content and delivery times and days. Participants also chose a username and password permitting them to log back into the website at any time during the study to change the text message characteristics if they desired.

Implementation intentions and SMS. In this condition, participants read the PMT-based message then formed their implementation intentions following the same

instructions as those presented to the participants in the ‘implementation intention’ condition. Next, participants were given the exact same SMS manipulation, with the same requirements, that the SMS condition received with just one exception- an additional statement was added in bold text stating that they might choose to receive messages that remind them of the plan(s) that they had formed-58.6% (17/29) chose to receive this type of reminder. Participants in this condition were permitted to choose their own content for the text message reminders (rather than specify that they had to receive text message reminders of their plans). We took this approach to permit an exploratory examination of the interactive effects of implementation intentions and different types of SMS (without introducing further manipulations into our design) and to keep the implementation intention + SMS condition and the SMS condition roughly equivalent with both having the freedom to select their own text message content.

Measures

Self-report items assessed exercise behaviour, along with other constructs not reported here (see footnote 2). To measure exercise frequency at time 1 and time 2 participants were requested to complete a table in which they had to specify the type of exercise and the number of times that they performed the particular exercise. For behaviour at time 1, the table was formatted such that there were two rows (plus headings): one for each of the 2 weeks prior to the study. For behaviour at time 2, the table contained four rows relating to each of the 4 weeks during the experimental period. Within this questionnaire, exercise was described as physical activity of at least moderate intensity that is sustained for at least 20-30 minutes duration and

accompanied with increased breathing rate, increased heart rate so that the pulse can be felt, and a feeling of increased warmth and possibly sweating on hot or humid days. The measures and interventions focused on this definition of exercise as UK NHS guidelines (NHS Online, 2006) state that aerobic exercise that leaves one slightly out of breath is a good starting point for those individuals who exercise infrequently.

RESULTS

The main findings, including actual (rather than estimated marginal) means, are summarized in Table 1. As the PMT intervention did not significantly increase any of the PMT variables, the two control conditions were collapsed into one group (see Table 1). The *F*-values presented for exercise behaviour are based on intention-to-treat analyses (for hypotheses 1-3, $N=154$, one outlier removed, $z>3$; for hypothesis 4, concentrated on those allocated to the implementation intention + SMS condition, $N=29$), with those participants that dropped out of the study between time 1 and time 2 being treated as though they had not changed their behaviour. Participants' self-reported exercise behaviour at times 1 and 2 are summarized, across groups, in Table 1.

Preliminary Analyses

A *t*-test revealed there was no difference in baseline exercise frequency between those participants who completed time 2 measures and those that did not ($t(153)=1.50, p=.14$), nor was there any difference across experimental groups [$F(4, 150)=0.22, p=.93$]. Chi-square analysis revealed rates of dropout did not vary across gender ($\chi^2(1)=.00, p>.05, \Phi=.00$), sedentary and non-sedentary individuals ($\chi^2(1)=1.44, p>.05, \Phi=.10$), or experimental groups ($\chi^2(4)=.52, p>.05, \Phi=.06$), nor was

there a difference in the proportion of males and females, ($\chi^2(4)=4.15, p>.05, \Phi=.16$), or sedentary and non-sedentary participants, ($\chi^2(4)=1.20, p>.05, \Phi=.09$), across experimental groups.

Participants, on average, requested 3.7 text messages for each week of the study (Implementation intentions + SMS: 3.69, SMS: 3.71), logged onto the site 1.48 times (Implementation intentions + SMS: 1.62, SMS: 1.35) and changed the content or delivery days/times of the text messages on 1.15 occasions (Implementation intentions + SMS: 1.38, SMS: 0.94). These figures did not vary across the two text-message conditions (all $p>.31$). None of these three measures were related to changes in self-reported exercise behaviour (all $r<.03, p>.87$). Participants in the implementation intention conditions, on average, formed 1.39 plans. The number of plans, within the implementation intention conditions, did not correlate with changes in self-reported exercise behaviour ($r=.01, p=.93$).

Do SMS text messages and implementation intentions increase exercise and do they interact? (Hypotheses 1-3).

A 2 (implementation intention: given vs. not given) x 2 (SMS: given vs. not given) x 2 (time: baseline vs. follow-up) mixed ANOVA was conducted to test whether the interventions had differential effects on changes in exercise behaviour. SMS by time interactions would indicate that changes in exercise vary across those that received exercise-related text messages and those that did not (hypothesis 1). Implementation intention by time interactions would indicate such changes between those asked to form implementation intentions and those that were not (hypothesis 2). Three-way interactions, in the correct direction, would suggest that the effects of

implementation intentions are particularly pronounced when combined with SMS (hypothesis 3).

Although there were no main effects of implementation intentions or SMS text messages, there were significant time x SMS [$F(1, 150)=5.98, p=.02 (\eta_p^2=.038)$] and implementation intention by time [$F(1, 150)=4.04, p=.046 (\eta_p^2=.026)$] interactions, and a marginally significant time x implementation intention x SMS interaction [$F(1, 150)=3.03, p=.08 (\eta_p^2=.020)$]. Individuals receiving text messages stated greater improvements than those that did not (supporting hypothesis 1), and those that were asked to form implementation intentions reported greater increases in exercise than those that were not (supporting hypothesis 2). Splitting the three-way interaction by SMS revealed that implementation intentions were effective when paired with SMS [implementation intention x time: $F(1, 58)=5.03, p=.03 (\eta_p^2=.080)$], but were not significantly effective when they were not paired with SMS [implementation intention x time: $F(1, 92)=0.05, p=.83 (\eta_p^2=.001)$] thus supporting hypothesis 3.

Do particular types of plan reminders moderate the effect of the implementation intention + SMS manipulation on exercise? (Hypothesis 4)

The implementation intention + SMS group ($N=29$) were split into a dichotomous group reflecting whether participants forming implementation intentions received SMS that reminded them of their exercise plans (e.g., ‘don’t forget to go to the gym after lectures today’-coded as 1, $n=17$) or not (e.g., ‘I don’t want coronary heart disease-exercise more’- coded as 0, $n=12$). This variable (reminder type) was then entered into an ANOVA analysis to examine whether those individuals that received reminders of their implementation intentions were more successful in

increasing their exercise behaviour that those that did not. A significant time x reminder type interaction [$F(1, 27)=5.36, p=.03 (\eta_p^2=.166)$] emerged that indicated that those individuals that received text message reminders of their implementation intentions increased their exercise behaviour more than those that did not receive this type of text message, supporting hypothesis 4.

DISCUSSION

The findings suggest that a combined implementation intention/text-message system is more effective than either strategy alone in terms of increasing exercise. Text message reminders of one's implementation intentions, rather than other types of text messages, seem particularly effective in strengthening the effects of implementation intentions on self-reported exercise. Implementation intentions, without text message reminders, did not change exercise behaviour.

It was proposed that reminding individuals' of their plans might improve the effects of implementation intentions in changing behaviour (over an extended period of time outside of the laboratory). In this study, the impact of implementation intentions on behaviour were stronger in the condition in which these plans were paired with SMS text-messages. Moreover, the additional analyses conducted regarding hypothesis 4 revealed that pairing implementation intentions with SMS was only beneficial when an individual chose to receive reminders of one's plans, implying that reminding an individual of their plans drives the effects. This effect may occur because reminding an individual of their implementation intention should enforce the two processes through which implementation intentions have been argued to change behaviour. Specifically, this intervention should increase the accessibility of

the environmental cue (as the individual is reminded of this cue) or cue an individual to implement their plan (as the individual is reminded of the association between the cue and their desired action), or both. The text message should also help an individual to retrieve their exercise goals, potentially by enhancing the accessibility of these goals. Text messages related to one's goals, in the absence of an individual making a relevant implementation intention, should help an individual to retrieve their goal only. They should not enhance the accessibility of relevant environmental cues or reinforce the association between the cue and planned exercise behaviour. However, we do not directly test these processes and additional explanations should be considered.

First, text message reminders might have increased one's commitment to their plan. Individuals' commitment to their implementation intention might influence their impact on behaviour (Seehausen et al., 1994, cited in Gollwitzer & Schaal, 1998). Second, the text message reminders (with, or without, implementation intentions) could have made one's intentions to exercise more positive and positive intentions are necessary in order for implementation intentions to be effective in changing behaviour both on theoretical (see, for example, the Rubicon Model, e.g., Gollwitzer, 1990) and empirical (Prestwich et al., 2003; Sheeran et al., 2005) grounds. A lack of sufficiently positive intentions might also explain why those in the implementation intention condition (without SMS text reminders) were unsuccessful in increasing self-reported exercise. Third, as participants within the implementation intention + SMS condition could choose whether to receive text messages that directly reminded them of their implementation intention or different types of messages, the differences between those

receiving plan reminders and those that did not, *within* this combined condition only, might be attributed to differences between these two groups. However, our approach allowed an exploratory view of the effects of different types of text messages on implementation intention efficacy without adding an extra experimental group within the design. Furthermore, MANOVA revealed no motivational differences between these two groups (see footnote 2). Even if unmeasured differences existed between these two groups, it does not affect the conclusion that pairing implementation intentions with SMS text messages increases the efficacy of implementation intentions. At this stage, it is important to first demonstrate that a new strategy has the potential to effectively change behaviour.

These processes (increased accessibility of cues; reminding people of the association between cues and actions) and moderating factors (enhanced commitment to plans; stronger underlying motivation) might explain why implementation intentions, in this study, and in others (e.g., Higgins & Conner, 2003; Jackson et al., 2005) failed to change behaviour. The means through which the manipulation is delivered (e.g., within questionnaires; with assistance from the experimenter; with the provision of example plans); variation in the context in which the behaviour is assessed (inside/outside the laboratory) or period of time that the behaviour is assessed (and the intensity at which the behaviour is performed- e.g., three times a week vs. once a month vs. once in total) are just some of the factors that might influence implementation intention processes and moderating factors and ultimately whether implementation intentions, in any particular study, are influential or not. While our study cannot determine which of these factors, if any, contributed to their failure

(when used without SMS text reminders) to change self-reported behaviour, it shows that pairing implementation intentions with SMS text reminders was a significantly more effective approach through which to enact change.

The findings need to be objectively verified, demonstrated using reliable behavioural measures, and replicated within alternative samples in order to improve generalizability. Participants were required to think back regarding their exercise over the previous four weeks using a self-report measure which could produce some recall bias. However, this limitation applies equally to all conditions and therefore is unlikely to explain the differential results. Replication is important as the sample size, spread across five conditions (and six conditions when the implementation intention + SMS condition is broken down into those that received reminders of their plans, $n=17$, and those that received alternative text messages, $n=12$), is relatively small. The study would have benefited from a longer intervention period to more clearly ascertain the long-term effects of the combined strategy. Continued use of text messages might lead to annoyance and undermine any attempt for long-term change. Despite this, given that it has been argued that successful changes induced by implementation intentions should be maintained as they work in a similar fashion to habits (Sheeran & Orbell, 1999; Milne et al., 2002), effects emerging from implementation intentions strengthened through text messages should be even more persistent.

To summarize, we present a test of whether the effects of implementation intentions on health behaviour can be strengthened by text message reminders. This combined, technologically advanced, approach appears more effective than standard implementation intentions.

FOOTNOTES

¹ Full details of the motivational message are available from the first author.

² MANOVA indicated that, within the implementation intention + SMS condition, there were no differences between those that chose text messages reminding them of their implementation intention and those that did not [$F(3, 23)=0.32, p=.81$: intention, $F(1, 25)=0.43, p=.52$; PBC, $F(1, 25)=0.13, p=.72$; time 1 exercise, $F(1, 25)=0.63, p=.44$).

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Table 1: Differences in Exercise Behaviour Across Time and Implementation Intention & SMS conditions (N=154)

Variable	Time	Implementation Intentions+SMS Mean (SD) [n]	Implementation Intentions Mean (SD) [n]	SMS Mean (SD) [n]	Control 1 Mean (SD) [n]	Control 2 PMT Mean (SD) [n]	Control 1 + Control 2 Mean (SD) [n]
Exercise	T1	0.62 (0.65) [29]	0.74 (0.74) [29]	0.77 (0.81) [31]	0.66 (0.72) [31]	0.72 (0.74) [34]	0.69 (0.73) [65]
	T2	1.50 (1.29)	1.03 (1.06)	1.12 (1.00)	0.96 (1.00)	0.92 (0.98)	0.94 (0.98)