

The optimal timing of supporting patients in health-related behavior change after TIA or ischemic stroke: a prospective cohort study to determinants of health-related intention to change over time

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The optimal timing of an intervention to support health-related behavior after transient ischemic attack (TIA) or ischemic stroke is unknown. We aimed to assess determinants of patients' health-related intention to change over time. We prospectively studied 100 patients with TIA or minor ischemic stroke. Patients completed questionnaires on fear, response-efficacy (belief that lifestyle change reduces risk of recurrent stroke), and self-efficacy (patients' confidence to carry out lifestyle behavior) for behavior change, at baseline, 6 weeks and at 3 months after their TIA or ischemic stroke. We studied differences between these determinants at each visit by means of Wilcoxon signed-rank tests. Median self-efficacy score at baseline was 4.3 [interquartile range (IQ) 3.9–4.7], median fear 16 (IQ 7–21), and response-efficacy 10 (9–12). Fear was significantly higher at baseline than at 3 months (mean difference 2.0; 95% confidence interval: 0.78–3.9) and started to decrease after 6 weeks. No change in self-efficacy or response-efficacy was found.

Introduction

Modification of health behavior after transient ischemic attack (TIA) or ischemic stroke including smoking cessation, healthy diet, and increased physical activity is considered important and strongly recommended in many guidelines. However, at present little is known about effective interventions to support patients in this health behavior change [1–9]. Insight in determinants of lifestyle behavior change and optimal timing of the intervention is essential to develop a successful intervention to support health-related behavior change [10–13].

The protection motivation theory to examine determinants of lifestyle behavior change after TIA or ischemic stroke has shown to be a useful model for predicting health-protective intentions and behavior changes in other conditions, such as diabetes, coronary heart disease, and breast cancer [14]. We earlier found that response-efficacy (the belief that lifestyle change can reduce the

Since fear significantly decreased over time after TIA or ischemic stroke and self-efficacy and response-efficacy scores remained high, the optimal moment to start an intervention to support patients in health-related behavior change after TIA or ischemic stroke seems directly after the stroke or TIA. *International Journal of Rehabilitation Research* 44: 32–37 Copyright © 2020 The Author(s). Published by Wolters Kluwer Health, Inc.

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risk of recurrent stroke), self-efficacy (patients confidence to carry out behavior necessary to reach a desired goal), and fear were determinants of intention to change health-related behavior after TIA or ischemic stroke [15]. Self-efficacy was the strongest determinant of intention to stop smoking, increase physical activity, and improve healthy diet [15]. Both response-efficacy and self-efficacy were associated with intention to change health behavior in other cardiovascular studies [16–23]. At present, there are no studies focusing on change of these determinants over time after TIA or ischemic stroke. As these determinants probably vary over time, there may be a window of opportunity to start a health-related behavior supporting intervention [24].

To get insight in the timing to start an intervention supporting health-related behavior change after TIA or ischemic stroke, we aimed to assess the determinants of intention to change over time (fear, response-efficacy, and self-efficacy) in patients with recent TIA or ischemic stroke.

Methods

All patients included in the present study participated in the DECIDE study. This study was approved by national

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and local institutional review boards (MEC-2011-356, NL36454.078.11) and written informed consent was obtained from all patients. The investigation conforms with the principles outlined in the Declaration of Helsinki. Detailed methods of the DECIDE study have been described earlier [15]. DECIDE was a prospective study on determinants of intention to change health-related behavior and actual change in patients with TIA or ischemic stroke. Patients of 18 years or older with a clinical diagnosis of TIA, including amaurosis fugax, or minor ischemic stroke with a modified Rankin Scale (mRS) score of 2 or less were included during admission on the stroke unit or outpatient clinic. The mRS is a commonly used scale for measuring the degree of disability or dependence in the daily activities of people who have suffered a stroke. Scores on the mRS range from 0 (no symptoms at all) to 5 (severe disability); for statistical purposes, death has a score of 6 [25].

Patients were excluded if they were discharged to a nursing home, were not Dutch-speaking, or had severe aphasia. Patients were recruited in the first week after admission to the stroke unit or TIA outpatient clinic. All patients received routine general lifestyle advice including regular physical exercise, healthy diet, and advice against smoking as part of standard care at baseline.

At baseline, we recorded data on clinical features of TIA or ischemic stroke, quantification of stroke severity according to the National Institutes of Health stroke scale [26], stroke etiology according to the Classification of subtype of acute ischemic stroke developed for the Trial of Org 10172 in Acute Stroke Treatment (TOAST) [27], demographic data, vascular risk factors and history, and use of medication. All patients underwent a cognitive assessment including the Montreal Cognitive Assessment (MoCA), a rapid screening instrument for cognitive impairment, particularly in stroke patients [28], and depression was measured with the Center for Epidemiologic Studies Depression Scale (CES-D) for both depression and anxiety [29,30]. Higher scores indicate more depressive symptoms.

Health-related behavior including smoking cessation, healthy diet, and increased physical activity was assessed:

- Physical activity was measured with the International Physical Activity Questionnaire short (IPAQ-S) questionnaire. Patients were asked to report activities performed for at least 10 min during the last 7 days, and time spent in physical activity performed across leisure time, work, domestic activities, and transport at each of the three intensities: walking, moderate, and vigorous [31]. We used reported minutes of moderate and vigorous physical activity to calculate a total physical activity score of minutes a day.
- Dietary behavior was evaluated with the short Food Frequency Questionnaire (FFF). This 14-item scale assesses the intake of saturated fatty acids, unsaturated fatty acids, and fruits and vegetables over the

week before the visit. An overall cardiovascular dietary score was calculated, ranging from -17 to +19, the higher the score, the more favorable the dietary pattern [32].

- Actual smoking status was assessed with questions on current smoking status, how many years they have smoked, and how much cigarettes a patient smokes a day. Smoking was defined as current smoking.

Patients were assessed at baseline (directly after inclusion), at 6 weeks and 3 months after inclusion. The initial assessment included self-reported questionnaires on all sociocognitive determinants of the protection motivation theory including severity, susceptibility, fear, response-efficacy, and self-efficacy. In this study, we used self-efficacy, response-efficacy, and fear as we previously identified them as determinants of intention to change health-related behavior after a TIA or stroke [15]. Patients completed the following questionnaires:

- Self-efficacy was measured with the self-efficacy scale, a 9-item scale with scores that range from 1 to 5 [33]. Higher values indicate more confidence to carry out the behavior necessary to reach the desired goal. Cronbach's α of the self-efficacy questionnaire was 0.75 [15]. This scale has been used successfully before in vascular patients [16,20,34,35].
- Fear was assessed with 8 questions. Patients were asked on a scale of 1-5 how nervous they are when thinking of getting another stroke, how upset they get, depressed or jittery, if their heart beats faster, an if they feel uneasy or anxious [36].
- Response-efficacy, assessed with the following statement: 'For me, regular physical activity will reduce my chances of getting another stroke' (1 = strongly disagree; 5 = strongly agree). Similar questions were asked for dietary change and smoking cessation [31,36].

Statistical analysis

Statistical analysis was performed with STATA 12.1 statistical package (Statacorp, College Station, Texas). Continuous variables were expressed as means and SD, scores were expressed as medians and interquartile ranges (IQs), and counts in patient numbers (n) and percentage (%). Fear, self-efficacy, and response-efficacy at baseline, after 6 weeks and 3 months were described and differences were tested with Wilcoxon signed-rank tests. Since the questionnaires for self-efficacy and response-efficacy included an additional question for smokers, data were presented and analyzed separately for smokers and nonsmokers. We studied the relation between determinants of health-related behavior change at baseline and after 3 months with univariable and multivariable linear regression. Adjustments were made for age, sex, baseline scores, and other determinants. For instance, in analyzing self-efficacy, adjustments were made for age, sex, baseline self-efficacy scores, and response-efficacy and fear.

Results

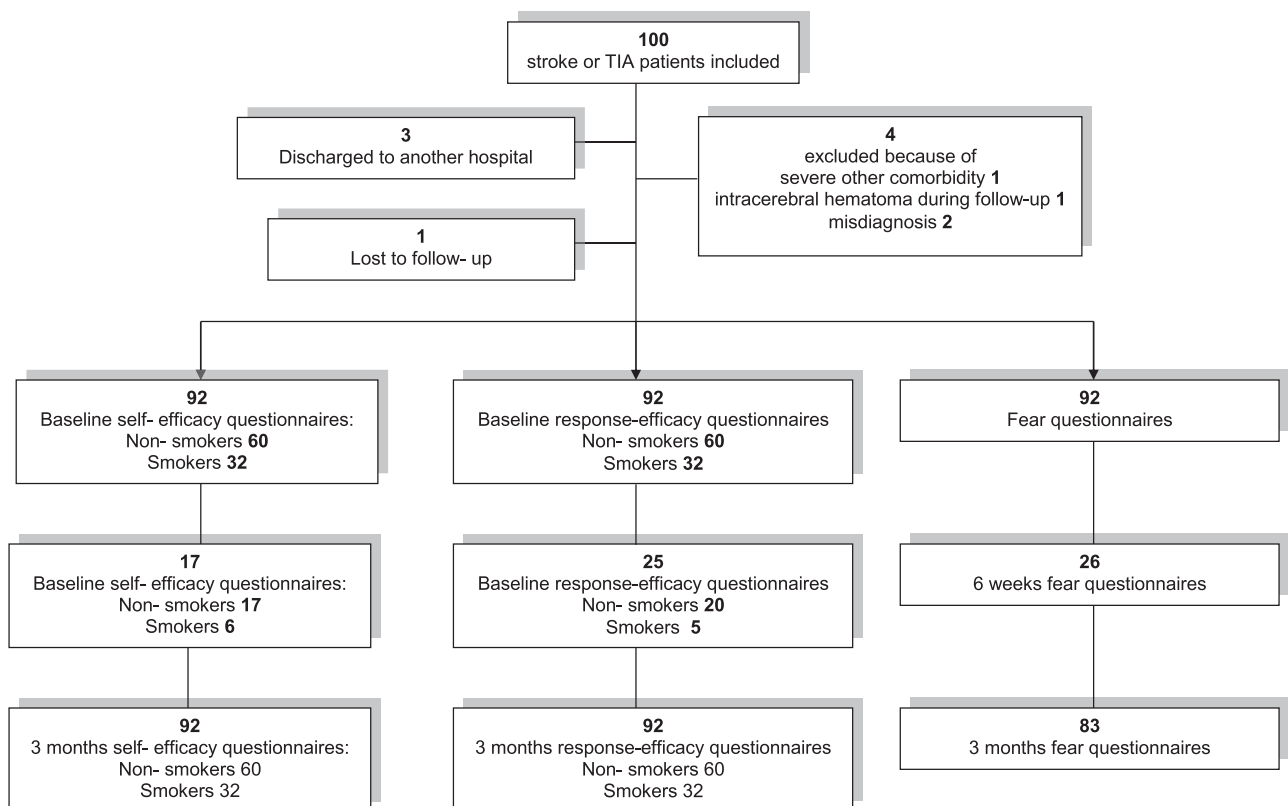
We included 100 patients between February and October 2012. Follow up was completed in 92 patients: one patient was lost to follow-up, one patient was excluded because of severe other comorbidity, one because of intracerebral hematoma during follow-up, two patients because of misdiagnosis, and three patients were discharged to another hospital (Fig. 1). No significant differences in baseline characteristics were found between included patients and excluded patients (data not shown). Mean age was 64 years (SD 12), 60% of the patients were male, and 53% had a TIA (Table 1). Median self-efficacy score at baseline was 4.3 (IQ 3.9–4.7), median fear 16 (IQ 7–21), and response-efficacy 10 (IQ 9–12). There were no differences between smokers and nonsmokers. Fear was significantly higher at baseline than at 3 months [mean difference 2.0; 95% confidence interval (CI): 0.78–3.9] (Table 2). This significance remained after adjustment for age, sex, baseline self-efficacy, and response-efficacy (0.37; 95% CI 0.11–0.64, Table 3). Fear started to decrease after 6 weeks (median fear at 6 weeks 16, at three months 11; $P=0.02$). No change in self-efficacy or response-efficacy was found.

Discussion

Fear significantly decreased in 3 months after TIA or ischemic stroke. Patients with TIA or ischemic stroke (both smokers and nonsmokers) have high self-efficacy and response-efficacy scores for health-related behavior change and these do not vary over time. This suggests that confidence in changing health behavior capacities and the belief that this change can prevent a new stroke are still high at 3 months. However, fear decreased after 3 months suggesting that the best time to start the intervention may be directly after the stroke or TIA or at least within 3 months.

To the best of our knowledge, this is the first study that focusses on changes in determinants of health-related behavior change after TIA or ischemic stroke. Self-efficacy has been studied before in patients with vascular disease (coronary heart disease, cerebrovascular disease, or peripheral artery disease) [20,35]. In those studies, comparably high self-efficacy levels were found, but the self-efficacy was not monitored over time. Response-efficacy for behavior change has not been described in patients with TIA or ischemic stroke before. Fear seems moderate (with a median of 16 on a scale of 32) and

Fig. 1



Flow chart of inclusion and follow up of patients.

decreased strongly within 3 months after stroke or TIA. Fear started to decrease after 6 weeks. During this period, patients often undergo additional examinations to assess the underlying etiology at different medical specialists. This might lead to uncertainty and fear. Possibly patients also adapt to the uncertainty, which lowers the fear. We could not compare our findings with those of others as

fear in relation to behavior change has not been studied quantitatively or in patients with TIA or stroke before. Fear of a recurrent stroke has been found in several other studies [37–41] and can possibly be used as an opportunity to motivate patients to change their health-related behavior in order to reduce risk of recurrence [24]. In two small studies with stroke patients, fear was mentioned by patients as a motivating factor to change health behavior [37,42]. Previous studies in patients with coronary artery syndrome have shown that the majority of patients who quit smoking successfully stopped immediately after the event [43]. Perceived feeling of a life-threatening disease seems to play a role in this process [44]. The European Society of Cardiology (ESC) guidelines recommend to seize this opportunity by addressing the issue of smoking before discharge [45]. These guidelines also recommend that support for cessation of smoking is initiated for all smokers during hospital admission and is continued for a prolonged period after discharge [45,46]. Although there is no evidence for this approach in stroke patients, it seems reasonable to assume that this advice can also be effective after ischemic stroke or TIA.

Table 1 Baseline characteristics (N = 100)

Sex (male), n (%)	60 (60)
Age (years), mean (SD)	64 (12)
Event characteristics	
Event type (TIA), n (%)	53 (53)
Stroke etiology (TOAST) ^a , n (%)	
Large vessel disease	13 (13)
Cardiac embolism	15 (15)
Small vessel disease	19 (19)
Other	0
Undetermined	53 (53)
NIHSS score ^b , median (IQ)	3 (1–5)
Vascular history, n (%)	
TIA	18 (18)
Ischemic stroke	15 (15)
Ischemic heart disease	36 (36)
Atrial fibrillation	11 (11)
Peripheral arterial disease	8 (8)
No vascular history	49 (49)
Cognition and depression	
Score on MoCA ^c , median (IQ) scores from 0 to 30	24 (21–26)
Score on CES-D ^d , median (IQ) scores from 0 to 30	7 (5–13)
Vascular risk factors	
Hypertension, n (%)	65 (65)
Systolic blood pressure (mmHg), mean (SD)	135 (22)
Diastolic blood pressure (mmHg), mean (SD)	78 (13)
Hypercholesterolemia, n (%)	79 (79)
LDL level (mmol/l), mean (SD)	3.17 (1.0)
Blood glucose level (mmol/l), mean (SD)	5.9 (1.4)
Diabetes mellitus, n (%)	30 (30)
Health-related behavior	
Smoking, n (%)	36 (36)
Alcohol abuse, n (%)	5 (5.2)
Physical exercise ^e (min/day), median (IQ)	129.6 (60–218.6)
Physical exercise >30 min a day n (%)	75 (75)
Overall dietscore ^f , median (IQ) scores from –17 to +19	1.0 (–2 to 2.5)
BMI (kg/m ²), mean (SD)	26.5 (3.6)
Overweight (BMI > 25), n (%)	64 (64)

CES-D, Center for Epidemiologic Studies Depression Scale; IQ, interquartile range; MoCA, Montreal Cognitive Assessment; NIHSS, National Institutes of Health stroke scale; TIA, transient ischemic attack; TOAST, Trial of Org 10172 in Acute Stroke Treatment.

^aClassification of subtype of acute ischemic stroke developed for the Trial of Org 10172 in Acute Stroke Treatment.

^bQuantification of stroke severity according to the National Institutes of Health stroke scale), a 15-item scale with scores that range from 0 to 42 and higher values indicating greater severity.

^cAssessed with the Montreal Cognitive assessment.

^dScored with the Centre for Epidemiologic Studies Depression Scale.

^eMeasured with the International Physical Activity Questionnaire short questionnaire.

^fEvaluated with the short Food Frequency Questionnaire. The higher the score, the more favorable the dietary pattern.

Strengths of our study are that this is the first study that focuses on determinants of health behavior change after TIA or ischemic stroke over time. Also we collected detailed information about potential determinants such as difference between smokers and nonsmokers. This study has also some limitations. First, we studied patients for a relatively short period of time. Patients are often rehabilitating longer than 3 months, which can cause further changes over time. Second, not all patients completed questionnaires at 6 weeks (n = 17–25, Fig. 1), which may have affected the results. Baseline and 3-month follow-up questionnaires were completed during an outpatient clinic visit. However, not all patients visited the outpatient clinic after 6 weeks and many patients did not return the submitted questionnaires by mail. We mainly drew conclusions based on the analyses of the difference between baseline and 3 months follow-up. Self-efficacy and response-efficacy scores did not change during all measurements. And most patients had completed all questionnaires after 3 months. Furthermore social desirability bias during questionnaire completion may also have played a role as self-efficacy is high in these patients where our earlier study showed that most patients do not actually change their behavior, due to the intention-behavior gap [47,48].

Table 2 Determinants of health-related behavior change after 6 weeks and 3 months

	Baseline	6 weeks	P-value	3 months	P-value
Self-efficacy total, median (IQ)	4.3 (3.9–4.7)	4.4 (4–4.7)	0.13	4.5 (4–4.8)	0.28
Self-efficacy smokers total, median (IQ)	4.3 (3.9–4.7)	4.2 (3.6–4.3)	0.83	4.4 (3.7–4.9)	0.97
Self-efficacy nonsmokers, median (IQ)	4.3 (3.8–4.8)	4.5 (4.3–4.8)	0.24	4.5 (4.2–4.7)	0.46
Response-efficacy smokers, median (IQ)	10 (9–12)	12 (12–12)	0.09	10 (8–11)	0.73
Response-efficacy nonsmokers (IQ)	8 (6–8)	8 (6–8)	1.00	8 (6–8)	0.81
Fear, median (IQ)	16 (7–21)	16 (7–23)	0.83	11 (7–18)	0.02

IQ, interquartile range.

Table 3 Univariable and multivariable relations between determinants of health-related behavior change at baseline and after 3 months

	Beta	P-value	aBeta	P-value
Self-efficacy total, median (IQ)	0.55 (0.32–0.78)	0.00	0.64 (0.40–0.88) ^a	0.00
Self-efficacy smokers total, median	0.53 (0.21–0.85)	0.53	0.76 (0.47–1.06) ^a	0.00
Self-efficacy nonsmokers, median	0.57 (0.25–0.90)	0.00	0.63 (0.28–0.99) ^a	0.00
Response-efficacy smokers	0.08 (–0.23 to 0.39)	0.61	0.06 (–0.26 to 0.39) ^b	0.69
Response-efficacy nonsmokers	0.35 (0.00–0.69)	0.05	0.34 (–0.01–0.71) ^b	0.06
Fear, median (IQ) scores	0.42 (0.25–0.60)	0.00	0.37 (0.11–0.64) ^c	0.01

IQ, interquartile range.

^aAdjusted for age sex, baseline response-efficacy, and baseline fear.

^bAdjusted for age, sex baseline self-efficacy, and baseline fear.

^cAdjusted for age, sex baseline self-efficacy, and baseline response-efficacy.

In summary, at present it is unclear how and at which moment patients can be best supported in health-related behavior change after TIA or ischemic stroke. Fear, self-efficacy, and response-efficacy play a role in this behavior change process. We found that response-efficacy and self-efficacy remain high after 3 months, and fear decreased significantly after 6 weeks. Therefore, the optimal timing of supporting patients in health-related behavior change after TIA or ischemic stroke seems to be directly after the stroke or TIA.

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Conflicts of interest

There are no conflicts of interest.

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