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Stroke and TIA survivors' cognitive beliefs and affective responses regarding treatment and future stroke risk differentially predict medication adherence and categorised stroke risk

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Abstract

Cognitive beliefs and affective responses to illness and treatment are known to independently predict health behaviours. The purpose of the current study is to assess the relative importance of four psychological domains – specifically, affective illness, cognitive illness, affective treatment and cognitive treatment – for predicting stroke and transient ischemic attack (TIA) survivors' adherence to stroke prevention medications as well as their objective, categorised stroke risk. We assessed these domains among stroke/TIA survivors (n = 600), and conducted correlation and regression analyses with concurrent and prospective outcomes to determine the relative importance of each cognitive and affective domain for adherence and stroke risk. As hypothesised, patients' affective treatment responses explained the greatest unique variance in baseline and six-month adherence reports (8 and 5%, respectively, of the variance in adherence, compared to 1–3% explained by other domains). Counter to hypotheses, patients' cognitive illness beliefs explained the greatest unique variance in baseline and six-month objective categorised stroke risk (3 and 2%, respectively, compared to 0–1% explained by other domains). Results indicate that domain *type* (i.e. cognitive and affective) and domain *referent* (illness and treatment) may be differentially important for providers to assess when treating patients for stroke/TIA. More research is required to further distinguish between these domains and their relative importance for stroke prevention.

Keywords

health beliefs; affective responses; cognitive beliefs; medication adherence; chronic illness

Stroke and TIA survivors are at high risk for recurrent stroke; thus, interventions to promote adherence to stroke prevention medications are necessary for improving outcomes in this

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population (Boysen & Truelsen, 2000). The exploration of psychological determinants of adherence behaviour in this population has been sparse. Therefore, further determination of the psychological factors that may influence greater adherence in stroke and TIA survivors is of vital importance for patients and practical importance for clinicians. Using the common-sense model of self-regulation (Leventhal, Brissette, & Leventhal, 2003) as a theoretical framework, the current study investigates the importance of stroke and TIA survivors' beliefs about their stroke risk and stroke prevention treatments and their affective reactions to illness and treatment for their adherence to stroke prevention medication as well as objective, categorised stroke risk (blood pressure and cholesterol levels).

Psychology researchers have long distinguished between affective and cognitive factors involved in behaviour (Breckler & Wiggins, 1989; Trafimow & Sheeran, 1998). Within health psychology, dual-process models of health behaviour, such as the common-sense model of self-regulation, have distinguished between individuals' affective responses regarding a health threat (e.g. fear response attributed to a health threat) and their cognitive beliefs (e.g. belief in their control of the health threat), and how they differentially relate to behavioural responses (Leventhal, Diefenbach, & Leventhal, 1992). For example, individuals' affective responses regarding physical activity directly predict their physical activity, as well as mediate the effect of their cognitive beliefs on physical activity (Kiviniemi, Voss-Humke, & Seifert, 2007). Research has demonstrated that not only are affective responses and cognitive beliefs distinct from each other, but that individuals' affective attitudes towards many different health behaviours are *stronger* predictors of the behaviours than are individuals' cognitive evaluations (Diefenbach, Miller, & Daly, 1999); these behaviours include long-term, repeated behaviours such as illegal drug use, smoking, applying sunscreen, exercising and obtaining mammograms among women for high risk for breast cancer (Diefenbach et al., 1999; Janssen, Waters, van Osch, Lechner, & de Vries, 2014; Lawton, Conner, & McEachan, 2009). With regard to recurrent stroke prevention, others have investigated the relative importance of cognitive and affective *impairment* on post-stroke rehabilitation participation and success (Skidmore et al., 2010), but not the difference between cognitive beliefs and affective responses to illness and treatment as important factors for post-stroke treatment adherence and control of stroke risk factors.

The degree to which cognitive beliefs and affective responses to health threat influence health behaviour may depend on the referent of those beliefs/responses – namely, whether they regard the illness or the treatment. Illness and treatment beliefs have long been associated with behaviour such as medication adherence. Much research in health psychology has shown that patients' treatment-related beliefs are more strongly predictive of their treatment adherence than are their illness-related beliefs (Horne & Weinman, 1999). O'Carroll et al. (2011) investigated the importance of stroke survivors' illness and treatment-related beliefs for adherence to treatment and determined that patients' concerns and necessity beliefs regarding treatment were predictive of their adherence cross-sectionally and prospectively. There is very little information on the influence of the affective domain and its referent (illness or treatment) with regard to adherence behaviour among stroke survivors.

To our knowledge, the differential effects of combinations of domain *type* (cognitive and affective) and domain *referent* (illness-related and treatment-related) on treatment behaviour and outcomes have not been investigated. Similar to O'Carroll et al. (2011), the current study was designed to investigate the relationship of stroke and transient ischemic attack (TIA) survivors' illness- and treatment-related beliefs to their stroke prevention treatment adherence. However, unlike O'Carroll et al. (2011), the present study further distinguishes whether cognitive illness and treatment beliefs and affective responses to illness and treatment differentially influence medication adherence. Further, this study includes hard outcomes in addition to measures of adherence – namely, blood pressure and cholesterol levels, which are well-documented stroke risk factors. Leoo, Lindgren, Petersson, and von Arbin (2008) found that the most frequent risk factors of recurrent stroke were hypertension and high blood cholesterol, although not all recurrent stroke patients had high blood pressure or high cholesterol. Sacco et al. (2006) conducted a review of the role of high blood pressure in recurrent stroke occurrence, finding that the association between higher systolic and diastolic blood pressure and ischemic stroke risk is strong and that treatment with antihypertensive medication showed reduced risk of recurrent stroke. Tirschwell et al. (2004) found that higher total cholesterol was associated with increased risk of ischemic stroke. Further, LDL-lowering treatment (statins) has been shown to substantially reduce the risk of stroke (Baigent et al., 2005).

Given findings in the literature suggest that affective responses are more strongly related to behaviour than are cognitive beliefs and that treatment-related beliefs are more strongly related to behaviour than are illness-related beliefs, we hypothesis that stroke and TIA survivors' *affective*, *treatment-related* responses regarding their stroke prevention treatment will be more predictive of their medication adherence and categorised stroke risk than will be other-combinations (stroke/illness-related affective responses; cognitive, treatment-related beliefs; and cognitive, stroke/illness-related beliefs). To make the theoretical distinctions clear between the four psychological domains created from the more commonly studied dichotomies – cognitive vs. affective factors and illness vs. treatment referents – we refer to these categories as affective illness responses, affective treatment responses, cognitive illness beliefs, and cognitive treatment beliefs.

Finally, because one might expect the emotional experience of a stroke to be stronger than that of a TIA, we hypothesis that there may be differences in the absolute levels of the domains between stroke and TIA-only survivors (e.g. stroke survivors may exhibit greater affective response about future stroke than do TIA-only survivors) and potentially different relationships between the belief domains and adherence or categorised stroke risk; however, we have no specific a priori hypotheses regarding which group might exhibit stronger domain adherence relationships.

Overview

This study analyses data from a larger intervention trial that was conducted to assess a peer-led intervention in stroke risk control for stroke/TIA survivors in an urban, largely racial- and ethnic-minority population. The current analysis utilises these patients' baseline reports of their illness- and treatment-related beliefs to predict their self-reported adherence to

stroke prevention medications and their objective categorised stroke risk (from blood pressure and cholesterol levels), concurrently and at six-month follow-up. Four domains – an affective treatment domain, a cognitive treatment domain, an affective illness (stroke risk) domain and a cognitive illness (stroke risk) domain – were created from the available items assessed at baseline and prior to intervention delivery. Two independent raters coded the items as affective or cognitive-related and as illness-related or treatment-related, before composites of items in each domain were created for the analyses. Exploratory factor analysis was also conducted to evaluate the hypothesised theoretical distinction between belief combinations.

Each domain's bivariate relationship with medication adherence and categorised stroke risk was calculated, in addition to the strength of each domain in its ability to explain the variance in medication adherence and categorised stroke risk in multivariate analyses. Differences between TIA-only survivors and stroke survivors on the variables and relationships of interest were assessed.

Method

Participants and procedure

The current analysis is from the baseline and six-month data of a larger intervention trial (Goldfinger et al., 2012, for a more detailed description of the intervention trial). The methods of the study relevant to the current analysis are briefly described here: stroke and TIA survivors (n = 600) participated in an intervention designed to prevent recurrent stroke in a high-risk population. Participants were from underserved communities in New York city (inclusion criteria: ≥40 years of age, had at least one stroke or transient ischemic attack (TIA) in the past five years and were cognitively able to participate in the intervention workshops) and completed baseline data (interview questions and objective blood pressure and cholesterol measurement) before participating in the peer-led intervention; outcome measures were again evaluated at six months into the intervention. All study materials and the study protocol were approved by the Mount Sinai School of Medicine Institutional Review Board, and informed consent was obtained from all participants before their enrolment in the study.

Two independent raters (trained in psychological research and theory but naïve to the study purpose and hypotheses) coded the available survey items (see all items under *Measures*) as either affective or cognitive in nature and as either illness- or treatment-related. There was 93% agreement on the items. The raters agreed 100% on the cognitive vs. affective distinction but disagreed on whether the following two items were illness-related or treatment-related: 'How much do you think medicines can help prevent strokes?' and 'How much do you think your health in the future will depend on your medicines?' Through further discussion and based on the original intent of the items (to measure beliefs about treatment efficacy and necessity, respectively), we determined that both items should be considered treatment-related. Exploratory factor analysis was also conducted to evaluate the hypothesised four-factor structure of the items; maximum-likelihood estimation with direct oblimin rotation (an oblique rotation method that allows for factors to be correlated with each other) was used to identify the factor structure. Factors with eigenvalues greater than 1

were kept; the three-factor solution using this criterion was verified using parallel analysis, which provides the number of factors one would expect by chance, given the sample size and number of items. Both criteria resulted in the following three-factor solution (see the item-factor loadings in Table 1 which presents the pattern matrix): the cognitive illness and cognitive treatment items loaded onto distinct factors, as expected; the affective illness item loaded onto the same factor as the affective treatment items, yielding a three-factor solution. However, given the theoretical distinction we make between the psychological domains, the existing literature that supports such a distinction between illness- and treatment-related beliefs, and the high inter-rater reliability of the coders in categorizing the affective illness and affective treatment beliefs as such, we kept the domains as separate variables in the analyses of the hypotheses. Further, as discussed in the *Results* section, the affective illness item correlated only moderately with the affective treatment composite (not highly enough to warrant combining the domains), and the two variables were differentially related to the outcomes, which justifies keeping them as separate factors, in line with the qualitative coding by the independent raters.

Pearson correlations were used to compare the relative strength of each of the domains' bivariate relationship with medication adherence and with objective stroke risk. The unique variance explained by each domain, and therefore each domain's importance while controlling for variance in the outcome that is explained by the other domains, was calculated through a series of hierarchical linear regression analyses in a process called dominance analysis (Azen & Budescu, 2003). For example, to determine the unique predictive power of the affective treatment domain, the other three domains were entered as predictors into the first step of the regression and the affective treatment domain variable was entered by itself into the second step of the regression. The process was repeated, separately for the two outcomes, with each of the domains as the singled-out domain so that we could determine each of their unique predictive power.

Measures

Cognitive beliefs and affective responses—The four psychological domains were created from available items in the baseline survey; items were chosen by the authors that were theoretically appropriate for each domain, some of which came from existing measures of similar constructs. Response options to all items were the same and ranged from 'not at all' (=1) to 'very much' (=4). The affective illness domain was represented by the item, 'How worried are you about having a stroke in the future?' The cognitive illness domain (cognitions about risk factors) was represented by the following two items (α = .60): 'How well do you think your blood pressure is controlled?' and 'How well do you think your cholesterol is controlled?' An internal consistency of .60 is below what is typically considered to be satisfactory for more standard length scales (e.g. five-item scales or longer). However, using the Spearman–Brown prophecy formula (see Baumgartner, 1968) to calculate the equivalent internal consistency values if the cognitive illness domain had been represented by more items, we calculated that a four-item measure would have an alpha of .75 and a six-item measure would have an alpha of .82, which are good reliabilities for these length scales. Therefore, for the current two-item measure, an internal consistency of .60 is acceptable.

The affective treatment domain was represented by the following three items (α = .66) from the 'specific concerns' subscale of the beliefs about medicines questionnaire (BMQ): 'How much does having to take your medicines worry you?', 'How much do you worry about the long-term effects of your medicines?' and 'How much do you worry about becoming too dependent on your medicines?' Two of the BMQ specific concerns scale items were not chosen to represent this domain because they did not ask about affect-related responses ('How well do you understand what your medicines do for you?' and 'How much do your medicines disrupt your life'). The cognitive treatment domain was represented by the following four items (α = .67), the last three of which are from the 'specific necessity beliefs' subscale of the BMQ: 'How much do you think medicines can help prevent strokes?', 'How much does your health depend on your medicines?', 'How much do you think your health in the future will depend on your medicines?' and 'How much do your medicines protect you from becoming worse?' Two of the specific necessity items from the BMQ were deemed, prior to analysis, as less relevant to stroke prevention context and were therefore not chosen to represent cognitive treatment beliefs in this analysis: the items, 'Would your life be impossible without your medicines?' and 'How ill would you be without your medicines?', imply use of medication to keep an active, symptomatic condition under control on a daily basis, such as asthma or diabetes, rather than a chronic state of illness (i.e. stroke) prevention. Composites (averages) of the items for each domain were created for the analyses so that comparison between them would be fair, in terms of variance explained through measurement error.

Medication adherence—Medication adherence was measured at baseline and again after six months using the eight-item Morisky Medication Adherence Scale (MMAS; Morisky, Ang, Krousel-Wood, & Ward, 2008), which is a self-report measure with seven yes/no items (e.g. 'Have you ever stopped taking your medication without telling your doctor because you felt worse when you took it? Yes/No') and one five-option item ('How often do you have difficulty remembering to take all your medicines?'). Conventional scoring was used but reversed so that higher scores represented better adherence.

Categorised stroke risk—Patients' degree of stroke risk was represented by their objective levels of blood pressure and blood cholesterol, measured at baseline and again after six months, coded as the following: 0 = low risk (low blood pressure, when systolic blood pressure is lower than 140 and diastolic blood pressure is lower than 90 and low cholesterol, when LDL is lower than 100); 1 = some risk (high blood pressure, when systolic blood pressure is greater than 140 and/or diastolic blood pressure is greater than 90 *or* high cholesterol, when LDL is greater than 100); and 2 = high risk (high blood pressure, when systolic blood pressure is greater than 140 and/or diastolic blood pressure is greater than 90 *and* high cholesterol, when LDL is greater than 100).

Patient characteristics—To compare patients who had suffered a stroke to those who had never had a stroke, we categorised patients as TIA-only or as having had a stroke (perhaps in addition to one or more TIA events). Other characteristics were assessed in order to characterise the sample and included the following: gender, age at baseline interview, years since last TIA or stroke, total number of TIA or stroke events and race and ethnicity.

Results

Table 2 summarises demographic characteristics and descriptive statistics as study variables for the total sample at baseline (n = 600) and after six months (n = 506). There were no statistically significant differences between TIA-only survivors (n = 284) and stroke survivors (n = 316) on any of the study variables or measured demographic characteristics; further, the demographic breakdown of the sample after six months (n = 506) did not significantly change from baseline. Correlation and regression analyses were conducted for TIA-only survivors and stroke survivors separately, but the results did not differ between the groups; in addition, all analyses of six-month outcomes were done with and without controlling for intervention/control group membership, but the relationships between study variables did not differ between intervention groups. Therefore, the analyses reported are with the total data-set and without controlling for TIA-only/stroke or for intervention/control group.

Medication adherence

The bivariate and multivariate relationships between the psychological domains and medication adherence are presented in Tables 3 and 4, respectively. The bivariate relationships indicate that patients' affective treatment responses were the strongest predictor of adherence at baseline ($r(591) = -.40$, $p < .001$) and at six-months ($r(505) = -.33$, $p < .001$). All domains were significantly related to reported medication adherence at baseline and at six-month follow-up: affective illness and affective treatment responses were negatively related to adherence, and cognitive illness and cognitive treatment beliefs were positively related to adherence.

In support of our hypothesis, the multivariate analyses (Table 4) show that the affective treatment domain was the strongest predictor of adherence for both adherence reported at baseline (8% of the variance in adherence, which is a moderate to large effect, Cohen, 1992; compared to 2–3% variance accounted for by each of the other domains) and adherence reported at six-month follow-up (5% of the variance in six-month adherence, compared to 1–2% variance accounted for by each of the other domains).

Categorised stroke risk

The bivariate and multivariate relationships between the domains and categorised stroke risk are presented in Tables 3 and 4, respectively. The bivariate relationships show that patients' cognitive illness beliefs were just as strongly related to patients' categorised stroke risk as were their affective treatment responses; correlated correlation analyses (Meng, Rosenthal, & Rubin, 1992) were conducted to test the difference between the correlations for each outcome. This analysis uses a Fishers Z transform to compare two correlations between an outcome and two independent predictors, where the predictors are correlated with each other. The predictors, cognitive illness beliefs and affective treatment responses, were correlated with each other at $r(584) = -.21$. Their correlations with categorized stroke risk at baseline, $r(584) = -.17$ and .09, respectively, were not significantly different from each other *in magnitude*: the Z-statistic for the difference between them was −1.63 and the 95% confidence interval for their difference in magnitude included 0 was (−.19, .02). Similarly,

their correlations with categorized stroke risk at six-month follow-up, $r(500) = -.15$ and .12, respectively, were not significantly different from each other in magnitude: the *Z*-statistic for the difference between them was −.47 and the 95% confidence interval for their difference in magnitude included 0 was (−.14, .08). These were the only two domains to be significantly related to categorised stroke risk at baseline and at six-month follow-up; cognitive illness beliefs were negatively related to categorised stroke risk, which means that patients' estimates of their own risk factor control were accurate to a degree. Affective treatment responses were positively related to categorised stroke risk, which means that patients' concerns about their stroke prevention treatment were related to greater risk of having stroke at baseline and at six-month follow-up.

The multivariate analyses (Table 4) show that, counter to our hypothesis, the affective treatment domain was not the strongest predictor of categorised stroke risk; in fact, only the cognitive illness beliefs accounted for significant variance in categorised stroke risk at baseline (3% of the variance, $F(1, 569) = 14.92$, $p < .001$). Affective treatment responses accounted for a small amount of unique variance in categorised stroke risk at six-months (1% of the variance, $F(1, 485) = 4.39$, $p < .05$); cognitive illness beliefs accounted for significant variance in categorised stroke risk at six-months as well (2% of the variance, $F(1, 485) = 10.56$, $p = .001$).

Discussion

This study is the first, to our knowledge, to investigate the differential prediction of four belief/response *type* and *referent* combinations: affective, treatment-related responses; cognitive, treatment-related beliefs; affective, illness-related responses; and cognitive, illness-related beliefs on adherence and categorised stroke risk (blood pressure and LDL levels). The first contribution of the study to the literature is in demonstrating that the combinations of beliefs/responses are separable constructs with potentially varying relationships to outcomes. Indeed, each domain predicted unique variance in the adherence outcome, and the domains were only weakly to moderately related to each other, indicating that the domains are, in fact, distinct theoretical constructs, despite the exploratory factor analysis indicating that the affective illness and affective treatment responses were part of the same latent factor. It may be that 'worry' is a better umbrella construct for these construct combinations; patients may not distinguish between worry from the illness and worry from the treatment. Still, these are theoretically distinct constructs and future research must further investigate whether the theoretical distinction translates into practical, clinical differences. The current results indicate that they do, as the affective illness and affective treatment domains differentially predicted adherence and control.

The study's second contribution to the literature is in relating these domains to adherence behaviour and objective stroke-related outcomes both concurrently and prospectively. As hypothesised, participants' affective treatment responses were the most strongly related to and accounted for the greatest unique variance in patients' reported medication adherence at both time points. However, counter to hypotheses, the cognitive illness beliefs were the most strongly related to and accounted for the greatest unique variance in patients' objective categorised stroke risk at baseline and prospectively, at six-month follow-up. Affective

treatment responses were still significantly related to categorised stroke risk at six-months, but not as strongly as the cognitive illness beliefs. The reason for these findings is likely the nature of the cognitive illness beliefs, which were patients' own estimates of their stroke risk factor control. The findings indicate that patients' estimates of stroke risk-factor control are accurate when concurrently measured and they predict categorised stroke risk prospectively.

It is somewhat surprising that the cognitive treatment domain was less strongly predictive of adherence than were each of the affective and cognitive illness domains because *treatment* beliefs are typically more strongly related to *treatment* adherence than are illness beliefs (Horne & Weinman, 1999, 2002). Furthermore, whereas the affective responses were more strongly related to adherence than were the cognitive beliefs overall, which has been found for other health behaviours (Lawton et al., 2009), *within* illness-related beliefs, the cognitive items were more predictive than the affective items. However, the differences described above were quite small (R-squared differences of .01) and may not be replicated in future studies.

Researchers have demonstrated the predictive power of patients' 'specific concerns' regarding their treatment in several illness domains (Croghan et al., 2003; Horne et al., 2004; Horne & Weinman, 2002). However, the cognitive affective distinction in patients' responses to a health threat did not play a role in the development or subsequent testing/use of the BMQ scales (see Horne, Weinman, & Hankins, 1999). It may be that the BMQ's subscales' distinct predictive powers are, in part, due to differences in each subscale's representation of either cognitive *or* affective responses. The current study utilised relevant BMQ items as well as other measures to assess the relative importance of survivors' cognitive and affective, illness and treatment beliefs. Future research should attempt to tease apart the relative importance of belief *referent* (e.g. pros of the medication, cons of the medication) and belief *type* (cognitive or affective) since the BMQ subscales are confounded with the cognitive vs. affective response distinction. To do this, one would have to test the existing BMQ subscales with additional *affective* specific necessity items and *cognitive* specific concerns items.

The limitation of the affective illness domain being represented by only a single item would also be addressed by a study that increases the number of items in all of the domains. Further, whereas the two cognitive illness items had acceptable reliability for a two-item measure, as described in the *Measures* section, a greater number of items would provide better reliability for future research on this topic. However, in research in clinical settings, striking a balance between optimal psychometrics and brevity of measures, to limit patient and provider burden, is important. Single items may be more clinically useful and practical and with sufficient reliability (Drolet & Morrison, 2001; Loo, 2002). If single- or two-item measures are to be used in the future, the reliability of these measures should be empirically evaluated by measuring them in separate samples and over time within a sample.

The field has also demonstrated a developing interest in individuals' affective responses and their influence on health behaviour, including the impact of fear, worry and perceived risk (phrased in terms of feelings and affectively laden beliefs), on both positive and negative health behaviours (Chapman & Coups, 2006; Janssen et al., 2014; McCaul, Reid, Rathge, &

Martinson, 1996; Weinstein et al., 2007). More specifically, researchers have demonstrated that worry about an illness and/or treatment is not the same construct as perceived risk for the illness and that these perceptions have differential relationships to health behaviours. For example, Wang et al. (2009) demonstrated that healthy adults perceived the greatest risk for cancers and the lowest risk for diabetes, but men were the most worried about developing heart disease and women were the most worried about breast cancer, followed by heart disease. In addition, Shiloh, Wade, Roberts, Alford, and Biesecker (2013) showed that worry was distinct from, but more closely related to, illness likelihood perceptions than to illness severity perceptions (both considered risk perceptions), across several illnesses. Moreover, when assessing beliefs about one particular illness, such as stroke in the current study, an individual's risk perception and his or her worries about the illness may not be necessarily correlated with each other and may have differential relationships to health behaviour. For example, Bowen, Alfano, McGregor, and Andersen (2004) found that breast cancer worry was significantly predictive of breast self-examination but perceived risk for breast cancer was not. These recent inquiries relate to the findings of the current study, as well as point to possible future directions for research on stroke prevention behaviours and outcomes.

It may be that the measures in the cognitive illness domain ('How well do you think your blood pressure is controlled?' and 'How well do you think your cholesterol is controlled?') in the current study overlap with previous research measures of risk perception, thereby indicating that worry (the affective domains) and risk perceptions are differentially predictive of behaviour and outcomes, to different degrees depending on the illness. The relative importance of each domain may alter depending on the cognitions and types of affect evaluated as well as on the illness in question and whether the patients are healthy, current sufferers or survivors of the illness. The uniqueness of the current population – stroke and TIA survivors – may explain the observed negative relationship between patients' affective illness responses (worry about future stroke) and medication adherence, both at baseline and at six-month follow-up, which was surprising given that the majority of existing literature on the topic indicates that greater worry about a health threat (e.g. getting the flu, getting breast cancer) is positively associated with taking action to prevent the threatening event (e.g. getting vaccinated against the flu, doing breast self-examinations). This motivating effect of worry about illness may not apply in a stroke recurrence prevention context, despite the fact that worry about treatment is predictive of behaviour. Future research in this behavioural context can attempt to parse the effect of different types of affect-laden beliefs and risk perceptions on stroke prevention behaviours and outcomes.

Future research could better relate and empirically evaluate the overlap and distinctions between worry (regarding illness separate from treatment) and perceived risk and the belief domains evaluated in the current study. It would be interesting to compare perceptions of different chronic illnesses, as did Wang et al. (2009) but on the utility of worry or other affect-related beliefs to that of risk perception beliefs for predicting health behaviours and outcomes. The affective treatment, affective illness, cognitive treatment, cognitive illness domains could be evaluated on relative predictive utility for different chronic illnesses, for healthy adults compared to survivors/sufferers of the conditions. The current results indicate

that for stroke victims, worry about stroke prevention treatment is more predictive of adherence, yet perceptions of risk are more predictive of stroke-related health outcomes.

Finally, the current measures used to represent affective responses, both illness-related and treatment-related, were specifically related to *worry*, which is only one type of affective belief or response one might have with regard to an illness or treatment, so future research could expand measures to better represent the entire affective treatment and affective illness domains (e.g. anger, anxiety, stress from the illness and treatment, not just worry about them).

The results indicate that it is important to assess all four domains when investigating stroke/TIA survivor's adherence to their stroke prevention medications, with the most important domain being patients' affective, treatment-related responses – that is, an emphasis on their worries and concerns regarding their prescribed treatments, followed by their cognitive illness beliefs, or their perceptions of their own stroke risk. Although the current study evaluated a theoretical dichotomy that was not investigated by O'Carroll et al. (2011), the results support O'Carroll et al. (2011) findings, which indicated that stroke survivors' medication-related concerns were more strongly associated with adherence than were medication-related necessity beliefs. Future research can tease apart the particular importance of medication-related concerns that are affective vs. cognitive in nature and can determine the optimal domains that should be addressed in interventions, given the time constraints under which providers find themselves.

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Table 1

Results of the exploratory factor analysis. The cell entries are the factor loadings (the pattern matrix) from the EFA with maximum-likelihood extraction and direct oblimin rotation. Entries represent the regression coefficients for each item predicting the factor it loads onto.

	Factor		
Item	**1**	**2**	**3**
Cognitive Illness Item: How well do you think your cholesterol is controlled?	1.03		
Cognitive Illness Item: How well do you think your blood pressure is controlled?	.38		
Cognitive Treatment Item: How much do your medicines protect you from becoming worse?		.68	
Cognitive Treatment Item: How much do you think your health in the future will depend on your medicines?		.68	
Cognitive Treatment Item: How much does your health depend on your medicines?		.65	
Cognitive Treatment Item: How much do you think medicines can help prevent strokes?		.35	
Affective Treatment Item: How much do you worry about the long-term effects of your medicines?			.68
Affective Treatment Item: How much do you worry about becoming too dependent on your medicines?			.61
Affective Treatment Item: How much does having to take your medicines worry you?			.58
Affective Illness Item: How worried are you about having a stroke in the future?			.50

Note: Loadings under .29 are not presented in the Table.

Table 2

Demographic information and descriptive statistics of study variables for the full sample at baseline (n = 600) and after six months (n = 508).

Variable/Characteristic	Possible or observed range	Mean (SD) or percentage total	Mean (SD) or percentage total
Sample size		n = 600	n = 508
Age	40–90 years	63.40(11.22)	63.64(11.27)
Female Gender		59%	58%
Black Race, Non-Hispanic		47%	47%
White Race, Non-Hispanic		15%	15%
Hispanic Ethnicity		38%	38%
Number of Stroke/TIA Events	1–14	1.68(1.28)	1.65(1.20)
Years since last Stroke/TIA	0–5 years	1.81(1.45)	1.83(1.42)
Affective Illness Items (higher values indicate greater worry)	1–4	2.52(1.27)	
Affective Treatment Items (higher values indicate greater worry)	1–4	1.96(.93)	
Cognitive Illness Items (higher values indicate greater perceived risk)	1–4	3.23(.83)	
Cognitive Treatment Items (higher values indicate greater perceived usefulness of treatment)	1–4	3.39(.65)	
Medication Adherence (Morisky scale; higher values scored to indicate better adherence)	0–8	6.06(1.71)	6.13(1.85)

Table 3

Results of the bivariate analyses (n = 600 for baseline; n = 505 for 6-month follow-up).

	1	2	3	4	5	6	7
1 Affective Illness Items							
2 Cognitive Illness Items	−.17†						
3 Cognitive Treatment Items	.06	.11**					
4 Affective Treatment Items	.38†	−.21†	.02				
5 Medication Adherence, Baseline	−.27†	.29†	.12**	−.40†			
6 Medication Adherence, Six-Month	−.26†	.21†	.11*	−.33†	.62†		
7 Stroke Risk, Baseline	.03	−.17†	.00	.09*	−.10	.00	
8 Stroke Risk, Six-Month	.00	−.15**	.03	.12**	−.13	−.05	.44†

*$p < .05$;

**$p < .01$;

†$p < .001$.

Table 4

Results of the hierarchical linear regression analyses for four outcomes: medication adherence at baseline, medication adherence at six-month follow-up, categorized stroke risk at baseline, and categorized stroke risk at six-month follow-up.

	β	R^2
Medication Adherence, Baseline		.23† (F(4, 564) = 41.60)
Affective Illness	−.14†	.02† (F(1, 564) = 12.33)
Cognitive Illness	.18†	.03† (F(1, 564) = 22.16)
Affective Treatment	−.31†	.08† (F(1, 564) = 56.71)
Cognitive Treatment	.13**	.02** (F(1, 564) = 11.62)
Medication Adherence, Six-Month		.16† (F(4, 485) = 23.14)
Affective Illness	−.16†	.02† (F(1, 485) = 13.36)
Cognitive Illness	.12**	.01** (F(1, 485) = 7.89)
Affective Treatment	−.24†	.05† (F(1, 485) = 28.22)
Cognitive Treatment	.10*	.01* (F(1, 485) = 5.63)
Stroke Risk, Baseline		.03** (F(4, 569) = 5.04)
Affective Illness	−.01	.00 (F(1, 569) = .02)
Cognitive Illness	−.17†	.03† (F(1, 569) = 14.92)
Affective Treatment	.06	.003 (F(1, 569) = 1.77)
Cognitive Treatment	.01	.00 (F(1, 569) = .05)
Stroke Risk, Six-Month		.04** (F(4, 485) = 4.67)
Affective Illness	−.06	.003 (F(1, 485) = 1.58)
Cognitive Illness	−.15**	.02** (F(1, 485) = 10.56)
Affective Treatment	.10*	.01* (F(1, 485) = 4.39)
Cognitive Treatment	.05	.002 (F(1, 485) = 1.06)

Notes: β is the standardized regression coefficient for each domain composite predicting the outcome in the final model (when all belief composites are entered simultaneously). The R-squared values for each domain are the unique R^2 change values obtained through dominance analysis – when the specified domain is entered into the hierarchical linear regression in a step after the other three domains are entered together.

$^{*}p < .05$;

$^{**}p < .01$;

$^{\dagger}p < .001$.