Dietary and fluid adherence among haemodialysis patients attending public sector hospitals in the Western Cape

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Objective

There has been considerable debate about the extent to which social cognitive models of health behaviour apply in developing countries. The purpose of this paper was to determine the applicability of the Theory of Planned Behaviour (TPB) in predicting dietary and fluid adherence among a sample of haemodialysis patients attending public sector hospitals in the Western Cape.

Design and methods

A sample of 62 historically disadvantaged patients undergoing haemodialysis completed a battery of psychometric instruments measuring attitudes, subjective norms, perceived behavioural control regarding dietary and fluid adherence, health literacy, perceived social support, and self-reported dietary and fluid adherence. Interdialytic weight gain (IDWG), predialytic serum potassium levels, and predialytic serum phosphate levels served as biochemical indicators of dietary and fluid adherence.

Results

Regression analyses indicated that the linear combination of attitudes and perceived behavioural control significantly accounted for 15.5% of the variance in self-reported adherence (a medium-effect size) and 11.4% of the variance in IDWG (a modest-effect size). No significant predictors were identified for predialytic serum potassium and predialytic serum phosphate levels.

Interpretation and conclusions

The results indicate that, while the TPB may not function in the same manner as it does in Western samples, it may have some nuanced applicability among haemodialysis patients attending public sector hospitals in the Western Cape.

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The global population of end-stage renal disease (ESRD) patients undergoing haemodialysis in mid-2001 was estimated to exceed 1.1 million patients, at a cost of US$70 - 75 billion.[1] Moreover, the size of this population has been expanding at a rate of 7% per year and is likely to exceed 2 million patients by 2010.[1] In 2003, an estimated 430 000 South Africans were living with ESRD.[2] Even though ESRD may be more prevalent and severe in developing countries than in developed countries, it has remained under-researched in Africa in comparison with major infectious diseases such as AIDS, tuberculosis and malaria.[2]

Although kidney transplantation is considered the treatment of choice,[3] the limited number of organ donors means that the majority of patients need a compensatory method of treatment. Haemodialysis has been developed as a viable, safe and efficient method for the maintenance of patients with ESRD.[4] The procedure requires patients to be dialysed three times per week for approximately 4 hours per session. Patients are also required to adhere to strict dietary restrictions (which include limiting potassium and phosphate intake) and fluid restrictions.[3]

Serum potassium, phosphate, and fluid in haemodialysis

Patients undergoing haemodialysis must keep their potassium levels between 3.0 and 6.0 mmol/l.[5] Excessive dietary potassium intake may lead to hyperkalaemia and fatal cardiac rhythm abnormalities.[6] Haemodialysis patients must also keep their phosphate levels between 1.4 and 2.0 mmol/l.[5] Elevated serum phosphate levels or phosphate retention can lead to renal osteodystrophy and may contribute to cardiovascular disease.[6] Furthermore, patients are limited to approximately 700 - 1 000 ml of fluid per day and must keep their fluid weight gains between 0.5 and 1 kg per day.[5] Excess fluid (oedema) can result in fluid build-up around the lungs, causing shortness of breath and high blood pressure.[5] Prolonged fluid overload is associated with hypertension, pulmonary oedema, congestive heart failure, and shortened patient survival.[7] To this end, dietary and fluid adherence is of crucial importance to the quality of life and survival of haemodialysis patients.

Despite the possible serious side-effects of dietary and fluid non-adherence, haemodialysis patients by all accounts consistently exhibit poor adherence.[6,8] An understanding of the psychosocial factors associated with dietary and fluid adherence may aid in improving adherence.

The Theory of Planned Behaviour

One widely used theory that has been used to gain an understanding of health behaviour is the Theory of Planned Behaviour (TPB).[9] The TPB postulates that the likelihood of an individual engaging in a specific health behaviour correlates with the strength of his or her intention to engage in the behaviour. A behavioural intention represents an individual's commitment to act and is itself the outcome of a combination of several variables. The variables that predict behavioural intentions are: the individual's attitude towards the behaviour (including his or her beliefs about the outcomes of the behaviour and the evaluations of these outcomes), the individual's perception of existing subjective norms concerning the behaviour (including his or her perception of others' attitudes towards adherence and motivation to comply with others), and the individual's perceived behavioural control (including an evaluation of internal factors such as perceived capacity to engage in the behaviour and external factors such as the availability of existing resources). The TPB also states that perceived behavioural control can have a direct effect on behaviour without the mediating effect of attitudes towards the behaviour and subjective norms. Consequently, if patients believe, upon consideration of perceived barriers, that they can adhere to physician-recommended dietary and fluid restrictions, they might do so without the mediating effect of their attitude towards the restrictions, or perceptions of subjective norms regarding the behaviour.

The TPB has been used extensively to predict various health behaviours such as medication adherence among psychiatric patients,[10] exercise intentions among back pain sufferers,[11] and clinical glove use among health care workers.[12] However, the TPB (to date) has not been used to predict dietary and fluid adherence among haemodialysis patients.

Dietary and fluid health literacy

Dietary and fluid health literacy refers to patients' knowledge of their diet and of the medical consequences of dietary and fluid non-adherence.[13] Poor knowledge of one's treatment regimen has been shown to be an important predictor of non-adherence.[14,15] Similarly, enhanced patient education (aimed at increasing patient knowledge in areas such as diet and the importance of adherence) has been reported to play a role in slowing the progression of renal failure and delaying the need to initiate renal dialysis.16 Nevertheless, no studies (to date) have examined the relationship between health literacy and dietary and fluid adherence among haemodialysis patients attending public sector hospitals in the Western Cape.

Perceived social support

Perceived social support refers to '… the encouragement from family and friends for the patient to co-operate with the recommendations and prescriptions of a health professional …'.[17] Supportive relationships with others may aid in health maintenance and recovery by helping to promote healthy behaviours such as adherence to prescribed medical care.[18] Furthermore, considerable evidence suggests that perceived social support may be a strong predictor of dietary and fluid adherence among haemodialysis patients.[19,20]

Participants

A convenience sample of 62 in-centre haemodialysis patients were recruited from the renal units of two public sector hospitals in the Western Cape Province, South Africa. The participants were mainly poor and historically disadvantaged. Table I sets out demographic information about the sample.

Method

Procedure

The study, which was assisted by the renal units' medical staff, commenced in mid-2004 and ended in mid-2005. After undergoing haemodialysis, each patient was informed of the study by the doctor or nursing sister and introduced to one of the study personnel who then explained the study to the patient and invited him or her to participate. Participation involved completing a battery of paper and pencil psychometric questionnaires on a single occasion, in English or Afrikaans. Ethical approval for conducting the study was obtained from the Faculty of Health Sciences Ethics Committees of both institutions.

Questionnaires

Attitude towards dietary and fluid adherence

To measure patients' attitudes towards dietary and fluid restrictions, the Renal Adherence Attitudes Questionnaire (RAAQ) was used.[21] The questionnaire consists of 26 items with four Likert scale responses ranging from 'strongly disagree' to 'strongly agree'. The items form 4 subscales: 'attitude towards social restrictions' (6 items, =0.88), 'attitudes towards wellbeing' (7 items, α=0.77), 'attitudes towards self-care/support' (4 items, α=0.68), and 'acceptance' (9 items, α=0.86). Higher scores indicate a more positive patient attitude towards dietary and fluid restrictions.

Subjective norms

In order to measure subjective norms specific to patients undergoing haemodialysis, we developed an 8-item Likert-type questionnaire using conventional scale construction guidelines.[22] Examples of items were 'My family gets annoyed with me if I eat food that I should not', and 'I feel I am letting people down when I eat foods I should avoid'. Higher scores indicate a stronger perception of dietary and fluid adherence being the norm. A panel of 5 experts comprising psychologists, social scientists and psychometrists reviewed the newly constructed questionnaire before it was administered to the sample. Cronbach alpha reliability coefficients were subsequently calculated, and are reported in the Results section.

Perceived behavioural control

A similar procedure was followed to construct the 4-point, 8-item Likert-type scale to measure perceived behavioural control. Examples of items include 'Following my diet does not require a lot of effort', and 'It is too expensive to buy the proper food all the time'. Higher scores indicated a stronger perception of behavioural control over dietary and fluid restrictions. The questionnaire was also reviewed by a panel of experts before administration. Cronbach alpha reliability coefficients were calculated and are reported in the Results section.

Dietary and fluid health literacy

A scale with 38 items was constructed with 'true' and 'false' as the response categories. Twelve items measured potassium knowledge and knowledge of medical complications associated with potassium non-adherence; 13 items measured phosphate knowledge and knowledge of medical complications associated with phosphate non-adherence; and 13 items measured fluid knowledge and knowledge of medical complications associated with fluid non-adherence. The questionnaire was scored by giving 1 for a correct response and 0 for an incorrect response. Therefore, a minimum total score of 0 and a maximum total score of 39 were possible. Higher scores indicated greater dietary and fluid health literacy. A registered dietician reviewed the scale and certified the correct responses. Cronbach alpha reliability coefficients were subsequently calculated and are reported in the Results section.

Table I. Demographic characteristics of the sample

	N	*f*	%)	M	SD	Range
Hospital	62		(100)			
1		19	(30.6)			
2		43	(69.4)			
Age (years)	60		(96.7)	40.3	9.4	21 - 60
Time on dialysis (months)	56		(90.3)	91.1	87.1	0.5 - 340
Race	62		(100)			
White		4	(6.5)			
Black		12	(19.4)			
Coloured		40	(64.5)			
Asian		4	(6.5)			
Other		2	(3.2)			
Sex	62		(100)			
Male	26		(41.9)			
Female	36		(58.1)			
Marital status	62		(100)			
Single		25	(40.3)			
Living together		0	(0)			
Married		30	(48.4)			
Divorced		3	(4.8)			
Other		4	(6.5)			
Educational status	59		(95.1)			
Standard 5 or lower		21	(33.9)			
Standard 8		18	(29)			
Standard 10		18	(29)			
Degree or diploma		2	(3.2)			
Adults per household	61		(98.3)	3.1	1.5	1 - 10
Children per household	61		(98.3)	1.1	1.3	0 - 5
Household income (per month)	51		(82.2)			
Under R1 000		20	(32.3)			
R1 000 - 3 000		20	(32.3)			
R4 000 - 7 000		6	(9.7)			
R8 000 or higher		5	(8.1)			
Diabetes status	60		(96.7)			
Yes		10	(16.1)			
No		50	(80.6)			
Hypertension status	60		(96.7)			
Yes		36	(58.1)			
No		24	(38.7)			

N = number; *f* = frequency; M = mean; SD = standard deviation.

Perceived social support

To measure perceived social support, the Multi-dimensional Scale of Perceived Social Support (MSPSS) was used.[18] The questionnaire consists of 12 items (with 4 Likert scale responses ranging from 'strongly disagree' to 'strongly agree'). The items form 3 subscales, each relating to a source of the support: 'family' (4 items, α=0.87), 'friends' (4 items, α=0.85), and 'significant other' (4 items, α=0.91). The total scale exhibits high internal consistency (α=0.88). Higher scores indicate higher levels of perceived social support.

Dietary and fluid adherence

Predialytic serum potassium levels (measured in mmol/l) and predialytic serum phosphate levels (measured in mmol/l) served as biochemical indicators of dietary adherence, and IDWG levels (measured in kg) served as a biochemical indicator of fluid adherence.[4] The mean of three consecutive monthly predialytic serum potassium levels and three consecutive monthly predialytic serum phosphate levels most proximal to the time of questionnaire administration were calculated retrospectively for each patient. The mean of 12 consecutive dialysis session measurements of IDWG most proximal to the time of questionnaire administration was also calculated retrospectively for each patient.[23] Measurements of IDWG were corrected for each participant's average weight before haemodialysis. No attempt was made to control for variables such as adequacy of haemodialysis (Kt/V or URR), residual renal function, or medication such as phosphate-binders, given that the research question of the present study relates to dietary and fluid adherence only.

Self-reported dietary and fluid adherence. The Renal Adherence Behaviour Questionnaire (RABQ)[21] was used to measure self-reported adherence. The questionnaire consists of 25 items (with 5 Likert scale responses ranging from 'never' to 'always') which form 5 subscales: 'adherence to fluid restrictions' (11 items, α=0.80), 'adherence to potassium/phosphate medication' (5 items, α=0.70), 'self-care' (2 items, α=0.78), 'adherence in times of particular difficulty' (5 items, α=0.56), and 'adherence to sodium restrictions' (2 items, α=0.68). Higher scores indicate greater adherence.

Data analysis

All statistical procedures were performed using the Statistical Package for the Social Sciences (SPSS). Frequencies, percentages, means, standard deviations and ranges were calculated for the various independent variables. The univariate normality of the dependent variable distributions was assessed using the Kolmogorov-Smirnov (*D*) test of normality. Base 10 and natural base logarithmic transformations were performed in order to normalise skewed distributions. Multicolinearity between predictor variables was assessed using the Variance Inflation Factor (VIF) statistic. The assumption of independence of errors was assessed using the Durbin-Watson test. Missing values were replaced with the means of the variables of the sample as list-wise deletion would have significantly reduced the sample size.

Results

Demographic information regarding the sample appears in Table I.

Data screening and tests of parametric assumptions

All the dependent variables were normally distributed except for health literacy ($D(62)=0.16$, $p<0.00$), and potassium levels ($D(62)=0.11$, $p<0.05$). The distribution of potassium level scores was normalised ($D(62)=0.10$, $p=0.06$) but not health literacy scores ($D(62)=0.18$, $p<0.05$). There was no significant multicolinearity between predictor variables. The various questionnaires displayed good internal consistency (see Table II). The correlations between variables are presented in Table III.

Table II. Cronbach's alpha for measures after deletion of poorly performing items

Variable	Cronbach's alpha
Subjective norms	0.61
Perceived behavioural control	0.75
Health literacy – potassium knowledge	0.62
Health literacy – phosphate knowledge	0.65
Health literacy – fluid knowledge	0.65

Predicting self-reported adherence

Only variables that significantly correlated with self-reported adherence served as predictor variables. To this end, only attitudes and perceived behavioural control were entered into the forced entry multiple regression analysis. This model significantly accounted for 15.5% ($R^2=0.15$) of the variance in self-reported dietary and fluid adherence ($F(2, 59)=5.40$, $p=0.00$). However, attitude was not a significant predictor variable and was subsequently removed from the model. Perceived behavioural control significantly accounted for 14.3% ($R^2=0.14$) of the variance in self-reported dietary and fluid adherence ($F(1, 60)=9.98$, $p=0.00$).

Predicting potassium and phosphate levels

In the correlation matrix in Table III, there were no significant correlations between attitude, subjective norms, perceived behavioural control, health literacy, perceived social support and either potassium or phosphate levels.

Predicting IDWG

Only attitude and perceived behavioural control, which significantly correlated with IDWG, were entered into a forced entry multiple regression analysis. The model significantly explained 11.4% ($R^2=0.11$) of the variance in IDWG ($F(2, 59)=3.81$, $p=0.02$). These results appear in Table IV.

Discussion

The study aimed to determine whether the TPB could predict dietary and fluid adherence among haemodialysis patients attending public sector hospitals in the Western Cape Province of South Africa. We found that the full TPB model was not optimal in explaining variance in self-reported dietary and fluid adherence, potassium levels, phosphate levels, or IDWG.

Nonetheless, attitudes and perceived behavioural control significantly explained 15.5% of the variance in self-reported adherence – a medium-effect size for multivariate models in the social sciences.[24] Consistent with our results, perceived behavioural control may have a direct effect on behaviour;[25] in this case, self-reported adherence. Our results indicate that perceived behavioural control on its own accounted for 14.3% of the variance in self-reported adherence.

Table III. Correlations between variables

	Attitude	Subjective norms	Perceived behavioural control	Health literacy	Perceived social support	Self-reported adherence	Phosphate	Potassium	IDWG
Attitude	1								
Subjective norms	0.10	1							
Perceived behavioural control	0.58†	–0.17	1						
Health literacy	0.15	–0.11	0.06	1					
Perceived social support	0.33†	0.35†	0.04	–0.03	1				
Self-reported adherence	0.31*	–0.02	0.37†	–0.12	0.20	1			
Phosphate levels	–0.10	0.02	–0.05	0.04	0.22	–0.02	1		
Potassium levels	0.09	–0.01	–0.07	–0.01	0.11	0.15	0.23	1	
IDWG	–0.30*	0.02	–0.29*	0.07	0.05	–0.05	0.20	0.21	1

*p<0.05. †p<0.01.

Table IV. Summary of forced entry multiple regression analyses for variables predicting self-reported adherence and IDWG (N=62)

Variable	R^2	sr	β	*p*
Self-reported adherence				
Model	0.15			0.00†
Attitude towards adherence		0.11	0.13	0.36
Perceived behavioural control		0.24	0.29	0.04*
IDWG				
Model	0.11			0.02*
Attitude towards adherence		–0.17	–0.21	0.16
Perceived behavioural control		–0.13	–0.16	0.26

*p<0.05. †p<0.01.

R^2 = squared multiple correlation indicating proportion of variance explained; sr = semi-partial correlation; b = standardised beta coefficient.

These relationships were in the expected direction such that more positive attitudes and higher levels of perceived behavioural control were associated with greater dietary and fluid adherence. As neither health literacy nor perceived social support was significantly correlated with self-reported adherence, we did not enter these variables into the regression model. The TPB was unable to significantly account for variance in phosphate levels and potassium levels. It may be the case that biological factors may eclipse behavioural variables and therefore be more closely associated with phosphate and potassium levels.[26] The linear combination of attitude and perceived behavioural control significantly explained 11.4% of IDWG: a modest-effect size.[24] Thus it appears that positive attitude towards fluid restrictions and a strong sense of control over reducing fluid intake were modestly associated with reduced IDWG.

We predicted that the linear combination of TPB variables together with health literacy and perceived social support would account for a significant proportion of the variance in self-reported and biochemical markers of dietary and fluid adherence. This proved not to be the case. Instead we found nuanced relationships between some of the TPB predictors and adherence. Several reasons may account for our findings. One criticism of the TPB is that although the theory incorporates individuals' representations of their social world by measuring normative beliefs, it still assumes that individuals are rational information processors.[25] Consequently, adherence to dietary and fluid restrictions is assumed to result largely from a rational weighing up of the potential costs and benefits of adherence. In developing countries, socio-economic barriers that eclipse rational decision-making may reduce adherence to treatment regimens. Poverty in itself is likely to affect adherence because financial resources may need to be directed elsewhere, funds for travel to haemodialysis sessions may not be available, and child-care during clinic visits may not be readily accessible. The competing demands of several responsibilities such as work or family life, along with the stresses associated with poverty and difficult life circumstances, tend to negate acknowledgement of the importance of complying with treatment regimens. Thus, the assumption of volition, on which the TPB rests, in determining health behaviours may not always be valid.

Health literacy as a predictor of dietary and fluid adherence in haemodialysis

Although much evidence suggests that knowledge of one's treatment regimen is an important predictor of adherence,15 health literacy did not predict variance in self-reported adherence, potassium levels, phosphate levels or IDWG. This finding is congruent with those of Cummings *et al.*[27] as well as Durose *et al.*[13] The distribution of health literacy scores was significantly negatively skewed even after logarithmic transformations were performed. The subsequent non-normality of the distribution of health literacy scores may have contributed to the null findings.

Perceived social support as a predictor of dietary and fluid adherence in haemodialysis

The finding that perceived social support did not significantly predict variance in phosphate levels is in keeping with that of Cummings *et al.*[22] and Hitchcock *et al.*,[28] who similarly found no relationships between these variables. However, ours contradicts other findings that such a relationship indeed exists.[19,20] These other results indicate that the nature of the relationship between perceived social support and dietary and fluid adherence is complex and should not be assessed in isolation from other social determinants on behaviour.

Relationship between self-reported dietary and fluid adherence and biochemical indicators of dietary and fluid adherence

There were no significant correlations between any of the biochemical measures of dietary and fluid adherence and self-reported dietary and fluid adherence. This finding is consistent with other findings[29-31] and may be due to at least two factors: Firstly, some participants completed their battery of questionnaires independently, while others had their battery of questionnaires read to them. In the case of the latter, response bias might have occurred due to social desirability responding. Secondly, there might have been natural fluctuations between patients in serum potassium levels, serum phosphate levels and IDWG that were not a direct consequence of dietary and fluid non-adherence and might have been related to varying compliance to drugs that might have had an influence on these (angiotensin-converting enzyme inhibitors in the case of

serum potassium, phosphate binders in the case of serum phosphate levels, and diuretics in the case of IDWG). To this end, there may be a curvilinear relationship between biochemical indicators and self-reported dietary and fluid adherence.

Implications and social relevance

The results of the present study indicate specific interventions among ESRD patients undergoing haemodialysis in public sector hospitals in the Western Cape. These include promoting positive attitudes among patients and increasing their perceptions of behavioural control towards dietary and fluid adherence. Improved dietary and fluid adherence among haemodialysis patients is likely to result in reduced incidence of medical complications associated with dietary and fluid non-adherence, and subsequently reduce the ESRD mortality rate.

Limitations and directions for future research

The present study has the following limitations: firstly, the health literacy distribution of scores was significantly skewed, which might have affected the results of the correlational analyses that incorporated this variable. Secondly, upon completion of the questionnaire, many participants reported that they were unsure about differences between response categories such as 'strongly agree' and 'agree'. Future research of this nature should consider supplementing qualitative interviews with quantitative methods. Thirdly, we did not control for potentially confounding biochemical factors that might have influenced serum potassium levels and serum phosphate levels. Future studies should aim to implement more controls so as to isolate the effects of the sociobehavioural variables associated with adherence. Lastly, future studies should assess possible correlates of dietary and fluid non-adherence that were not addressed in this study. These include quality of life,[6] depression,[32] patient dissatisfaction with dialysis care,[33] and absence of symptoms.[31]

In summary, it appears from our data that the TPB is partially applicable in understanding self-reported treatment adherence among public sector haemodialysis patients in the South African context. Further theoretical research is needed to understand the predictors of adherence among South African haemodialysis patients.

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