General Practitioners' Intentions and Prescribing for Asthma: Using the Theory of Planned Behavior to Explain Guideline Implementation

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ABSTRACT

Objectives: Limited studies have demonstrated that the Theory of Planned Behavior (TPB) may be able to help in explaining the variation in physicians' behavior. We selected the management of asthma as the tracer topic because asthma had nationally known clinical guidelines, and the main medicinal therapies used for asthma had limited applications for the treatment of other diseases, and hence, it was possible to trace the relevant prescribing from routine data. In this study we used the TPB to explain general practitioners (GPs) intentions and prescribing in accordance with asthma clinical guidelines.

Methods: We surveyed a stratified random sample of 122 GPs in England. The GPs demographic and prescribing data were obtained from routine sources. The participants completed a TPB questionnaire that was developed based on qualitative interviews and had been tested in a pilot study. Regression methods were utilized for data analysis.

Results: Forty-three percent of variance in prescribing intentions was explained by direct TPB measures. Perceived controls were the main predictors of variation in intentions. TPB belief item variables contributed to regression analysis that explained up to 34% of variation in the efficiency prescribing indicators. Effective prescribing indicators were unrelated to TPB variables.

Conclusions: Using TPB was helpful in understanding the prescribing intentions of GPs. This could help in promoting the prophylactic usage of inhaler corticosteroids and prevent chronic asthma symptoms and side-effects. However, further empirical and methodological researches are required.

Keywords: Asthma, prevention, control, guideline adherence, primary care physician

INTRODUCTION

The study reports the results of a survey of general practitioners' (GPs) beliefs, attitudes, prescribing intentions, and prescribing outcomes. The survey was used to assess the ability of the Theory of Planned Behavior (TPB) in capturing

the observed variations in GP prescribing intention and prescribing behavior. The analyses present the limitations and merits of TPB in this setting.

Guideline implementation

Governments as well as pharmaceutical industries and charitable organizations spend a lot of resources on medical and clinical research. Most of the behavior change interventions have been based on the assumption that clinicians would change if they are given information.[1] These assumed models of changes are called 'production-dissemination'[2] or 'information deficit' models of behavior change.[3,4] As a result the clinicians were '*bombarded with information*', faced '*conflicting viewpoints*' and were '*uncertain about what to uphold as a value or recognize as a fact*'.[5]

Several studies have shown that in the era of uncertainty, healthcare providers vary substantially in what they provide.[6] Clinical practice guidelines are sought as tools to reduce variation in health care and also to reduce the cost. Many continuous medical education interventions fail to improve behavior.[7,8] Theory-based approaches are encouraged to identify effective ways of implementing guidelines. Social cognition theories, notably the Theory of Planned Behavior, is among the theories considered as likely to help in understanding clinician behavior and guideline implementation.[9]

Prescribing for asthma as the tracer condition

We selected the management of asthma as the tracer topic for assessing the validity of the TPB in describing a physicians' prescribing behavior, for two reasons. First asthma had nationally known clinical guidelines. Second, the main drug therapies used for asthma had limited applications for the treatment of other diseases. Inhaled corticosteroids had limited applications for diseases other than asthma. The latter criterion was required, as our prescribing data was not linked to individual patient characteristics or diagnoses.

Inhaled short-acting β_2-agonist bronchodilators are the first line of treatment for mild asthma. Chronic and frequent use of these products is not recommended and their use should be limited to control of exacerbation of asthmatic signs and symptoms.[10] Inhaled corticosteroids are used as the second line of treatment. The main indication for the use of inhaled corticosteroids is for the management of asthma in patients not controlled by, or requiring the frequent use of, short-acting β_2-agonist bronchodilators. At the time of the study, the inhaled corticosteroids used for prophylactic treatment of asthma were of three main types: Beclomethasone dipropionate, budesonide, and fluticasone propionate.[11] There were also combination preparations including inhaled corticosteroids and short- or long-acting β_2-agonist bronchodilators. Examples of these were beclomethasone and salbutamol, budesonide and formeterol, and fluticasone and salmeterol.

The combination products are generally more expensive than single products, but easier to administer to patients. These medicines are administered by different devices, in different dosages, and as generic or non-generic preparations, affecting both their efficacy and cost. For patients requiring large quantities of corticosteroids, addition of long-acting β_2-agonist bronchodilators is recommended, as separate formulae or in combination with corticosteroids.

Theory of planned behavior

The TPB is a social cognition theory that considers individuals as *rational actors* who process information, before making behavioral intentions and performing behavior.[12] Attitudes toward behavior (attitude), perceived social pressure (subjective norm), and perceived behavioral control (perceived control) result in the formation of intentions. Intentions are the underlying psychological factor for the formation of behavior, while perceived controls may also contribute to it [Figure 1].[13] There are several examples of using the TPB in explaining physicians' and nurses' behavior, as well as a number of studies that have applied the TPB to guideline implementations.[14-19] Most of the studies are limited to explaining reported behavior and intentions only.[18]

Intention is the cornerstone of the TPB, both as a predicted variable and a predictor of behavior, and the strength of intention is the important predictor of behavior. Influencing attitude toward intention, subjective norm or perceived control may enhance the intention. The theory proposes that attitude, subjective norm, and perceived control are based on salient beliefs. Attitude arises from a set of beliefs about the behavioral consequences (behavioral

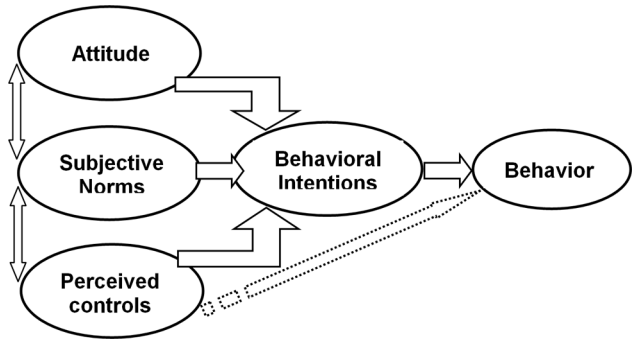

Figure 1: Simplified presentation of the yheory of Planned behavior

beliefs) and evaluations of these consequences (outcome evaluations). Subjective norm is based on the individual's perceived views of others, about the behavior (normative beliefs), and the level of the individual's desire to adhere to the views of these people (motivation to comply). Likewise, perceived control is determined by the individual's control beliefs and perceived power of those beliefs. For example for a GP to have a positive attitude toward prescribing a specific drug for a given patient, she or he should positively value the expected change in the patient's health and also believe that the drug is capable of achieving that change. On account of this theoretical reasoning, TPB and other theories that utilize the same principle are referred to as expectancy-value theories.[20]

The survey is aimed to assess the ability of TPB to explain and predict the GPs' prescribing in accordance with the clinical guidelines. The aim was pursued through the following objectives: To explore the ability of TPB to explain the GPs' intentions to adhere to national guidelines on prescribing for asthma and their actual prescribing behavior.

METHODS

Setting, participants, and data collection

A stratified random sample of GPs across England was surveyed in 2002. Two reminders followed the main surveys. Details of the sampling method and sample size calculation approaches are reported elsewhere.[18,19] In summary, the sample size calculations, based on zero-order correlations between the TPB constructs, indicated that 242 respondents were required for the survey.[18] Assuming 50% response rate and allowing for inaccuracies in the sampling frame, 495 GPs were sampled. We sent the non-respondents two reminders at intervals of approximately 20 days. Prescribing data for bronchodilators and inhaled corticosteroids were obtained from the relevant authorities in England. Further practice and GP data were obtained from the statistics of the General Medical Services (GMS).

Questionnaires

The questionnaires were developed following the guidelines provided.[13,21] As recommended,[21] semi-structured interviews were used to elicit salient beliefs of GPs about outcomes, barriers to, and facilitators of adhering to clinical guidelines for asthma drug treatment and for using statins.[22,23] Salient belief items were included in the questionnaires. The preliminary questionnaires were assessed in terms of face validity and readability by a GP, a health psychologist with experience of TPB questionnaires, and three health service researchers. The questionnaires were assessed in a pilot study and updated and shortened as a result. The questionnaires included TPB item questions, two questions on self-identity, asking whether the GPs considered themselves as evidence-based or patient-centred practitioners, and demographic questions. The questionnaires incorporated multiple measures for each variable to increase the measurement reliability.[13,24] The questionnaire included 47 TPB items, measured on seven-point bipolar or unipolar scales.

Behavioral intention

Three measures of intention were used in the questionnaires. Each item assessed one of the three main aspects of intentions: Intention (or volition), desire, and expectation.[13]

Past behavior

Two questions asked whether the GPs' past prescribing was in line with the clinical guideline recommendations.

Attitude

This was measured both directly and indirectly. Six items were used for direct measurement of attitude using the semantic differential scaling approach.[25] The items included the *good–bad* scale, to capture the general attitude, scales with 'instrumental' qualities (e.g., *valuable–worthless*), and scales with 'experimental' (e.g., *appropriate–inappropriate*) qualities.[21] To measure indirect attitudes, five salient perceived outcomes

(beliefs) of adhering to asthma clinical guideline prescribing recommendations were identified from the qualitative interviews.

Subjective norm

Subjective norm was measured *directly*, using two items to assess the perceived view of the respondent, that is, whether others expected or approved of his prescribing in accordance with the guideline recommendations.[21] *Indirect subjective norm* was measured based on normative beliefs about the perceived views of practice, nurse, GP colleague, local hospital consultant, and primary care prescribing adviser. For each 'important other', the belief power and the respondent motivation to comply with the view of 'important others' were assessed.

Perceived control

It was intended to capture the respondents' confidence in performing the behavior. Direct perceived control was captured using three items capturing self-efficacy and perceived control over prescribing. Indirect perceived control was measured based on six salient control beliefs. For each control belief the belief strength and the perceived power were assessed.

For each belief item, the strength or the power of the belief was multiplied with the evaluation or expectancy of the outcome. The mean of the sums of products of the belief items constituted the score for the indirect measure of attitude, subjective norm or perceived control [Table 1].[12] As there was no *a priori* to decide the optimal scaling method for indirect measure items,[21] the choice of the scaling approach was based on testing statistically different scaling approaches and choosing the one that provided the highest correlation values between the indirect and direct measures of the TPB components. The results of the pilot study were used to determine the optimal scaling approach for the belief-based TPB items.[26]

Prescribing outcome indicators

Prescribing analyses and cost (PACT) data were the sources for the prescribing data used in the study.[27-29] General practice demography influences the GP-prescribing patterns. Prescribing units are therefore developed for weight, age, and gender, to reflect the prescribing variation caused by demographic differences. We used specific therapeutic group age-sex related prescribing units that took into account the disease and treatment category and were calculated for different sections of the British National Formulary.[30]

Table 1: Construction and scaling of indirect TPB variables

TPB measure	Construct	Scaling approach
Indirect attitude (behavioral beliefs)	∑(belief strength×outcome evaluation)	Unipolar – bipolar
Indirect subjective norm (normative beliefs)	∑(belief strength×motivation to comply)	Bipolar – unipolar
Indirect perceived behavioral control (control beliefs)	∑(belief strength×perceived power)	Bipolar – unipolar

TPB: Theory of planned behavior

Prescribing units were calculated for the practices' list sizes, considering the demographic distribution of the patients on the list, and then were divided by the number of whole time equivalent GPs (obtained from the questionnaires) working in each practice.

Two primary prescribing outcomes were defined: 'Effective delivery' and 'efficiency' indicators of prescribing. Prescribing outcomes were based on 'adequate daily quantities', the British version of defined daily doses.[31] Prescribing costs were calculated using the net ingredient cost. Inhaled corticosteroids' adequate daily quantities per weighted prescribing units were used as the effective delivery measure of prescribing. Inhaled corticosteroid cost per adequate daily quantity was used as the efficiency measure of asthma prescribing.

Analysis

For the final analyses, data from the regional pilots and main surveys were combined after careful examination of the two samples. All the items were ordered so that lower scores represented 'negative' responses toward the behavior. Missing items were replaced by the mean of other items on the scale. In the first instance, attitude, subjective norm, and perceived control items were treated bipolarly (–3 to 3), and intention and reported past behavior items were treated unipolarly (1 to 7) [Table 1].[12]

Ordinary least square regression analyses were used to explain the variation in prescribing intentions and prescribing indicators (behavior). Multi-collinearity, multivariate outliers, and

heteroscedasticity were assessed using the recommended approaches.[32] For theoretical reasons all independent variables were included in the models explaining variation in intention at the same time. Non-significant variables retained kept in the models unless they caused multi-collinearity. Univariate analyses were performed to assess correlations between independent variables with prescribing indicators. Variables with univariate *P*-values of equal to or less than 0.2 were included in regression models to explain variation in the prescribing outcomes. Highly skewed variables or variables with similar values for many respondents were transformed or replaced with binary variables.

Ethical considerations

Written consents were obtained from respondents to access their prescribing data. Each questionnaire or reminder sent included a hand-signed covering letter, one page summary protocol and pre-paid return envelope, and an information sheet about the study. All the data received was dealt with confidentially. The names and addresses of the GPs were obtained from the Primary Care Research Center after approval of the British Medical Association. All respondents were told that they would be included in a lottery and the winner would receive a digital camera as a token of gratitude.

Findings

Despite efforts to boost the response rate, the survey achieved low response rates of 19% (94 out of 495). We have previously reported the results of a detailed analysis to assess the possibility of important response biases due to this low response rate.[33] In summary, there was limited evidence of bias. We identified that the GPs working in practices in which all the practitioners were qualified in the UK were more likely to respond (odds ratio=1.7; 95% CI=1.0 – 2.7; *P*=0.04).

The total number of respondents in the asthma survey was 94 plus 26 pilot respondents (122 in total). All but ten GPs were working in computerized practices, with 50% reporting asthma clinical guidelines on their computer systems. Other practice characteristics are reported in Table 2.

Intention to prescribe medicines for asthma

General practitioners intended to follow the clinical guidelines prescribing recommendations for the treatment of asthma (three items; scale range: 1 to 7; mean=5.5; Cronbach's α=0.58). The exclusion of the third intention item from the scale increased the internal reliability coefficient to 0.79, but did not improve the regression model or the significance of regression coefficients. Hence, the original scale of three items was used for the analyses. The GPs also reported that they had followed the guidelines' advice when prescribing for asthmatic patients, within the past three months, for more than half of their patients (two items; scale range: 1 to 7; mean=5.4; Cronbach's α=0.54). Indirect belief-based variables are reported in Table 3.

Three direct TPB measures assessed the GPs' perceived controls, attitudes, and subjective norms. The GPs perceived themselves to be able to overcome barriers to evidence-based prescribing for asthma (scale range: -3 to 3; mean=1.5; Cronbach's α=0.78). Less than 10% of the respondents did not perceive themselves to have control over barriers. GPs had a positive attitude toward following clinical guidelines' prescribing recommendations (scale range: -3 to 3; mean=2.1; Cronbach's α=0.90), and perceived that the social norm was to prescribe in that manner (scale range: -3 to 3; mean=2.0; Cronbach's α=0.63). Up to 43% of variance in prescribing intentions was explained by a direct TPB measures [Table 4]. Perceived control was the sole predictor variable with a significant regression coefficient. The addition of prior reported behavior and self-identity measures did not significantly improve the model. After including all TPB variables in the model, only direct perceived control and indirect subjective norm significantly contributed to explaining 47% of the variance in intentions [Table 4].

Table 2: Participants' demographic characteristics

Age (range)	46 (29 – 69)
Years since graduation (range)	21 (6 – 43)
Female (%)	51 (42)
Dispensing practice (%)	33 (27)
Training practice (%)	36 (30)
Former fund-holding status (%)	45 (37)
Computerized (%)	107 (88)
Consultation time (range)	9.6 (5 – 15)
Senior partner in practice (%)	55 (45)

Table 3: Indirect belief-based variables and the modal belief items

	Correlation with the corresponding direct measure: Pearson r (*P* value)	Internal reliability: Cronbach α	Mean (SD) (scales' range: −21 to 21)
Indirect attitude	0.45 (<0.001)	0.73	12.4 (4.1)
Indirect subjective norm	0.76 (<0.001)	0.88	10.1 (6.1)
Indirect perceived control	0.33 (<0.001)	0.32	4.4 (3.6)
Belief items			
Behavioral beliefs (range: 1 to 7)			
If I (*GP*) *prescribe for treatment of asthma as recommended in clinical guidelines …*			
1. Patients will be healthier			5.5 (1.3)
2. I receive 'quality markers'			3.7 (1.8)
3. Standard of care will not be judged as negligent			4.1 (1.7)
4. It prevents harm to patients			5.3 (1.5)
5. It provides better quality of care for patients			5.7 (1.3)
Normative beliefs (range: −3 to 3)			
… thinks I should/should not prescribe for asthma as recommended …			
1. Practice nurse			2.0 (1.0)
2. GP colleague			1.7 (1.1)
3. Local hospital consultant			2.0 (1.2)
4. Primary care prescribing adviser			2.1 (1.1)
Control beliefs (range: −3 to 3)			
1. BTS* guidelines for asthma are evidence-based (facilitator)			1.4 (1.5)
2. BTS asthma guidelines have substantially changed their recommendations			0.2 (1.4)
3. I am under time pressure to care for asthmatic patients			1.2 (1.8)
4. BTS asthma guidelines are not flexible			0.6 (1.6)
5. The inclusion of BTS guidelines for asthma in the BNF is appropriate (facilitator)			2.3 (1.2)
6. I constantly hear about the BTS asthma guidelines (facilitator)			0.3 (1.6)
Self-identity			
1. I am an evidence-based practitioner			5.1 (1.4)
2. I am a patient-centered practitioner			5.7 (1.4)

*BTS: British Thoracic Society

Table 4: Regression models explaining the variation in intention to prescribe for asthma treatment as recommended by the clinical guidelines

Dependent variable	β coefficient (CI)	*P*-value for β	Model's F value (*P* value)	Model's R square
Model with direct variables			26.5 (<0.001)	0.43
Perceived control	0.44 (0.26 to 0.62)	<0.001		
Attitude	0.20 (−0.03 to 0.42)	0.09		
Subjective norm	0.19 (−0.05 to 0.43)	0.11		
Model with all TPB variables			46.1 (<0.001)	0.47
Indirect subjective norm	0.07 (0.04 to 0.11)	<0.001		
Perceived control	0.44 (0.25 to 0.62)	<0.001		

Prescribing for asthma

Effective delivery indicator: Inhaled corticosteroids' adequatedaily quantities per weighted prescribing units

Prescribing data for 96 GPs was available for the calculation of this indicator. Inhaled corticosteroid adequate daily quantities per prescribing unit ranged from 0.13 to 2.43 (median=0.91, mean=0.82, SD=0.49).

Demographic and practice characteristics explained 18% of variation in inhaled corticosteroid adequate daily quantities per prescribing unit. No direct or indirect TPB variable or belief item significantly contributed to the regression model.

Table 5: Regression models explaining variation in effective delivery and efficiency indicators of prescribing for asthma

Dependent variable	β coefficient (CI)	*P* for β	Model's F (*P*)	Model's R squared
Model for effective delivery			4.4 (0.003)	0.18
Computerized practice	0.44 (0.09 to 0.80)	0.02		
Years since graduation	0.01 (0.002 to 0.03)	0.02		
Asthma clinic	−0.23 (−0.43 to −0.03)	0.03		
Dispensing status	0.17 (−0.04 to 0.38)	0.11		
Model for efficiency			5.5 (<0.001)	0.34
Behavioral belief 1: Patients' will be healthier	−0.007 (−0.01 to −0.002)	0.007		
Asthma clinic	0.07 (0.02 to 0.12)	0.009		
Practice deprivation score	0.05 (0.005 to 0.01)	0.03		
Normative belief 4: Primary care prescribing adviser	0.004 (0.00 to 0.008)	0.03		
Control belief 6: Hearing about BTS* asthma guidelines	0.003 (0.00 to 0.006)	0.04		
Computerized practice	−0.08 (−0.17 to 0.01)	0.07		

*BTS: British Thoracic Society

The model suggested that more experienced GPs and those who worked in computerized practices were more likely to offer better quality asthma prescribing. On the other hand the presence of asthma clinics was correlated with less inhaled corticosteroid per prescribing unit [Table 5].

Efficiency indicator: Inhaled corticosteroid cost per adequate daily quantities

The belief items and demographic and practice variables explained 34% of variance in the efficiency outcome [Table 5]. It suggested that the presence of asthma clinics in practices and high deprivation scores were associated with less efficient prescribing. The model suggested that GPs who believed more strongly that adhering to asthma guidelines improves patients' health, were likely to be more efficient prescribers; and those GPs who believed more strongly that they constantly heard about asthma guidelines, and those who perceived more strongly that primary care prescribing advisers expected them to follow the guidelines, were likely to be less efficient prescribers. The TPB direct and indirect variables did not contribute to the model.

DISCUSSION

Similar to the findings of previous studies of health professionals,[18] the TPB proved to be a powerful model for explaining variation in behavioral intention. Belief-based TPB variables significantly explained variation in asthma prescribing efficiency indicators. These latter explanatory powers were achieved, however, through significant deviations from the standard methods of analysis of TPB items, as suggested by Ajzen and others.

Indirect subjective norms and direct perceived control variables were able to explain 47% of the variation in intentions to prescribe in accordance with the asthma guidelines. The absence of any significant contribution from attitudes was unexpected, as attitudes were generally the most powerful predictors of intentions in TPB studies of clinicians.[14,17,19,28,34,35] The TPB variables had no contribution to the effective delivery outcome of prescribing for asthma. It was not possible to ascertain whether this showed a genuine lack of relationship between the psychological constructs of the TPB and the outcome, difficulties in measuring a valid indicator of asthma prescribing from the PACT data, or a lack of statistical power.

The findings suggested that having an 'asthma clinic' in practice was correlated with lower quality asthma prescribing. This finding was puzzling, as case studies demonstrated that asthma clinics were linked to many aspects of better asthma care.[36,37] On the other hand a randomized trial of using specialist nurses to support practice nurses in asthma care failed to improve patient outcomes.[38] An explanation for the survey's finding could be that asthma clinics had improved the management of patients in a way that short-acting β_2-agonist bronchodilator treatment was adequate for a bigger proportion of patients. As a result, less inhaled corticosteroids were prescribed.

Similar to a study of statin prescribing,[19] TPB belief-based variables were powerful predictors of variation in the efficiency outcome of asthma prescribing. Similar to that study, perceiving more pressure from primary care prescribing advisers was linked to less efficient prescribing for asthma. Also the analysis suggested that GPs who heard more about the BTS asthma guideline were less likely to prescribe efficiently. Among all demographic and practice characteristics, three had significant contributions to the model. Computerized practices were likely to prescribe more efficiently, while those with asthma clinics or higher deprivation scores seemed to be less efficient in their prescribing of inhaled corticosteroids. It was known that asthma clinics might result in increase in asthma treatment costs,[36] but there should be no reason for it to reduce the efficiency in choosing inhaled corticosteroids. A previous study suggested there could be an interaction effect between practice deprivation and the corticosteroid to bronchodilator ratio,[39] in which, in more deprived areas, the ratio was less 'preventive' of asthmatic admission to hospital. In other words higher ratios did not reflect themselves in reduction in admission rates. This might also be the result of higher levels of need in deprived areas.[40]

We did not identify any links between expressed interest in asthma and the prescribing outcomes. This was different from older studies,[41] which concluded that interest in asthma reduced prescribing costs. Campbell *et al.*,[42] concluded that the training status of the practice was not a significant predictor of quality of care. Training status did not feature in any of the multivariate models of prescribing outcome indicators. Prescribing outcomes alone might not be accurate reflections of GP intention and activity. Other clinicians' behavior, habits and routines, and unsuccessful behavioral attempts may limit the validity of the prescribing outcomes as we have described elsewhere.[19]

Prospective designs are appropriate for TPB studies, so that behavioral intention and its determinants are measured at one point of time and behavior at a later stage.[43] Simultaneous measurement of behavior with other elements of the model is not recommended and might provide poor and unreliable measures of past behavior. In our survey, the prescribing outcome was collected prospectively. Another important feature of the design was the attempt to capture documented behavior from the prescribing data instead of relying on reported behavior, which was common in TPB studies.[18] Conducting TPB studies alongside randomized trials could improve the quality of data for testing TPB in future studies. It would also help in identifying reasons for adopting or not adopting interventions.

Limitations of the study

Despite strenuous efforts, the response rate to our survey was poor. This was the most important limitation of the study, and potential risk of bias for the findings. We conducted a detailed analysis of non-responses, to assess the risk of bias, and found no evidence of significant bias.[33] Shorter questionnaires might have led to a better response rate. The questionnaire length would remain the limiting factor for TPB studies of health professionals. A solution for reducing the number of items in the questionnaire was to drop value statements from belief-based items. This could shorten the questionnaire substantially. In a study of primary care physicians, the investigators dropped value items; instead they multiplied positive beliefs by an average positive value and multiplied negative beliefs by an average negative value.[43] Shortening the questionnaires in this way had theoretical drawbacks, as one expected different beliefs to elicit different values from different physicians. The validity of solutions like this also depended on finding solutions to the more serious limitation of TPB studies, namely, the inability of the theory to suggest an optimal scaling approach for the questionnaire items.

Another limitation is that the interpretation of composite scales from indirect belief items in TPB studies is difficult.[20] One proposed solution is to put expectancy and value items in the regression model and then add the interaction in the model, to see how much more of the attitude's variance was explained by the interaction. However, the authors argued that this was not psychologically sound.[20,44] Future studies might use statistical optimization to identify the best scaling approach and composition strategy for the analysis of the TPB items.[45] Such optimization should be based on datasets of a few different studies of health professionals, ideally all with prospective measures of outcome behavior.

Attempts were made to identify the optimal

scaling approaches for belief-based items, for the calculation of expectancy-value composite scores. Different scaling approaches did not make a lot of difference to the outcome of analyzing behavioral beliefs and it was possible to identify a relevant scaling approach. There was agreement on how to scale normative beliefs in the literature.[13,21] Further methodological studies are required to investigate the options available. Future works should consider the potential for variable scaling of items within beliefs, between beliefs, and also expectancy statements.

Social desirability was another potential bias as following clinical guidelines' recommendations for the treatment of asthma was 'socially desirable'. Hence, the respondents might have unintentionally ('social desirability')[46] or intentionally ('faking good') expressed themselves more positively toward the behaviors than they really were.[46,47] However, inclusion of further questions in the questionnaire to assess this was not feasible. The questionnaires were already long enough to discourage some GPs from responding. Also previous studies suggested that social desirability had a minimal impact on TPB models.[48]

Previous studies proposed that subjective norm was the weakest explanatory variable of intention.[49,50] Hence, the power calculation for the surveys was based on the relationship between subjective norm and intention.[18] The results of the surveys did not support that assumption. Subjective norms performed as well as other elements of the TPB in the models. This might be the result of careful attention to the measurement of subjective norm and normative beliefs in the surveys.[50] Careful attention was given to the optimal scaling of TPB indirect measures. Many previous studies shunned this important consideration.[35]

Implications of the findings

The nature of prescribing problems in developing countries is somehow different from what is usually observed in the UK. In many countries poly-pharmacy or multidrug use is a challenge to the system. Studies have shown that the average number of drugs per prescription is between 2.4 to 10, while if prescribing is conducted rationally, the average number of drugs per prescription should be less than two.[51-55] Another frequently cited prescribing challenge is the overuse of injections. For example, studies demonstrated that 15 – 60% of people attending healthcare facilities in different developing countries received at least one injection.[52-54,56] Also it was reported that 40 – 50% of prescriptions contained antibiotics.[52-54] The private sector is a major provider in many of these countries, especially of primary care, and is very much unregulated. The results of the studies of prescribing in the UK, therefore, are not easily generalized to middle-income developing countries.

Evidence-based management of asthma is an important public health aim. Prophylactic usage of inhaler corticosteroids prevents chronic asthma symptoms and side-effects to appear,[57] reduces the usage of emergency care and hospitalization for asthmatic patients, and improves their quality of life. Hence, it is important to understand why some physicians do not prescribe inhaler steroids as often as they should do. The study was helpful in identifying physicians' important beliefs and the values assigned to those beliefs. TPB tools and questionnaires, however, were not sensitive enough to identify the delicate differences between groups of responders. GPs might approach clinical guideline recommendations selectively. Hence, it is useful to know which guideline recommendations are implemented by what group of practitioners, in which case it will be useful to know the characteristics (e.g., beliefs) of GPs that implement or do not implement certain recommendations. In marketing research, this separation of the target population into subgroups is known as 'segmentation'.[58] Sophisticated choice modeling ('conjoint analysis') methods are developed to identify and understand the existence of segments and subgroups.[59,60] Identification of the subgroups can help in devising different interventions, specific to the needs of different subgroups. Choice modeling may use discrete choice, rating or scaling questions and may or may not incorporate vignettes (case scenarios). Choice modeling is also recommended as a technical solution to the problem of scaling the belief-based items.[20] The suggestion proposed here differs from the previous studies, as it aims to use choice modeling for the identification of subgroups within the target population and not just as a technical remedy to statistical problems.

The TPB can be used for devising behavior

change interventions, yet the effectiveness of TPB interventions for changing provider behavior is not known,[61] although there are successful examples of changing intentions.[62] TPB has demonstrated its ability in explaining the intentions of clinicians, and also when it is linked to guideline implementation. Further studies are required to assess its use in understating the variation in prescribing behavior.

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