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DOI:

[10.1016/j.jpsychores.2018.10.010](https://doi.org/10.1016/j.jpsychores.2018.10.010)

*Document Version*

Peer reviewed version

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*Citation for published version (APA):*

Weinman, J., Graham, S., Canfield, M., Kleinstäuber, M., Perera, A. I., Dalbeth, N., & Petrie, K. J. (2018). The Intentional Non-Adherence Scale (INAS): Initial development and validation. *Journal of Psychosomatic Research*, 115, 110-116. <https://doi.org/10.1016/j.jpsychores.2018.10.010>

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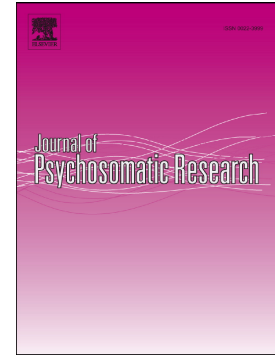
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## Accepted Manuscript

The Intentional Non-Adherence Scale (INAS): Initial development and validation

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PII: S0022-3999(18)30765-7  
DOI: doi:[10.1016/j.jpsychores.2018.10.010](https://doi.org/10.1016/j.jpsychores.2018.10.010)  
Reference: PSR 9603

To appear in: *Journal of Psychosomatic Research*

Received date: 14 August 2018  
Revised date: 28 September 2018  
Accepted date: 19 October 2018

Please cite this article as: John Weinman, S. Graham, M. Canfield, Maria Kleinstäuber, Anna I. Perera, Nicola Dalbeth, Keith J. Petrie, The Intentional Non-Adherence Scale (INAS): Initial development and validation. *Psr* (2018), doi:[10.1016/j.jpsychores.2018.10.010](https://doi.org/10.1016/j.jpsychores.2018.10.010)

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The Intentional Non-Adherence Scale (INAS): Initial development and validation

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## **Abstract**

### *Objective*

Adherence continues to be a major challenge in healthcare but there is still limited understanding of all the factors which can influence adherence behaviour. The present study was designed to identify a range of factors associated with intentional non-adherence and to see if they could be formed into a psychometrically sound scale.

### *Methods*

Patients in three different clinical groups (Hypertension (N=175); Oncology (N=115); Gout (N=196)) were given the new scale together with an adherence self-report and/or biomarker measure. Other, more established measures of factors known to be associated with adherence (BMQ, PAM, BIPQ), were also completed by patients for comparative and validation purposes.

Exploratory Factor Analysis (EFA) was conducted to examine the factor structure of the new scale, and other statistical analyses were used for testing the psychometric properties of the new scale.

### *Results*

EFA revealed two factors, which were labelled “*Resisting illness*” and “*Testing treatment*”. Both scales were found to have good psychometric properties and explained unique variance in adherence in all three clinical groups.

### *Conclusion*

This new scale shows promise in describing and explaining some relatively novel factors underlying treatment non-adherence. Further work in different patient groups and clinical contexts is needed to confirm the factor structure and predictive value of these scales.

*Keywords:* Intentional non-adherence; illness; treatment; medication; reliability; validity

## INTRODUCTION

There is widespread evidence that only 30-50% of patients are adherent to the medicines prescribed for long-term physical or mental health problems (1). This leads to reduced clinical benefit, avoidable morbidity and mortality and medication wastage. Measuring adherence presents a challenge to researchers as there are only a few conditions, such as gout where biomarkers can provide a direct assessment of the amount of medicine taken. While there are electronic monitoring measures which can be incorporated medicines containers, these are quite costly and so researchers often rely on self-report measures, such as the Medication Adherence Report Scale (2), which was used in the present study (see below).

Numerous interventions have been developed for facilitating medicines adherence (3,4) but sub-optimal adherence continues to be a massive problem in healthcare (1,5). Although research has shown that there are multiple factors underlying poor adherence (6,7), interventions still often rely on fairly simple unidimensional solutions, such as reminders (8), which have shown limited efficacy at best. While early research focused more on unintentional factors, such as forgetting (9), more recent studies have highlighted the importance of intentional factors, arising from patients' beliefs and levels of motivation and engagement. Many studies therefore incorporate measures, such as the Beliefs about Medicines Questionnaire (10) and the Patient Activation Measure (11) to capture these additional variables (see methods section).

While the number of recognised determinants of adherence has grown, evidence from systematic reviews (5,12) indicates there is still considerable unexplained variance. Even within the domain of intentional non-adherence, there is still an

emphasis on the negative aspects of treatment, such as side effects, which may cause patients to have concerns about taking their prescribed medicine. Thus, the aim of the present study was to develop and test a new measure, which could assess different components of intentional non-adherence and to determine whether these could explain additional variance in behavioural and biomarker measures of non-adherence.

Rather than relying on existing theoretical constructs, such as risk perceptions or beliefs about the pros and cons of medicines, we attempted to identify intentional factors that get in the way of adhering to medical treatment from the patient's own perspective. We were able to do this from two distinct sources. First, from our previous studies, where we had data from interviews or free text responses, we could identify various reasons, which patients provided for not taking their medicines. These included factors relating to people's illness beliefs, their perceptions of their own identity and the way in which medicine could have a negative impact on this (e.g., medicine is an unwanted reminder of being unwell).

The second source of possible factors came from the qualitative research literature, which has revealed a range of reasons from in-depth interviews exploring patients' views about their prescribed medicines (13,14). An overview by Pound and colleagues (14) conceptualised non-adherence as a preference to minimize the intake of medicines and describe this as "resisting medicines" since the medicines can often be perceived as an unwanted reminder of illness and hence as a threat to self-identity. We therefore selected items to reflect this broader range of reasons for intentional non-adherence to ascertain their potential explanatory role in medication adherence, and to see if they could be grouped into any broader scales. We also

sought to compare the explanatory power of this new measure with some widely used predictors of adherence.

## METHODS

### *Item selection*

Two of the authors (KP;JW) examined their own datasets as well as results from qualitative research on treatment adherence to select items which did not seem to be present in existing adherence prediction measures, such as the Beliefs about Medicine Questionnaire (BMQ) (10) and the Patient Activation Measure (PAM) (11). After generating a long list of over 30 items, we examined this for duplicates or ambiguous items and ended up with a shortlist of 22 items, which are shown in Appendix 1.

### *Patient samples*

Patients from 3 different outpatient clinics provided data for this study, as follows:

- (i) 175 patients attending routine hypertension outpatient clinics at two large London teaching hospitals. Of these 74 (mean age = 56.2 years; 44 female, 30 male) were used for the main psychometric analyses and 101 (mean age 51.5 years; 62 F,39M) were from a separate study comparing the new measure and PAM scales (see below).
- (ii) 115 patients (mean age 62.2 years; 41 female, 68 male) attending an Oncology outpatient clinic at a large London teaching hospital and for whom medication was now their primary treatment.
- (iii) 196 patients (mean age = 61.6 years; 28 female, 168 male) with gout and being treated with an urate lowering medication were recruited from a

secondary care rheumatology clinic and a clinical research unit at the University of Auckland. Serum urate (SU) levels were available for 188 participants with gout. The mean serum urate level was 0.37 mmol/L (SD = 0.11, range: 0.18 to 0.76). For patients on urate-lowering medication a serum urate target of <0.36 mmol/L is recommended (15), and 54.1% (n = 106) of the sample reached the target SU. A sub-sample of 30 patients (mean age = 69.62 years, SD = 8.89; 4 female, 26 male; mean SU level = 0.35 mmol/L, SD = 0.11; 56.7% [n=17] had a target SU) also provided 4 week follow up data for the test-retest analysis (see below).

Patients were approached in each clinical setting and were recruited if they provided consent and had the ability to read in English, as no translations of the questionnaire were available at the time of the study. For the London samples, ethics approval was obtained from the proportionate review sub-committee of the Research Ethics Committee (North West - Greater Manchester West Research Ethics Committee - 16/NW/0469) and the Health Research Authority . In New Zealand the study was approved by the University of Auckland Human Participants Ethics Committee (Approval No. 015963) and the Health and Disability Ethics Committees New Zealand (Approval No. NTX/12/EXP/130).

### *Measures*

#### **Intentional non-adherence**

The **Intentional Non-Adherence Scale** (INAS) is a 22-item scale identifying varying reasons why patients may *intentionally* stop taking their medications as prescribed.



The items, which are shown in Appendix 1, are preceded with the following instructions: *People have different experiences when taking medication and use their medications in ways which suit them. Sometimes people forget or decide not to take their medication for various reasons. We are interested in your personal views and experiences of your prescribed medication regime and the way you use your medications.*

*All of the information you provide is confidential. There are no right or wrong answers to these questions – an answer is correct if it is true for you. We are most interested in your own opinion. Please choose the response that best fits with your circumstances.*

*Listed below are some of the reasons why people sometimes stop taking their medications. We would like to know how often each of the following statements is true for you in the **past 6 months**. For each statement please tick (✓) **one** box which best represents you.*

Examples of items are: *“To see if I really need it”, “Because I don’t like chemicals in my body”, “Because my body is sensitive to the effects of the medicine”, “Because I think the drug might become less effective over time” and “Because it reminds me that I have an illness”.*

Item responses are scored on a five-point Likert scale on which 1= *strongly disagree*, 2= *disagree*, 3= *neutral*, 4= *agree*, 5= *strongly agree*. The final scoring of the questionnaire was developed and confirmed following the exploratory factor analyses (see below).

### **Medication adherence**

In the hypertension and oncology samples, adherence to medication was assessed using the **Medication Adherence Report Scale (MARS-5)** (2), a validated 5-item self-report scale. The MARS-5 consists of 5 common patterns of non-adherent

behaviour. Examples of items from the *adherence* scale include: “*I forget to take my medicines*”, “*I alter the dose of my medicines*” and “*I use my medicines less than is prescribed.*”

Item responses are scored on a five-point scale, where 1= *always*, 2= *often*, 3= *sometimes*, 4= *rarely*, 5= *never*. Scores for each of the five items are calculated to give a cumulative score ranging from 5 to 25, with higher scores indicating higher levels of reported adherence.

With the Gout sample, adherence to medication was assessed by a biomarker from a patient’s serum urate (SU) level (details in section on patient samples above). Since the aim of treatment is to lower the elevated SU levels, patient adherence can be directly assessed from their (SU) level as an objective physiological marker, which is a gold standard measure of adherence to urate lowering medication.

### **Beliefs about Medicines**

In the hypertension and oncology samples, the **Beliefs about Medicines Questionnaires-Specific** (BMQ-Specific) (10) was used. This is a widely used, validated questionnaire comprising 10 items assessing patients’ beliefs and personal views about the *necessity* of prescribed medication for controlling their illness and their *concerns* about the potential adverse consequences of taking their prescribed medication.

Examples of items from the *necessity* scale include: “*My life would be impossible without my medicines*” and “*My medicines protect me from becoming worse.*”

Examples of items from the *concerns* scale include: “*Having to take medicine worries me*” and “*My medicine disrupts my life.*”

Participants indicate their degree of agreement to each statement on a five-point Likert scale, which ranged from 1= *strongly disagree* to 5= *strongly agree*. The scores obtained for individual items are totalled to give a Necessity and Concerns scale score. Total scores for each scale range from 5 to 25, where higher scores signify high perceived *necessity* for medication and high *concerns* about the use of medication.

### **Illness Perceptions.**

The **Brief Illness Perceptions Questionnaire** (BIPQ,16) was used to assess illness perception in the gout sample. There are 9 items, each of which assesses a separate component of illness perception using a 0 to 10 response scale. The components of illness perception assessed by the BIPQ are Consequences, Timeline, Personal Control, Treatment Control, Identity, Concern, Understanding and Emotional Response. This is a widely used scale, which has very good psychometric properties across a wide range of health problems (17)

### **Patient Activation**

With a sample of 101 patients from the hypertension clinic, we used the Patient Activation Measure (PAM) (11) to assess patient activation. This 13 item scale assesses patient self-reported knowledge, skill, and confidence for self-management of one's health or chronic condition. Each item had five response options, with scores from 1 to 5: (1) strongly disagree, (2) disagree, (3) agree, (4) agree strongly

and (5) not applicable. Higher scores are indicative of greater patient confidence and involvement in illness self-management.

### *Procedure*

Patients attending routine appointments within out-patient hospital clinics were invited to participate in a research study about their personal beliefs and experiences of their prescribed medication. Request for participation for potential participants included an email invitation letter, accompanied by a Patient Information Sheet, informing the participants of the purpose and nature of the research study

The questionnaires were administered in each of the respective out-patient clinics, where the researcher identified and approached eligible participants in the waiting room, inviting them to take part in the study and complete a questionnaire either before or after their consultation appointment. If patients were willing to take part in the study, an introduction to the study was provided by the researcher, which described the purpose of the research, the nature of their involvement and how this would contribute to the research study. The researcher was in attendance throughout administration, providing information and support or discussing any concerns, if needed. The clinician lead was also available throughout, should the participant need to receive any additional support and resources.

Of the 158 oncology patients on the clinic schedule that were eligible for inclusion, 32 refused to take part in the study, 3 individuals initially agreed to take part, but later withdrew without completing the questionnaire due to time constraints. Eight individuals asked to complete the questionnaire via the free-post self-addressed

postal system but none of these were returned. Overall, 115 patients completed and returned the questionnaire, giving an overall response rate of 115/158 (72.7%) .

Within the hypertension clinics of the 82 study-eligible patients that were approached, 3 declined to take part and 5 requested to complete the questionnaire off-site via the free-post postal system but none of these were returned. The final study sample resulted in a completion response rate of 74/82 (90.2%).

With the gout sample, 277 patients were approached and 196 agreed to participate, resulting in a response rate of 70.8 %

#### *Statistical analysis*

A maximum likelihood Exploratory Factor Analysis (EFA) with an oblique rotation (Promax) was conducted in STATA. Prior to performing the EFA, suitability of the item pool for factor analysis was assessed using Kaiser–Meyer–Olkin’s test. Factor retention criterion was determined by the Kaiser criterion (eigenvalues >1), scree plot and parallel analysis (18). Items were removed from the EFA if their factor loadings were non-significant or if they loaded significantly but weakly (i.e., <.40) onto more than one factor. The resultant factor scales were labelled in accordance with the data output.

The internal reliability of the summed scores for the INAS subscales was assessed by calculating Cronbach's alpha. Validity was assessed by examining the correlations (Pearson’s correlation) between the scores from the INAS subscales and measures of adherence to medicine, beliefs about medicines in the Oncology

and Hypertension samples. Correlations between the INAS scales and the PAM were also examined in another sample of patients with hypertension. Additional multiple linear regression analyses were conducted to ascertain variables associated with adherence to medication (MARS scores). For the combined Oncology and Hypertension sample (N=185), demographic (age and gender) and clinical variables (diagnose group) were entered in model 1; demographic, clinical and BMQ variables (necessity and concern) were entered in model 2; and demographic, clinical, BMQ and INAS variables were entered in model 3. For the additional sample of hypertension patients (N=110), PAM scores were added into a single model including demographic, clinical, BMQ and INAS variables.

Differences between means of INAS subscales across patient diagnoses (oncology, hypertension and gout) were assessed using ANOVA.

Further Pearson's correlation analyses were conducted using data from the Gout sample to examine associations between the subscales of the INAS, the BIPQ and a biomarker measure of adherence (serum urate levels). An independent samples t-test was performed to compare patients who reached or exceeded the serum target level of 0.36 mm/L with those whose serum levels were below the target. In a sub-sample of 30 gout patients, the intraclass correlation coefficient (ICC) was used to assess test-retest reliability of the new measure over a 4 week period.

## RESULTS

### *(a) Preliminary analysis*

Means and standard deviations for each of the INAS items are shown in appendix 1. Only participants with complete data for INAS (98.8%) were included in the analysis.

Histograms and Q-Q plots showed that four items were highly skewed and thus were excluded. The inter-item correlations for the remaining 18 cases were examined. All items correlated positively and significantly ( $p > .001$ ) with each other. Kaiser–Meyer–Olkin’s test was performed to assess the suitability of the item pool for factor analysis. Considering all 18 items together, the overall Kaiser–Meyer–Olkin was .94, exceeding the recommended minimum value of .60 (18) for conducting an EFA.

*(b) Exploratory Factor Analysis (EFA)*

A maximum likelihood EFA of the 18-items assessing intentional non-adherence to prescribed treatments revealed the presence of two factors with an eigenvalue exceeding 1, which together explained 91% of the total variance (factor 1, 83%; factor 2, 8%). Although factor 2 only explained a small proportion of total variance, the scree-plot, parallel analysis and eigenvalue rule all suggested that two factors should be extracted. The factor matrix showed that 8 items loaded on the first factor (all  $> 0.6$ ) and 5 items loaded on the second factor (all  $> 0.6$ ). Five items loaded significantly on both factors, and thus were discarded. Re-factoring on the remaining 13 items produced a similar two factor structure explaining 93% of the variance. The correlation between the two factors was .65.

The final 2-factor structure of the 13-item scale is shown in Table 1. The first factor comprised 8 items linking the decision not to take treatment with not wanting to be reminded of one’s illness, the association of medication with illness and the desire to feel ‘normal’. This factor was labelled “*Resisting Illness*”(RI). The second factor has been labelled “*Testing Treatment* (TT)” as it comprised 5 items assessing reasons for not taking treatment based on the person’s attempts to see if they can get away with taking less or no treatment.

(c) *Reliability*

The two INAS sub-scales achieved high levels of internal consistency. For the 8-items forming the *Resisting Illness (RI)* scale, the Cronbach alpha coefficient was .95, and for the 5-items forming the *Testing treatment (TT)* scale the alpha was .93.

In the 30 participants with gout who were re-assessed after a 4-week period, test-retest reliability for the *Testing treatment* scale showed an intraclass correlation (ICC) of .97 and for the *Resisting illness* scale the ICC was .95.

(d) *Validity*

The validity of the 2 INAS subscales was evaluated in a number of ways. First, we wanted to see whether they correlated with both self-reported and biomarker measures of treatment adherence. Second, we wanted to examine possible associations with a range of measures, which have been found to explain adherence and self-management behaviours, and to compare the explanatory power of the INAS scales with these measures. Finally, we wanted to determine the extent to which the INAS scores discriminated between the three different clinical groups from whom we collected data.

## **Adherence**

### *Self-reported adherence*



Correlations between the two INAS subscales and the MARS are shown in Table 2. In the combined hypertension and oncology sample, both INAS subscales significantly and negatively correlated with self-reported adherence to medicine. Very similar patterns of correlation were found for these two patient groups but these effects were slightly stronger in the Oncology sample ( $r = -.57$  and  $-.61$ , TT and RI respectively) compared with the Hypertension sample ( $r = -.53$  and  $-.43$ , TT and RI respectively).

#### *Biomarker measure of adherence*

In the Gout sample, moderate but significant positive correlations were found between serum urate levels and both the Testing Treatment ( $r = .42$ ) and Resisting Illness ( $r = .48$ ) subscales of the INAS (see Table 2). An independent-sample t-test showed that gout participants who had a SU of 0.36 mmol/L or above (RI subscale:  $M = 16.48$ ,  $SD = 7.04$ ; TT subscale:  $M = 10.44$ ,  $SD = 5.44$ ) compared to participants who had a SU below the target level (RI subscale:  $M = 12.12$ ,  $SD = 6.09$ ; TT subscale:  $M = 7.59$ ,  $SD = 4.10$ ) had a significantly higher value on both subscales of the INAS (resisting illness subscale:  $t[160.54] = -4.54$ ,  $p < .001$ ; testing treatment subscale:  $t[146.04] = -3.95$ ,  $p < .001$ ).

#### **Beliefs about medicines, illness perceptions and patient activation.**

In the hypertension and oncology samples, patients completed the BMQ together with the INAS and the MARS. We did this to examine the extent to which the INAS subscales overlapped with the Necessity and Concerns scales of the BMQ. The results showed a very similar pattern of correlations for the group as a whole and for

both patient groups (see Table 2). Both INAS scales correlated moderately with the BMQ Concerns scale, emphasising that the INAS items were tapping into various worries that patients had about their medicines but that there was still considerable unexplained variance. In contrast, no correlations were found with the BMQ Necessity scale. In order to compare the variance in adherence self-report explained by the INAS and BMQ, we conducted a multiple regression analysis. The results reported in Table 3 show that while BMQ Concerns was significantly associated with MARS scores after controlling for demographic and clinical variables, this significant association disappeared when the INAS scores were entered in model 3. Both INAS subscales were found to be significantly associated with MARS scores after controlling for demographic, clinical and BMQ variables. The final model explained 37% of the variance in the MARS score.

The gout sample also completed the BIPQ and there we found smallish correlations with a number of the different components of illness perception. Both INAS scales correlated with the Illness Identity, Consequences, and Emotional representations scales, and the INAS Testing treatment scale was also correlated with Illness Concerns (see Table 2).

We also wanted to ensure that the INAS scales were sufficiently distinct from various self-regulatory constructs, such as personal control and patient activation. In the gout sample, it can be seen that there are no significant correlations with BIPQ Personal Control (Table 2). Similarly, in a sample of 101 hypertensive patients, no correlations were found with the PAM. In this sample we also conducted a multiple linear regression to evaluate whether patient activation, medication beliefs and reasons for intentional non-adherence predicted medication adherence while controlling for age

and gender. Regression results indicated the seven variables predicted 44.2% of the variance but only the INAS Resisting illness and Testing treatment scales significantly predicted medication adherence. Table 3 summarizes the results of the multiple linear regression.

(c) Discriminant validity

Means (SD) for the two INAS subscales according to patient diagnoses (oncology, hypertension and gout) can be found in Table 4. A series of one-way ANOVA showed differences across patient diagnoses in both INAS subscales. Post hoc comparisons with Scheffe tests showed that the mean differences between the oncology and hypertension groups were not significantly different ( $p = .86$  and  $p = .99$  for Resisting Illness and Testing Treatment, respectively), whereas the mean differences between gout patients and oncology and hypertension patients were statistically different on both subscales ( $p < .001$ ).

## DISCUSSION

This paper describes the preliminary development of a new scale designed to assess different aspects of intentional non-adherence. The items were chosen to assess a range of different reasons, which patients may give for deciding not to take their medicines as prescribed. Although these items are not strongly endorsed, they show impressive correlations with both subjective and objective measures of adherence and provide explanations for non-adherence, which were not found in other questionnaires such as the BMQ and PAM. Moreover, when exploring the variance in adherence scores, the model with the INAS scales outperforms these two widely used measures.

Looking at the content of the items in the two INAS subscales, it is apparent that the items cover a number of linked themes. The highest loading items in the *Resisting Illness (RI)* sub-scale relate to a reluctance to take medicines regularly because they serve as a constant reminder to the person that they have an illness together with a desire to feel normal again, as well as various concerns about the effects of the medicines. The *Testing treatment (TT)* sub-scale includes items reflecting the desire to omit or reduce treatment for a number of reasons, and reflect what Pound et al (14) describe as a preference to minimise the intake of medicine.

The content of these two scales provides some insight into the pattern of scores found across the three illness groups. The similar pattern of INAS scores in the Oncology and Hypertension samples was something of a surprise but there are some possible explanations for this. In both conditions medication is taken for preventive purposes rather than to alleviate day to day symptoms. Moreover, both types of treatment can cause side effects. In contrast, in Gout the urate lowering medication has a direct effect on the underlying disease process and its regular use results in relief from the pain of gout. Thus, the lower INAS scores in these patients may well reflect the fact that taking this treatment can restore normality rather than challenge it. To confirm these hypotheses about the patterning of INAS scores across different illnesses as well as their predictive validity, it will be important to use the measure in patients with a range of other physical and mental health problems.

The pattern of statistical association with the other measures included is also revealing. The fact that both INAS scales correlate with the Concerns scale of the

BMQ confirms that both tap into a range of underlying worries that people have about having to take medication (19). Whereas the BMQ Concerns scale focuses more on the negative effects of the medicines themselves, the INAS reveals some broader issues about medicine-taking as a threat to the self-system and that the mere fact of having to take medicines can act as a reminder of the underlying sick self. In contrast, the absence of any correlation with the BMQ Necessity scale indicates that the INAS is not tapping into patients' evaluations of the need for their treatment per se but is assessing something much more strongly linked with their negative view of its perceived impact on their identity. Also the TT sub-scale seems to provide insights into a more dynamic process, in which the individual actively experiments with their level of medicine-taking to see if they can get away with taking less or even no treatment, possibly to see if the illness is still present. This may be particularly salient for those patients taking medicines for primarily preventive purposes or for those whose treatment has succeeded in reducing or eliminating the daily symptoms of their condition.

The concepts captured by the INAS could be used to inform targeted treatment approaches. The sub-scales of the measure appear broadly to be commensurate with established (extended Common-Sense Model; [19]) and emergent (Psychological Flexibility; Acceptance and Commitment Therapy [20,21,22]) psychological intervention models. For example, the "Testing Treatment" sub-scale could be used, in addition to the BMQ, to inform the provision of tailored educational materials that challenge unhelpful beliefs about medication as a threat to one's lifestyle. Whereas, if results from the "Resisting Illness" sub-scale suggest that medicine taking threatens one's identity or that non-adherence stems from a difficulty

in tolerating discomfort (e.g. emotive memories or thoughts about illness), then, for example, techniques derived from Acceptance and Commitment Therapy could be applied. The latter uses aspects of mindfulness and behaviour change methods to help a person notice how getting caught up in unhelpful thoughts (cognitive fusion) and self-stories (attachment to a conceptualised self), or attempting to avoid discomfort (experiential avoidance) can lead to ineffective behaviour, which may include non-adherence, and then to make more effective decisions (20).

As a preliminary study of a new scale for explaining different aspects of intentional non-adherence, this paper has a number of limitations. The psychometric analyses need to be extended to include additional tests of reliability and validity in other patient groups as well as in other countries and cultural settings. The INAS would also benefit from further evaluation of its factor structure by, for example, conducting confirmatory factor analysis. We are planning similar studies with different clinical populations as well as exploring the types of intervention which could successfully target the reasons for non-adherence revealed by the INAS. Mindful of the need for adherence interventions to be matched to patient determinants (23), it will be a challenge to develop novel approaches, which are able to address the adherence determinants revealed by the INAS.

#### *Competing interest*

The authors have no competing interests to report and the study was completed without any external funding

### *Acknowledgements*

We are very grateful to Dr Omar Mukhtar and Professor Albert Ferro for allowing us to see patients in their outpatient hypertension clinics, and to Kumud Kantilal for allowing us to see patients in the Oncology clinic. Thanks are also due to Flavia Bojescu for collecting data from the second hypertension sample, Nicholas Cao for collection of some of the gout sample and to Dr Chris Graham for contributing the section on potential intervention strategies arising from the use of the INAS scales

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**Table 1. Results of the exploratory factor analysis of the INAS for the total sample ( n = 275; Oncology = 115; Hypertension= 74; Gout=196 )**

| INAS-item  | Factor 1<br>(Resisting<br>Illness) | Factor 2<br>(Testing<br>treatment) |
|--|------------------------------------|------------------------------------|
| 1. To see if my illness is still there                                 |                                    | .61                                |
| 2. To see if I can do without it                                       |                                    | .95                                |
| 3. To see if I really need it  |                                    | .91                                |
| 4. Because I am not convinced that the medicine is really right for me |                                    | .73                                |
| 5. To give my body a rest from the medicine                            |                                    | .79                                |

|  |     |
|--|-----|
| 6. Because my body is sensitive to the effects of medicine     | .60 |
| 7. Because I worry about becoming dependent on my medicine     | .68 |
| 8. Because I want to think of myself as a healthy person again | .78 |
| 9. Because it reminds me that I have an illness                | .88 |
| 10. Because I want to lead a normal life again                 | .78 |
| 11. Because it is good not to have to remember                 | .86 |
| 12. Because it is inconvenient to take all the time            | .85 |
| 13. Because the drug schedule doesn't fit with my lifestyle    | .77 |

NB the reported loadings shown above are factor pattern coefficients

**Table 2. Correlations between subtotal scores from the two INAS factors and measures of adherence and illness perception (BIPQ)**

|  | <b>INAS<br/>Testing<br/>Treatment</b> | <b>INAS<br/>Resisting<br/>Illness</b> |
|--|---------------------------------------|---------------------------------------|
| <i>Oncology and hypertension samples (N=189)</i> |                                       |                                       |
| BMQ Necessity                                    | -.01                                  | -.08                                  |
| BMQ Concern                                      | .52**                                 | .41**                                 |
| MARS   | -.56**                                | -.55**                                |
| <i>(i) Gout sample (n=107)</i>                   |                                       |                                       |

|                         |       |       |
|-------------------------|-------|-------|
| BIPQ Consequences       | .31** | .20*  |
| BIPQ Timeline           | -.01  | .03   |
| BIPQ Personal Control   | .03   | .00   |
| BIPQ Treatment Control  | .08   | .04   |
| BIPQ Identity           | .25*  | .19*  |
| BIPQ Concerns           | .24*  | .19   |
| BIPQ Understanding      | .00   | .08   |
| BIPQ Emotional Response | .39** | .33** |
| Serum Urate (biomarker) | .43** | .43** |

\*\* p<.001 \*p<.05

**Table 3. Results of the multiple linear regression for (i) the association between adherence self-report (MARS), medication beliefs (BMQ) and INAS in the combined Oncology and Hypertension samples (N=189); (ii) the association between MARS, patient activation(PAM), medication beliefs (BMQ) and INAS in another Hypertension sample (N=101).**

(i)

|                | Unstandardized<br>B | Sig. | Model<br>R <sup>2</sup> |
|----------------|---------------------|------|-------------------------|
| <b>Model 1</b> |                     |      | .02                     |
| Gender         | -.31                | .08  |                         |
| Age            | .03                 | .55  |                         |
| Diagnosis      | .25                 | .64  |                         |
| <b>Model 2</b> |                     |      | .15                     |

|                          |             |                 |            |
|--------------------------|-------------|-----------------|------------|
| Gender                   | -.18        | .70             |            |
| Age                      | .02         | .20             |            |
| Diagnosis                | .33         | .50             |            |
| BMQ Necessity            | .10         | .30             |            |
| BMQ Concern              | <b>-.38</b> | <b>&lt;.001</b> |            |
| <b>Model 3</b>           |             |                 | <b>.37</b> |
| Gender                   | -.09        | .83             |            |
| Age                      | .01         | .73             |            |
| Diagnosis                | .17         | .68             |            |
| BMQ Necessity            | .01         | .98             |            |
| BMQ Concern              | -.08        | .29             |            |
| INAS Resisting Illness". | <b>-.13</b> | <b>.001</b>     |            |
| INAS Testing Treatment   | <b>-.20</b> | <b>.001</b>     |            |

Model 1: clinical and demographic variables. Model 2: clinical, demographic and beliefs about medicine variables. Model 3: clinical, demographic, beliefs about medicine variables and intention to non-adherence variables .

**(ii)**

| Variable             | $\beta$ estimate | p value     | Model R <sup>2</sup> |
|----------------------|------------------|-------------|----------------------|
| Age                  | .03              | .18         | .44                  |
| Gender               | .73              | .19         |                      |
| PAM-13               | .05              | .11         |                      |
| BMQ-Necessity Scores | .02              | .82         |                      |
| BMQ-Concern Scores   | -.06             | .28         |                      |
| Testing treatment    | -.20             | <b>.036</b> |                      |
| Resisting Illness    | -.10             | <b>.013</b> |                      |

**Table 4. Mean and Standard Deviation for the INAS subscales according to patient groups.**

| Patient groups | Resisting Illness | Testing Treatment |
|----------------|-------------------|-------------------|
|                | Mean (SD)         | Mean (SD)         |
| Oncology       | 18.20 (8.19)      | 10.39 (4.94)      |
| Hypertension   | 18.70 (7.65)      | 10.46 (4.82)      |
| Gout           | 14.28 (6.95)      | 8.96 (4.91)       |

**Appendix 1. Mean scores and (standard deviation) for the 22 item INAS in 189 outpatients (Oncology n = 115; Hypertension n = 74)**

|   |      |        |
|---|------|--------|
| 1.To see if my illness is still there                                   | 1.81 | (1.02) |
| 2.To see if I can do without it   | 2.21 | (1.16) |
| 3.To see if I really need it  | 2.12 | (1.15) |
| 4.Because I am not convinced that the medicine is really right for me   | 2.07 | (1.07) |
| 5.Because I am not sure that the doctor chose the right medicine for me | 1.99 | (1.04) |
| 6.To give my body a rest from the medicine                              | 2.25 | (1.23) |
| 7.Because the medicine is harsh on my body                              | 2.51 | (1.32) |
| 8.Because I don't like the medicine to accumulate in my body            | 2.34 | (1.18) |
| 9.Because my body is sensitive to the effects of medicine               | 2.60 | (1.33) |
| 10.Because I don't like the side effects                                | 2.82 | (1.46) |
| 11.Because I don't like chemicals in my body                            | 2.43 | (1.21) |
| 12.Because it may affect the body's own natural healing processes       | 2.37 | (1.15) |
| 13.Because I think I am on too high a dose                              | 2.21 | (1.09) |
| 14. Because I think the drug might become less effective over time      | 2.22 | (1.07) |
| 15. Because I worry about becoming dependent on my medicine             | 2.21 | (1.12) |
| 16.Because I want to think of myself as a healthy person again          | 2.26 | (1.16) |
| 17. Because it reminds me that I have an illness                        | 2.18 | (1.07) |
| 18. Because I want to lead a normal life again                          | 2.50 | (1.22) |
| 19. Because it is good not to have to remember                          | 2.21 | (1.14) |
| 20.Because it is inconvenient to take all the time                      | 2.34 | (1.28) |
| 21. Because the drug schedule doesn't fit with my lifestyle             | 1.76 | (.88)  |
| 22. Because I don't think the treatment is worth it                     | 1.61 | (.83)  |

### Highlights

- The INAS contains two new scales assessing reasons for non-adherence to treatment.
- Patients may not adhere because they do not want to be reminded of their illness
- Others attempt to see if they can get away with taking less or no treatment.
- Both factors explain unique variance in subjective and objective adherence markers

ACCEPTED MANUSCRIPT