Factors associated with independent nurse prescribers' antibiotic prescribing practice: a mixed-methods study using the Reasoned Action Approach
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Title: Factors associated with independent nurse prescribers’ antibiotic prescribing practice: A mixed methods study using the Reasoned Action Approach

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Running Title: Nurses’ antibiotic prescribing behaviour

Structured summary:

Background: Numbers of nurse prescribers is increasing, yet little evidence exists about their antibiotic prescribing behaviour.

Aim: This paper presents the findings of a study which measured nurse independent prescribers’ (NIPs) intention to manage patients, presenting with an Upper Respiratory Tract Infection (URTI) for the first time, without prescribing an antibiotic and to examine the determinants of this behaviour.

Methods: This was a mixed method study using the Reasoned Action Approach (RAA). Content analysis of data from 27 telephone interviews with NIPs informed the development of a questionnaire which was tested for validity and reliability and used in
a national survey of NIPs across Scotland. Descriptive and inferential statistical analysis was carried out to determine intention to manage patients without prescribing an antibiotic and the significant influences on this intention.

Findings: Results from 184 participants found that NIPs intend to manage patients, presenting with an URTI for the first time, without prescribing an antibiotic. Key determinants were perceived norm, perceived behavioural control and moral norm. Significant beliefs were, positive social influence from other non-medical prescribers (p=0·007) and nurse prescribers (p=0·045), the enablers of prescriber experience and confidence (p=<0·001) and the barrier of pressure from patients/carers (p=0·010).

Conclusion: Nurse prescribing is expanding globally and these findings have international relevance. This paper is significant as it is the first to explore the determinants of NIP antibiotic prescribing intentions using a rigorous theoretical model. Findings provide reassurance that NIPs intend to prescribe appropriately. The identification of nurse-specific barriers and enablers to this intention should be acknowledged and targeted in future interventions to manage this behaviour.

Keywords: nurse, intention, prescribing, Reasoned Action Approach, upper respiratory tract infections

Introduction (words:2997)

Improving antibiotic prescribing is a fundamental objective in the United Kingdom (UK) antimicrobial resistance (AMR) strategy [1], as evidence suggests that inappropriate prescribing is a problem, especially within the community where the majority of antibiotics are prescribed [2, 3]. Most available research has focused on the decisions of doctors, yet independent nurse prescribing in the UK and United States of America is well
established with numbers increasing annually and many other countries are now adopting nurse prescribing [4-6]. Furthermore, evidence suggests nurse prescribing improves patient care [7, 8].

With a growing body of nurse prescribers, understanding their practice is essential; one cannot assume that nurse prescribers tend to respond in similar ways to medical prescribers, evidence is required. A mixed-method systematic review of studies which explored the influences on the antimicrobial prescribing behaviour of independent nurse prescribers globally, found only seven studies which explored this topic. Furthermore, only four explored the influences on whether to prescribe an antibiotic not with the other three focusing on the choice of antibiotic. The most frequently occurring influence on prescribing behaviour, found in these studies was diagnostic uncertainty, followed by the clinical condition of the patient, patient/parent pressure, peer support, cost and payment factors. This evidence was limited by relatively poor response rates, small sample sizes, and designs not theoretically supported and which often fail to explore the underlying reasons for nurses' prescribing decisions [9]. Measuring health professionals' behaviour is complicated because it often raises both ethical and logistical problems. Ethically because observing clinical behaviour involves issues of patient confidentiality [10] and logistically can produce the Hawthorne effect. This was found in an observational study of antibiotic prescribing behaviour in physicians where the proportion of antibiotics prescribed for viral cases was significantly less in the study group than by using retrospective analysis [11].

Evidence suggests that self-limiting upper respiratory tract infections (URTI) resolve without antibiotics, yet they are still prescribed in the majority of cases [12]. Targeting these self-limiting infections is a priority recommendation in the fight against AMR [13-15]. In addition, self-limiting infections are usually treated in the community where many nurse prescribers work [5]. Therefore, the aim of this study was to measure nurse
independent prescribers’ (NIPs) intention to manage patients, presenting with an URTI for
the first time, without prescribing an antibiotic and to examine the determinants of this
behaviour.

Since examining health professionals’ actual behaviour is complicated, the Reasoned
Action Approach (RAA), the latest version of The Theory of Planned Behaviour, provides
a solution to this difficulty. It measures intention to behave; intention being the immediate
antecedent to behaviour [16]. Using a behavioural theory ensures that social,
psychological and cognitive factors associated with prescribing are uncovered which can
then be used to design interventions to improve this behaviour. The RAA can identify the
unique, individual influences on nurse antibiotic prescribing behaviour and usefully
highlights the potentially complex interaction of the constructs of the theory; attitudes
towards performing the behaviour in question), perceived norms (the amount of social
pressure one feels about performing the behaviour) and perceived behaviour control
(PBC) (the ease or difficulty and confidence in being able to perform the behaviour)
(Figure 1). Perceived norms are divided into injunctive norms (people who approve or
disapprove of the behaviour) and descriptive norms (whether people like them, are more
or less likely to behave in this way). These aforementioned constructs all follow from our
underlying beliefs. For example, the more one believes that performing the behaviour
will have positive outcomes, the more positive one’s attitude will be towards performing
the behaviour. A further construct which is added to the RAA in certain contexts is that
of moral norms; a person’s personal feelings of moral obligation or responsibility to
perform or refuse to perform a behaviour [16,17]. Due to the public health consequences
of inappropriate prescribing, antibiotic prescribing can be considered a moral choice and
therefore this construct was added and explored in the study.

The RAA’s authors advise that the behaviour being explored should be defined in terms
of target, action, context and time (TACT) [16]. For this study the target was defined as
patients, the action as NIPs managing patients without prescribing an antibiotic, the context that the patient presents with an URTI for the first time, and time was during a patient consultation with the NIP.

**Methods**

This was a three-phase mixed method study using the RAA as the theoretical framework. Phase one involved an elicitation study comprised of one-to-one telephone interviews with NIPs to elicit their modal (the set of beliefs held with the greatest frequency in the population of interest), salient (beliefs that come readily to mind and are activated spontaneously without much cognitive effort) beliefs about managing patients, presenting with an URTI for the first time, without prescribing an antibiotic. These salient beliefs determine a person’s attitude, perceived norm and PBC and influence their intention.

All NIPs in Scotland were invited to participate via email requests sent from the gatekeepers (nonmedical prescribing (NMP) leads for each National Health Service (NHS) Health Board) with a two-week recruitment period. Estimated numbers of qualified NIPs in Scotland at this time, from NHS Education for Scotland data, were 2364. Telephone interviews were carried out (between October 2015 and February 2016) with 27 NIP volunteers until saturation was reached. A topic guide was used which was developed from RAA guidance and asked open-ended questions in relation to each of the major constructs of the RAA [16] (supplementary information). A content analysis of the responses, using guidance from Elo and Kyngas [18], was completed to find the most frequently occurring salient beliefs. Immersion in the data, through reading the transcripts several times, took place and then through coding, categories were generated. These categories were then grouped under higher order headings and then listed in order, from
most frequently mentioned to least frequently mentioned. To determine how many salient beliefs to include in the final set, guidance was sought from the RAA authors and beliefs were included based on their frequency of emission until 75% of all responses had been accounted for [16] (supplementary material).

These beliefs were then used to develop the indirect measures of intention in a questionnaire for the next phase of the study. Indirect measures were measured using Likert scores, and weighted to form a composite measure for each construct. The greater score, the greater the importance of the belief was for participants. Beliefs were then summed to create a median composite score for attitude, perceived norm and PBC. The questionnaire (supplementary information) also contained questions which directly measured NIPs’ intention, attitudes, perceived norm, moral norm and PBC to ensure all the constructs were measured. Direct measures used Likert scales, between one and seven, to form a composite score for each measure. A median above four was considered a positive response.

In phase two (July 2016), fifteen participants from the elicitation study volunteered to test the reliability and validity of the questionnaire items and completed feedback questions to test the face validity. Content validity was achieved by asking the elicitation interview participants to review the questionnaire. Construct validity was tested by ensuring that items measuring a particular construct, correlated more highly with each other than with items measuring a different construct. Mann-Whitney tests were carried out to see if there was a relationship between those who intended to manage patients without prescribing an antibiotic and those who did not. An index of internal consistency was applied to the direct measures using Cronbach’s alpha coefficient (α) and items were removed using a step reduction until the overall Cronbach’s alpha was improved and further reduction of items would not improve the overall values. Test-retest reliability was carried out by asking participants to complete the questionnaire again two weeks later.
and Spearman’s rho correlation coefficient was used to check for stability of indirect measures.

In phase three the finalised questionnaire was sent, via email from the gatekeepers, to all NIPs across Scotland using the programme SurveyMonkey (SurveyMonkey Inc, San Mateo, CA, www.surveymonkey.com). Only NIPs who were currently managing patients, presenting with an URTI for the first time, were asked to take part to ensure consistency with RAA guidance regarding the context of the behaviour [16]. The survey ran from December 2016 for six weeks Survey data was transferred to IBM SPSS Statistics for Windows, version 23 (IBM Corp., Armonk, N.Y., USA) and descriptive and inferential analysis was performed. Questionnaire that had excessive missing data (i.e. participants had stopped less than half-way through) were not included in the final analysis. To establish direct measures in the RAA questionnaire, overall scores were calculated and therefore missing values from individual items were ignored. However, indirect measures were weighted and then summed to create a composite score therefore missing values for these questions would impact on the overall score if ignored. As such missing values were replaced by the median of the other items in the scale.

Descriptive statistics assessed the distribution of the data to determine the suitability for parametric or nonparametric analysis. Composite variables were created for the direct measures and as data for most of the constructs was skewed, median and frequencies were used to describe the data, and non-parametric tests were appropriate [19].

To examine the influence of demographic variables a series of bivariate tests (Mann-Whitney U for gender; Kruskal-Wallis for educational qualification, work location and setting; and Spearman’s rho for years’ experience) were carried out to explore differences between groups of participants based on these characteristics. These
particular characteristics were selected after exploring the prescribing literature and using guidance from the RAA.

Inferential analysis was carried out using Spearman’s Correlation to explore the relationship of the direct and indirect measures (independent variables) with intention (dependent variable). This analysis identified the significant predictors of intention for the multiple linear regression model. A multiple linear regression model was used due to the ordinal nature of the data and lack of normality [20]. The purpose of the regression analysis was threefold. Firstly, to establish the overall fit of the model i.e. could the RAA predict intentions when applied to this behaviour. Secondly, to understand the relative importance of the determining factors and beliefs on intention; using intention as the dependent variable and the direct measures of attitude, perceived norms, moral norms and PBC as the predictor variables and then again using intention as the dependent variable and the beliefs being the independent variables. Finally, regression was used to assess the influence of each predictor with a view to designing an intervention to change the most powerful predictor. If multicollinearity was suspected a stepwise regression was employed to remove highly correlated predictors from the model.

The final part of the study mapped the key RAA behavioural determinants found in this study to the constructs in the Theoretical Domains Framework (TDF) [22]. This framework contains 33 behaviour change theories with domains mapped to evidence-based interventions. The second stage then mapped these domains to techniques judged to be appropriate in changing each construct domain using the mapping tool designed by Michie et al. [23].

The study was approved by Glasgow Caledonian University, School of Health and Life Sciences Ethics Committee (REF: HLS/NCH/14/16) and NHS Research and Development Department (REF: IRAS/177949).
Results

The Phase two study found the questionnaire to be both valid and reliable. The face validity of the questionnaire was improved by rewording one of the questions, based on comments from participants, and adding “normally” and “tend to” to acknowledge the individual nature of patients presenting with an URTI, based on test-retest reliability findings and participant comments. Six items measuring attitude and one measuring PBC were removed after internal consistency testing and finally items with a different direction of positive/negative responses were changed so that all measured in the same direction.

In Phase three, the total number of participants was 184. 'A priori' power calculation [21] demonstrated that 160 participants was sufficient to power the study. Table I shows that 159 (86·4%) were female and educational qualifications ranged from Diploma to PhD. Respondents had a variety of years’ experience working as a NIP and unsurprisingly the majority worked in the community since it was expected that patients with an URTI would initially present to this setting.

Intention to manage patients without prescribing an antibiotic was measured using a composite variable of three Likert items; “I expect to…” , “I want to…” and “I intend to manage patients presenting with an URTI without prescribing an antibiotic”. Results found that, with a median of six (Likert scales of one to seven), NIPs intend to manage patients, presenting with an URTI for the first time, without prescribing an antibiotic. Only 21.7% (n=40) of participants had an intention score of four or less, leaving 78·3% (n=144) with an intention greater than four, agreeing with the statements that they intended/wanted/expected to manage patients without prescribing an antibiotic.
Composite scores were calculated for the predictor constructs of attitude, perceived norm, moral norm and PBC. All median scores were above 5.5 demonstrating that participants had a positive attitude, felt no guilt, felt positive social pressure and felt in control when managing patients without prescribing.

Individual belief scores were calculated for the indirect measures of attitude (behavioural beliefs and outcome evaluations), injunctive norms (injunctive belief strength and motivation to comply), descriptive norms (descriptive belief strength and identification with the referent) and PBC (control beliefs and perceived power) and when combined all medians were positive.

Results demonstrated that although all constructs entered into the regression contributed to intention, perceived norm, moral norm and PBC were most influential (Table II).

Perceived norms (whether NIPs perceived that important others approved or expected the behaviour) was the most significant predictor. Moral norm (whether NIPs perceived the behaviour was morally wrong) and PBC (whether NIPs perceived themselves able to carry out the behaviour) were the next most significant predictors in explaining NIPs’ intentions to manage patients without prescribing an antibiotic.

Although the greatest predictors of intention had now been identified, it is at the level of beliefs that insight into people’s decisions and actions can be gained. Therefore, their underlying beliefs of perceived norm and PBC were regressed with intention (moral norm did not have any underlying beliefs) to identify the most important constructs to target with behaviour change interventions. Having other NMPs’ approval (p=0.007) and wanting to behave like other nurse prescribers (p=0.045), were significant normative beliefs. The significant control beliefs were NIPs’ experience and confidence (p<0.001), and pressure from patients/carers to prescribe (p=0.010) (supplementary information).
How these key determinants influence nurse prescribing behaviour in the context of the RAA are summarised in Figure 2.

Although the study found that NIPs intend to manage patients presenting with an URTI without prescribing an antibiotic, it is important to explore how these significant beliefs can be used to form the basis of future interventions targeting nurse prescribing behaviour for two main reasons. Firstly, to ensure that the beliefs that facilitate this behaviour continue in future populations of NIPs and that the beliefs that are barriers to this positive behaviour do not prevent this intention becoming an actual behaviour. These significant determinants were therefore mapped to the constructs in the Theoretical Domains Framework (TDF) [22] and then to evidence-based behaviour change techniques [23] (Table III).

An intervention will be most effective if it targets the component that carries most weight in predicting intentions [16]. Hornick and Woolf [24] add that, as well as being strongly related to intention, there must also be enough people who do not already hold this belief to merit trying to change it. Therefore, the significant beliefs were explored to establish if any had enough people who did not hold this belief. Patient or carer pressure was the significant belief which most participants thought made them less likely to manage patients without prescribing an antibiotic. Sixty six percent of participants (n=121) said this pressure was likely to occur and 32% (n=59) participants said this would make them less likely to manage patients without prescribing an antibiotic. It would therefore appear that this may be an important belief on which to focus a behavioural intervention.

Discussion

To the authors' knowledge this is the first study to use a theoretical framework to explore NIPs' antibiotic prescribing behaviour using quantitative methods to measure NIPs'
intention to manage patients presenting with an URTI without prescribing an antibiotic. Findings demonstrate that NIPs do intend to manage patients without prescribing an antibiotic. This is consistent with one previous smaller qualitative study that indicated the majority of NIPs would not prescribe antibiotics for an URTI [25].

The influence of social pressure from NMPs (including nurse prescribers) was shown to be a crucial factor in influencing NIPs intention to manage patients without prescribing an antibiotic. If NIPs felt that other NMPs thought they should manage patients without prescribing and that their approval was important to them, they were more likely to manage them without prescribing. If they felt that other NIPs intended to manage patients without prescribing and they wanted to be like them when it came to their prescribing, then again they were more likely to manage patients without prescribing. The influence of positive social pressure was also discussed in the literature when dealing with the challenges of patient consultations [25]. An informal peer group with other nurse prescribers was central to the success of nurse prescribing in a Trust in England [26] and in another study, focussing on antibiotic prescribing behaviours, findings showed that nurses identified with their own clinical group [27]. This suggests that NIPs should continue to use peer support from other NMP colleagues to aid in their prescribing decisions and reflect on and share their practice with their peers to build confidence in new prescribers. Both peer support and positive role-modelling are potential areas for changing behaviour and in supporting new prescribers.

Experience and confidence positively influenced, and perceived patient/carer pressure negatively influenced, NIPs’ control over their behaviour. Confidence was highlighted as influential in one study of nurse antibiotic prescribing [25], and in studies of nurse prescribing of other drugs [28,29]. Experience was also a finding in a smaller study of nurse prescribers [30]. Since the role of independent prescribing is an additional qualification, which nurses in the UK achieve after they have gained considerable
professional experience, it is difficult to assert whether it is the experience of prescribing, or their experience as a nurse that influences their prescribing. Although, the number of years’ experience as a prescriber did not have any effect on intention in the regression analysis, therefore it may be experience as a nurse rather than as a prescriber that influences this belief. This is noteworthy because nurses may be expected to prescribe much earlier in their career in the future [31].

Patient or carer pressure was the significant belief which most participants thought made them less likely to manage patients without prescribing an antibiotic. Similarly, patient pressure was the most frequently discussed factor in the Phase 1 interviews. The importance of this is supported by other nurse prescribing literature which found patient pressure to be an influencing factor in antibiotic prescribing [32, 33] and a challenge [25]. There were many reasons given in the interview data for this pressure; patients’ previous experiences of receiving an antibiotic from a medical prescribers leading to the expectation that they would receive an antibiotic again, patients’ beliefs that antibiotics would make them better, patients returning for another appointment for the same condition, and patients thinking that nurses were not as good as GPs. However, the descriptive findings from this study found that the majority of nurses did not succumb to this pressure. Providing information and reassurance, using safety netting such as delayed prescribing or follow-up appointments, and providing education were all ways of avoiding prescribing, in line with that reported previously [25, 34].

The information gained from mapping the findings to the TDF suggest that there are a variety of techniques which could be used to further enhance NIP behaviour. To address pressure to prescribe, guidance about strategies to manage these expectations such as safety netting, education, symptom management and empowering patients to self-manage, along with protected time to deliver these should be a priority for training and education. Other interventions could address the influence of positive peer pressure from
other NMPs. Dissemination of these findings to trainee NIPs, and having peer support and role modelling [35, 36] embedded in the culture, would support new prescribers. Learning from their peers and identifying nurse prescriber opinion leaders could help promote confidence in NIPs’ prescribing behaviour [37]. A third focus could be on changing NIPs’ beliefs about their capability through interventions such as mastery [38, 39], feedback and stress reduction.

This study has some limitations. Self-reporting was used to measure intention and its determinants which has weaknesses. Although participants may still have felt that they had to respond in a socially acceptable way, by giving what they thought was the “correct” response, the use of telephone, rather than face to face interviews, and an anonymous online survey were adopted to minimise social desirability bias. Secondly, the same participants who took part in Phase one and two of the study may have also taken part in Phase three, which may have affected their later intended behaviour. Thirdly, a lack of national data made it impossible to examine the representativeness of the sample against the current Scottish NIP population. Finally, due to the sampling technique used, and the fact that it was dependent upon voluntary participation, it is vulnerable to non-response bias and no data was collected on non-responders.

Conclusion

This multi-phased, mixed method study has established robustly for the first time that NIPs intend to manage patients presenting with an URTI for the first time, without prescribing an antibiotic. Significant influences, specific to this group of prescribers included pressure from patients/their carers to prescribe an antibiotic. This pressure has been a finding in the medical prescribing literature but the emphasis on NIPs having time and strategies to manage patients’ expectation is a unique finding from this study, which
along with the positive influence from other NMPs can be used to inform the design of an intervention.

The numbers of NMPs internationally are increasing annually and further countries are considering adopting this model of care [40]. The key role of nurses in transforming service delivery, and the Nursing and Midwifery Council’s new standards, which state that nurses should be able to demonstrate the ability to progress to a prescribing qualification following registration [31], mean there has never been a better time to highlight the influences on NIPs’ antibiotic prescribing behaviour. Interventions, based on the findings of this study, should be developed to ensure all NIPs are prescribing appropriately. There is a real global opportunity for nurses to make a difference to AMR through their prescribing practice.

Conflict of Interest Statement: None

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References


23. Michie S, Johnston M, Francis JJ, Hardeman W, Eccles MP. From theory to intervention: mapping theoretically derived behavioural determinants to behaviour


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Table II: Intention and all the constructs (direct and indirect): Regression

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<td>Std. Error</td>
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<td>Perceived Norm</td>
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<td>Social process of encouragement, pressure and support; modelling/demonstration of behaviour by others</td>
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<td>Environmental changes Stress management, coping skills Social process of encouragement, pressure and support; modelling/demonstration of behaviour by others</td>
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<td>Beliefs about capabilities</td>
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<td>processes of encouragement, pressure, support; self-talk; feedback; motivational interviewing</td>
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Figure 1: The Reasoned Action Approach

Figure 2: Greatest determinants of intention for NIPs managing patients, presenting with an URTI for the first time, without prescribing an antibiotic

<table>
<thead>
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<th>Significant individual beliefs</th>
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<tr>
<td>Other nurse prescribers</td>
<td>Perceived control over the behaviour</td>
</tr>
<tr>
<td>Experience &amp; confidence</td>
<td>Intention to manage patient without prescribing an AM</td>
</tr>
<tr>
<td>Patient/carer pressure to prescribe</td>
<td>Moral norm</td>
</tr>
</tbody>
</table>