

ORIGINAL ARTICLE

Attack context: an important mediator of the relationship between psychological status and asthma outcomes

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Background: The importance of psychosocial variables in asthma is increasingly recognised, although attempts to relate these to asthma outcomes often produce only weak relationships. This study aimed to identify whether such relationships might be obscured by the effects of recent asthma experience on psychological status.

Methods: An adult community sample of 37 patients who had suffered a recent attack of asthma and 37 with stable asthma were given measures of panic fear and control confidence. The relationship with subsequent emergency service use was examined using two way ANOVA and correlational analyses. Covariate influences (psychiatric morbidity, age, sex, treatment level, asthma duration, social status) were considered.

Results: Control confidence predicted emergency service use in different ways for recent attack and stable asthma patients. This interaction was highly significant ($F(1,69) = 10.32, p < 0.005$) with high confidence relating to an increased risk of an attack in the recent attack group and low confidence relating to increased risk for the stable asthma group. There was also an interaction between panic fear and attack context ($F(1,69) = 11.05, p < 0.005$) with low panic fear resulting in more attacks for recent attack cases.

Conclusions: Attack context (having a recent attack) is an important mediator of psychological status. Strong cognitive/affective responses to attacks may motivate improved self-care and this represents a window of opportunity for self-care interventions. Weak cognitive/affective responses to attacks may reflect denial and require different intervention approaches. For those with recently stable asthma the relationships are qualitatively and quantitatively different, and the implications for intervention are also discussed.

The role of psychosocial variables in influencing asthma self-care and asthma outcomes is of increasing interest. Previous studies have related negative asthma outcomes (morbidity, mortality, service use) to emotional status in terms of depression,^{1,2} panic fear (attack related anxiety),^{3,5} and denial.^{6–8} Cognitive factors including patient confidence about asthma control (or, conversely, perceived vulnerability to attacks) have also been linked to asthma outcomes.^{3,9} However, attempts to predict asthma outcomes from psychological indicators have typically explained relatively small amounts of the variance^{9–11} and have sometimes produced contradictory results. In one study both high and low panic fear were related to re-admission to hospital following treatment.¹² Similarly, both high and low confidence about asthma control have also been related to negative asthma outcomes.^{9,13}

One possible explanation for this is that intervening factors are acting to obscure the nature of such relationships, and one such factor may be situational context. In particular, the course of asthma is punctuated by attacks, and these traumatic events might influence measures of psychological status. Asthma attacks often involve high levels of panic fear,¹⁴ and having frequent attacks is associated with subsequent low confidence about asthma control.³ Hence, the “attack context” in terms of both whether an attack has occurred recently and the historical frequency of attacks may affect psychological status. Despite this, when studying relationships between psychological status and asthma outcomes little account is usually taken of the patient's recent experience.

By taking attack context variables into account, it may be possible to improve our ability to predict asthma outcomes. Improving our understanding of the role of psychological fac-

tors in contributing to the course of asthma—for example, via their effects on medication adherence^{13,15}—would also help to target and design interventions to improve asthma outcomes.

The aim of this study was therefore to investigate whether taking attack context into account improves the prediction of asthma outcome (emergency service use) from psychological variables. It should be noted that this work was conducted within the context of a wider study which aimed to identify qualitative and quantitative differences between recent attack and stable asthma patients.

METHODS

Study design

A prospective cohort study compared outcomes in a “recent attack” group and in “stable asthma” controls. Patients were given measures of psychological status at baseline and were divided into high and low scoring groups based on these scores. Emergency service usage over the following 12 months was then related to psychological status and attack context.

The potential covariate influences of age, sex, treatment level, asthma duration, education, home ownership, occupational status, time spent working, having a partner, and prior depression and anxiety were examined using ANCOVA analyses.

Sample

An opportunity sample of 37 “recent attack” patients from two semi-rural surgeries (population 18 990) who had suffered asthma attacks during the 20 months from October 1997 were recruited. Of these, 17 made GP appointments, 11 presented without appointment, eight presented at a local hospital, and one at the district general hospital. An attack

was defined as an increase in symptoms resulting in a non-routine GP or hospital visit and leading to either nebulisation, addition of steroid tablets, increased preventer medication, or trial of a new medication. The treatment criteria provided a check that the visit involved significant asthma morbidity.

A control group of 37 patients with stable asthma (no attacks in the previous 2 years) were individually selected to match the recent attack cases as closely as possible in terms of age, sex, and BTS treatment level.¹⁶ For more severe cases (BTS steps 4 or 5) the criterion for stable asthma was relaxed to "having no attacks for 12 months, with no more than one attack in 2 years" (in comparison, recent attack cases at BTS steps 4 and 5 had a mean (SD) of 3.4 (0.55) attacks in 2 years).

Stable asthma patients were selected from practice lists of patients identified as ever having asthma. However, only patients considered to have active asthma (including uptake of medication in the last 2 years) with a duration of at least 3 years were included. Patients were excluded if they were pregnant, taking corticosteroids for other illness, or if their GP had other objections.

Measures

Medical history

Emergency service use

Attack frequency (as defined above) was assessed from practice records for 2 years before and 1 year after interview. Attacks over 3 weeks apart were counted separately.

Psychiatric morbidity

Pre-existing morbidity for depression and anxiety was assessed from practice records. Caseness was recorded if the condition had been clinically referred or treated in the last 3 years.

Measures of psychological status

Panic fear

The seven item panic fear scale of the asthma symptom checklist¹⁴ indicates the frequency of fear symptoms experienced during attacks. The scale has been widely used and validity and reliability are reasonably well established.^{11, 18}

Asthma control confidence scale (ACCS)

A purpose made scale was created to assess confidence about future asthma control. Guidelines for producing self-efficacy scales¹⁸ were used to produce a measure of confidence in the face of various challenges. This consisted of four items asking: "How confident are you that you can keep your asthma under control . . .?" followed by either "on a day to day basis", "when you have a cold or flu", "when you are very busy or under stress" and finally "How likely is it that your asthma will remain under control over the next few years?". Responses were given on a five point scale with only the extremes labelled (not at all, very much so). The scale is undergoing psychometric testing but preliminary results show good internal reliability ($\alpha > 0.85$; $N = 250$), a good range of scores (4–20), high item total correlations (0.62–0.77), and a strong correlation ($R > 0.6$, $p < 0.01$) with the Perceived Control of Asthma Questionnaire¹⁹ which was published after this study began.

Demographic data

Data were collected on duration of asthma, presence of a live in partner/spouse, home ownership, time spent working (full time, part time, none), and years in secondary education. Social status was assessed using the OPCS social classification.²⁰

Justification of sample size

The sample was originally collected to meet the needs of the wider study. However, prior data on attack frequency for 65 randomly selected asthma patients over 3 years gave an

estimate for the common mean (0.58) and standard deviation (0.68). Using a minimum important difference of 0.5 attacks per patient per year and estimating cell means to reflect such differences allowed power calculation using nQuery software. To have 80% confidence to detect main effects of this size, using a 2×2 ANOVA requires 11 subjects per cell. To detect an interaction effect size of 1.0 attacks per year with 80% confidence using a 2×2 ANOVA requires 15 subjects per cell. It is acknowledged that the study was underpowered to detect smaller interactions, and that the detection of a large crossover interaction was fortuitous.

Procedure

GPs in the participating practices were asked to notify recent attacks to the asthma nurse who then identified two potential controls per case from a full listing of the practice's asthma patients. Patients were written to and then invited to participate by telephone. Participants were interviewed at home to collect qualitative data about their asthma, with questionnaires given at the end of the interview. Recent attack cases were interviewed 19–114 days following their attack (mean (SD) 52.4 (22.8)). Follow up attack data were collected from practice records. Casualty/hospital attendances were monitored and GPs and nurses received regular reminders via e-mail and practice meetings to log all acute asthma attendances. The data were analysed using SPSS (Version 9.0) software. The work was conducted within ethical guidelines and approved by the Exeter & District research ethics committee.

RESULTS

Of 117 patients identified, 11 were uncontactable. From those contacted (52 cases, 54 controls), 83 (78%) agreed to participate. One patient was excluded for using corticosteroids for another illness. Loss to follow up further reduced the sample to 37 cases and 37 controls. Due to time limitations at interview, some missing data were also generated and table 1 shows the numbers available for analysis. Ten patients were at BTS step 1, 43 were at step 2, and 21 were at steps 3–5.

Those included in the analysis were slightly older (mean 40.6 years) than those excluded or uncontactable (*t* test, mean difference 6.2 years (95% CI 1.3 to 11.0), $p < 0.05$). The female ratio was also significantly higher for those included (73%) than for those excluded (43%; Pearson's $\chi^2 = 9.66$, $p < 0.005$). Hence, women and older subjects were more likely to participate.

Baseline differences

The descriptive statistics and baseline differences (using independent samples *t* tests for continuous variables and Pearson χ^2 tests for categorical variables) are reported in table 1. The recent attack group were more likely to have had treatment for depression in the last 3 years (mean difference 24.3% (95% CI 5.4 to 43), $p < 0.05$) and also had significantly higher panic fear scores (mean difference 3.50 (95% CI 0.89 to 6.12), $p < 0.01$) and significantly lower control confidence (mean difference -2.66 (95% CI -3.88 to -1.45), $p < 0.001$) than the stable asthma group.

The two groups were closely matched in terms of BTS treatment level, age and sex, validating the matching procedure. The other demographic variables (education, home ownership, spousal status) were also well matched (table 1) so were not entered into ANCOVA analyses.

An ANCOVA analysis showed that the differences in panic fear and control confidence were not accounted for by the difference in depression morbidity between groups ($p > 0.1$ in both cases). Within the recent attack group, two tailed Pearson correlations revealed no significant dose-response relationships between the historical attack frequency (over 2 years,

Table 1 Descriptive properties and baseline differences between groups

| | Recent attack | Stable asthma | Total | Test statistic | No |
|---|---------------|---------------|---------------|-------------------------|----|
| Panic-fear | 18.84 (6.25) | 15.33 (4.85) | 17.11 (5.84) | t = 2.68** | 73 |
| Control confidence | 14.78 (3.09) | 17.44 (1.98) | 16.10 (2.91) | t = -4.39*** | 73 |
| Age (years) | 41.1 (13.9) | 39.6 (11.6) | 40.35 (12.73) | t = 0.52 | 74 |
| Asthma duration (years) | 16.7 (10.9) | 18.0 (9.87) | 17.31 (10.35) | t = 0.12 | 74 |
| Education (years) | 6.78 (2.25) | 6.77 (2.11) | 6.78 (2.17) | t = -0.53 | 72 |
| Occupational status† | 2.97 (1.00) | 2.70 (0.70) | 3.40 (1.45) | t = 0.86 | 73 |
| Attack frequency (last 2 years) | 2.38 (1.16) | 0.08 (0.28) | 1.23 (1.43) | t = 11.69*** | 74 |
| Attacks 1 year after interview | 0.70 (0.85) | 0.24 (0.55) | 0.47 (0.74) | t = 2.77** | 74 |
| BTS treatment level† | 2.41 (1.41) | 2.19 (0.84) | 2.30 (0.93) | t = 1.00 | 74 |
| Prior depression (%) | 35.1 | 10.8 | 23.0 | χ ² = 6.19*‡ | 74 |
| Prior anxiety (%) | 21.6 | 16.2 | 19.0 | χ ² = 0.35 | 74 |
| Home ownership (%) | 60.0 | 79.4 | 69.6 | χ ² = 2.83 | 69 |
| Work time (0=0, 1=part time, 2=full time) | 1.38 | 1.38 | 1.38 | χ ² = 0.00 | 74 |
| Partner/spouse (%) | 83.8 | 81.1 | 82.4 | χ ² = 0.93 | 74 |
| Sex (% female) | 78.4 | 67.6 | 73.0 | χ ² = 1.10 | 74 |

Values are mean (SD). * p<0.05; **p<0.01; ***p<0.001. †BTS level (5 levels) and occupational status (6 levels) were treated as quasi-continuous variables for comparison purposes. ‡Pearson (two sided) χ² test used throughout.

Table 2 Emergency service use for attack context and control confidence groups

| Attack context | Control confidence | Mean (SD) no of attacks at 12 months | No |
|----------------|--------------------|--------------------------------------|----|
| Recent attack | Low | 0.50 (0.71) | 26 |
| | High | 1.18 (0.98) | 11 |
| | Total | 0.70 (0.85) | 37 |
| Control | Low | 0.55 (0.82) | 11 |
| | High | 0.12 (0.33) | 25 |
| | Total | 0.25 (0.55) | 36 |

Table 3 Emergency service use for attack context and panic-fear groups

| Attack context | Panic-fear | Mean (SD) no of attacks at 12 months | No |
|----------------|------------|--------------------------------------|----|
| Recent attack | Low | 1.23 (0.83) | 13 |
| | High | 0.42 (0.72) | 24 |
| | Total | 0.70 (0.85) | 37 |
| Control | Low | 0.13 (0.34) | 23 |
| | High | 0.38 (0.77) | 13 |
| | Total | 0.22 (0.54) | 36 |

but excluding the recent attack) and either panic fear or control confidence. This implies that the effects found are responses to the recent attack rather than reflecting longer term attack history. The time elapsed since attack was also found to have no significant correlation with either panic fear or control confidence within the recent attack group.

Prediction of asthma outcomes

The sample was split into high and low scoring groups for both control confidence and panic fear using median splits. Two way independent sample ANOVA analyses were then performed with attack frequency (12 months after interview) as the dependent variable. The influence of all the potential covariates (age, sex, treatment level, asthma duration, education, home ownership, occupational status, time spent working, having a partner, and prior depression and anxiety) was then examined by separate two way ANCOVA analyses. This was necessary because, although some variables were well matched between the attack context groups, they were still free to vary between the psychological status groupings.

Control confidence

There was no overall effect of control confidence on future emergency service use (p>0.4), but the recent attack group had significantly higher service use than the stable asthma group (mean difference = 0.45 attacks/year (95% CI 0.16 to 0.85), p<0.005; table 2).

There was a significant interaction between attack status and control confidence (F(1,69) = 10.32, p<0.005) showing that the relationship between confidence and emergency service use was significantly different for the two study groups. For recent attack cases high confidence corresponded with increased emergency service use. For stable asthma controls high confidence corresponded with lower service use.

Of the possible covariates, only BTS treatment level produced a significant mediating effect (p<0.001) but taking account of this did not remove the interaction (adjusted F(1, 68) = 7.74, p<0.01) or the main effect of having had a recent attack (adjusted mean difference = 0.47 attacks/year (95% CI 0.17 to 0.77), p<0.005).

Panic fear

There was no main effect of panic fear (p>0.05) but the recent attack group had higher emergency service use than controls (mean difference = 0.48 attacks /year (95% CI 0.25 to 0.89), p<0.005; table 3).

There was a significant interaction between recent attack status and panic fear (F(1,69) = 11.05, p<0.005), again indicating different relationships for the two study groups. For recent attack cases low panic fear corresponded with increased emergency service use while, for controls, the same response corresponded with lower service use.

Treatment level was again the only significant covariate (p<0.001) but taking account of this did not account for the interaction effect (adjusted F(1,68) = 8.00, p<0.01) or the main attack-context effect (adjusted mean difference = 0.49 attacks/year (95% CI 0.20 to 0.77), p<0.005).

Combining the risk factors

It could be argued that high confidence is merely the opposite of low anxiety (indicated by panic fear). However, although control confidence and panic fear were moderately correlated (Pearson R = -0.50, p<0.001), the patients with high confidence were not always the same as those with low panic fear. Only seven of 37 recent attack cases had both low panic fear and high confidence, whereas 17 met either one or the other of these conditions.

DISCUSSION

The finding that patients seem to respond to attacks with changes in psychological status (panic fear and confidence) has implications for asthma behavioural research which are discussed before interpretation of the follow up data.

Attack context influences psychological status

Patients with recent attacks had significantly higher panic fear and lower control confidence than those with recent stable asthma. No dose-response relationship was found with historical attack frequency, time since attack, or any other significant covariate influences.

Asthma severity is not considered to be a likely explanation for these effects. It could be argued that controlling for treatment level is not a sufficient proxy for asthma severity. However, if underlying severity were the cause of higher panic fear and lower control confidence, then these same responses should be associated with increased attacks over the following year, especially in the recent attack group. The follow up data showed that this was not the case. Further support for a non-severity explanation comes from the recent work of Nouwen *et al*³ who compared high frequency emergency room attenders and a stable asthma group (also matched for age, sex, and corticosteroid level). They found differences in asthma self-efficacy and panic fear, despite no differences in objective indicators of asthma severity (FEV₁ reversibility and FEV₁ response to methacholine challenge). It is recognised that asthma severity is likely to influence asthma related psychological status, but it is merely argued that the effects of asthma severity are well controlled here (and in Nouwen's study) by case matching for treatment level, and that severity differences cannot explain the effects found.

One further possibility is that a substantial number of attacks were caused by anxiety hyperventilation⁴ rather than by physiological causes. However, if this were the case, one would expect high panic fear to increase the risk of future attacks but the follow up data for the recent attack group contradict this hypothesis.

The explanation that recent attacks have transient effects on patients' anxiety and confidence therefore seems both intuitively reasonable and the best explanation available. Although this conclusion might seem entirely predictable, attack context is rarely considered in studies linking psychological status to asthma outcomes, and this may help to explain the sometimes contradictory results found in the previous literature.^{9 12 13} In particular, the responses of patients from hospital-based samples may be influenced by the existence of recent attacks.

Prediction of future attacks

When the data for both the recent attack and stable asthma groups were pooled, no differences in future emergency service use were detected between the panic fear and control confidence groups. However, when the groups were considered separately, the significant interactions indicated diametrically opposed relationships with emergency service use for the two groups. Following a recent attack, patients with high confidence in their control were more likely to make acute contact, but the opposite was true following a history of stable asthma. Patients with low panic fear also had higher emergency service use following a recent attack, but not following a history of stable asthma.

Attack context (in terms of having a recent attack) does therefore seem to mediate the relationship between psychological status and future emergency service use. Treatment level was the only significant covariate, but taking this into account did not explain the effects found.

Possible explanations: recent attack group

In the recent attack group both high confidence and low panic fear corresponded to an increased risk of attacks. These

responses may reflect a longer term tendency for patients to minimise the importance of their asthma, and this would be consistent with previous studies linking denial with poor asthma outcomes.⁶⁻⁸

For the lower risk groups (low confidence, high panic fear) it is possible that a strong emotional reaction to the attack, or a sudden decline in confidence, could motivate patients to change their self-care behaviour. This would be consistent with the risk adaptation model of behaviour change²¹ which suggests that experiences of health vulnerability lead to "teachable moments", making the subject more amenable to suggestions to alter their health behaviours.

The idea that improved self-care can be motivated by attack experiences is supported by other studies. At least one asthma self-care intervention²² has found that, although intervention did not work in the community, a sample of patients recently admitted to hospital responded with a fivefold drop in readmission rates. Other recent work²³ has found an increase in regular preventer use (OR = 2.3) for patients hospitalised with asthma during the previous 12 months.

Possible explanations: stable asthma group

Here the relationships were qualitatively different from those for recent attack cases. Patients with higher control confidence and lower panic fear had fewer acute attendances. This may be explained by the idea that, following a period of stable asthma, high confidence is an appropriate response and perhaps helps to maintain existing effective self-care. This interpretation is supported by data from community based or outpatient samples (where the incidence of recent attacks is relatively low) which indicate that, in these populations, high confidence relates to reduced emergency service use and morbidity.^{9 24}

Low confidence following apparently stable asthma may reflect a higher incidence of subclinical asthma episodes (those not requiring emergency intervention). Alternatively, low confidence about one's strategies for asthma control may lead to inconsistent self-care behaviours. High panic fear in this group may also be indicative of a susceptibility to anxiety exacerbations of asthma.⁴

Potential implications for care

If the above interpretations are true, then patients suffering asthma attacks should be seen soon afterwards with a view to discussing changes in their self-care strategies. The results suggest that the cognitive and emotional responses persist for up to 3 months following an attack (time since attack did not correlate with psychological status), and this may provide a reasonable window of opportunity for intervention.

Those with high confidence or low panic fear following an attack may first need to be persuaded that their situation is serious and that their current self-care strategy is not working. Such advice would need to be phrased carefully to avoid unduly increasing anxiety. Previous literature suggests that low fear risk messages, given alongside a clear action plan (for example, a written self-management plan) are as effective as high fear risk messages alone.²⁵

Patients with stable asthma and low confidence still have a substantial risk of attack and therefore should not be excluded from self-care interventions, while stable asthma patients with high confidence (reflecting a successful history of self-care) may benefit from positive affirmation of their existing behaviour.

Limitations of this study

The study has potential problems with the reliability and generalisability of the data. The group sizes in the two way analyses were relatively small and relate only to two semi-rural surgeries. The non-continuous and skewed nature of the attack rate data also stretch the assumptions of the ANOVA model to some extent.

Hence, the interaction effects should be treated as preliminary data which, although indicating some interesting and plausible effects, need replication and confirmation. The interpretations should also be considered as hypotheses needing further investigation rather than firm conclusions, although they are partly supported by external evidence.

The findings on baseline differences are more robust, being based on the comparison of variables with reasonably normal distributions between larger and well matched groups.

Some of the measures used to assess covariates were not ideal. The use of more objective assessments of asthma severity would have been desirable to further exclude an asthma severity explanation. The use of practice data to assess the extent of prior depression and anxiety is also sub-optimal as this is likely greatly to underestimate the actual prevalence²⁰ and does not indicate severity. Prospective questionnaire-based measures would therefore have been more desirable, although this was not feasible with the study design used.

Future directions

It would be desirable to replicate the findings in ways which address the limitations of the current study. It would also be useful to clarify how asthma status, psychological responses, and self-care behaviours interact over time, and to determine the persistence of any changes in behaviour. Assessing attack severity could also help to confirm the hypothesis that the trauma of attack is the main driver of change in subjects who have suffered recent asthma attacks.

Identifying the role of other psychological factors—for example, goals relating to asthma, illness representations—in motivating self-care behaviours might provide more detailed indications for tailoring and targeting interventions to optimise care. In particular, the role of depression in determining self-care and asthma outcomes may need more detailed investigation.

Conclusions

Despite the acknowledged limitations, this study raises some interesting hypotheses as to how psychological responses to the course of asthma may influence self-care and asthma outcomes, and how taking “attack context” into account may improve our understanding of the relationships involved.

If, as seems likely, the relationship between psychological status and asthma outcome is fundamentally different for recent attack patients and those with stable asthma, then patient self-care might be improved by developing different interventions depending on the patient’s attack context and on their responses to this situation. In particular, high confidence or low panic fear in response to attacks seem to predispose to greater use of emergency services in the future.

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