

1 Patient experience, understanding and self-management of
2 asthma attacks: a qualitative study
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19 **Authorship statement:**

20 MJM and MB conceived and designed the study. AP and MJM acquired the data for the
21 study. All authors contributed to data analysis, drafting and reviewing, and final approval of
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Abstract

Rationale

Asthma attacks (AA) are potentially life-threatening complications of asthma associated with high levels of morbidity, mortality and rising healthcare costs. Patient experience, impact and understanding of AA is poorly described in the literature. Enhanced understanding will identify unmet needs in asthma care and support the development of improved personalised strategies for managing and preventing attacks.

Objective

To explore patients' experiences and understanding of AAs, the impact of AAs on their lives and self-management strategies during attacks.

Methods

Single centre (UK) qualitative semi-structured interview study with 30 patients who recently had asthma attacks (≤ 4 weeks). Data were analysed using the framework approach.

Results

The patient experience and impact of AA varied, including recognising an impending attack. Variation in patients' self-management behaviours during AAs was observed and was influenced by prior experience of attacks and care received for these and other life priorities. Several behaviours previously recognised as contributory to asthma deaths, including short-acting β -agonist (SABA) overuse, poor recognition of the risk of adverse outcomes, and delay in seeking medical help, were identified and reported. Most patients had a poor understanding of AAs and their management.

Conclusions

This study describes the differing impact of AA on patient experiences and understanding of asthma attacks. These differences, combined with healthcare factors and attack characteristics, affect patient self-management approaches. These findings highlight unmet needs in asthma attack care.

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Background

Asthma affects over 300 million people worldwide and 5.4 million people in the UK^{1,2}. Exacerbations of asthma (asthma attacks (AA)) are responsible for high levels of morbidity, mortality and healthcare costs in the UK, with 6.4 million AA-related primary care consultations and 93,000 hospital admissions per year.³⁴ However, the direct impact of these important events on patients' lives, experiences, and understanding of asthma attacks is unclear.

Asthma attacks are increasingly recognised to be biologically heterogeneous events.^{5,6} With different triggers, onset, and severity. However, beyond the recording of symptom scores during attacks⁷ or patient-reported triggers or onset.⁸ Few studies have attempted to describe patient experiences of AAs in detail; hence, the degree of variability in this experience is unknown.

Current self-management strategies during worsening asthma are centred around the use of personalised asthma action plans (PAAPs), which are based on the recognition of certain symptoms combined with measurements of lung function, such as peak flow.^{9,10} Unfortunately, PAAPs are under prescribed and often underused by patients.¹¹

Therefore, the recognition and a greater understanding of how patients experience attacks and how these experiences inform self-management is crucial. We believe these are important initial steps that could influence and shape modernised care for patients with AA, including the development of tailored strategies for attack management and prevention. This qualitative study aims to explore patients' experiences and understanding of AAs, the impact of AAs on their lives and how these factors influence patients' self-management strategies for attacks through interviews with patients who have experienced a recent asthma attack

Methods

Study design

This is a single-centre study. Qualitative data was generated through semi-structured interviews. Semi-structured interviews are a common methodology used for qualitative research, involving the use of open-ended questions that generated further points of discussion during the interview.^[13]

Study recruitment

Potential study participants were identified from a hospital in the Midlands following admission for AA or from outpatient clinics. Individuals were approached by the authors (AP and MJM) in the 4-week period following an attack, given study information and the opportunity to ask questions. Those who expressed an interest in the study were recontacted within 1-2 weeks following the attack to arrange consent and the interview visit. A purposeful sampling approach was used to consider asthma severity, duration of asthma, attack frequency, attack severity, and patient demographics (gender, age, ethnicity). For inclusion in the study, participants had to be ≥ 16 years of age, speak English, have a previous clinician diagnosis of asthma and have had a recent (≤ 4 weeks) clinician diagnosed AA as

per the ATS/ERS definition, i.e. ≥ 3 days of systemic corticosteroid (SCS) treatment (or an increase from a stable maintenance dose of SCS lasting ≥ 3 days)³. Written informed consent was obtained prior to the interviews. Reassurance was provided by the researcher to patients that any responses provided would not in any way influence current or future care within the healthcare setting.

Interview questions and data collection

The interview questions (Supplement 1) were developed by the research team consisting of qualitative researchers (LJ, MB) and respiratory physicians with qualitative training (AP, MJM). Questions were generated based on the research aims, and with consultation from the Patient and Public Involvement group based at the hospital, who sense-checked questions and modified wording. Two pilot interviews were conducted, after which minor changes to the interview guide wording and structure were made; both transcripts were included in the main analysis. This minimised possible confirmatory biases that could have been introduced by seeking diverse perspectives from several stakeholders. Also, the questions developed were open ended and allowed the patients to direct the flow of conversation

AP and MJM conducted interviews by telephone or in person (adhering to local COVID-19 guidance) between September 2020 and November 2021. These authors were not directly involved in the care of study participants. In-person interviews took place in a private clinic room.

Interviews lasted 45 – 75 minutes and continued until data saturation was reached. Prior to the start of the interviews, Baseline demographic data and a brief medical history, including relevant comorbidities and current asthma medication, were collected. Results of previous investigations supportive of asthma diagnosis and subjects' history of AAs in the preceding 12 months (including courses of SCS) were confirmed from electronic health records. Participants received a £10 e-voucher as a token of appreciation for their participation.

Data Analysis

Data was analysed using an inductive framework approach, guided by participants' responses using open-ended questions.^{14 15} (Supplementary Figure 1)

Interviews were digitally audio-recorded, assigned a unique code, and transcribed verbatim by a University of Nottingham-approved external transcription company that signed a non-disclosure agreement. After receiving the transcripts, they were checked and de-identified (by MJM and AP).

Three of the study team (MJM, APJ, LJ) familiarised themselves with the first four transcripts and carried out line-by-line coding, and personally reflected upon their findings before meeting to discuss the initial codes generated and then grouping these codes according to similarities. At the same time, these transcripts were separately coded by another member of the team (MB), and similarities between both interpretations were assessed, therefore creating the “provisional framework” for which further transcripts would be coded. This step was repeated with a further set of transcripts, incorporating any new codes generated from subsequent interviews into the overarching themes. All researchers met again to discuss and agree upon a set of themes that would make the “agreed framework”. The agreed framework was then applied and refined following analysis of the remaining transcripts by MJM and AP.

Data was indexed according to the final framework using NVivo 12 software. Finally, transcripts were charted according to each theme to facilitate synthesis and interpretation. In line with the framework approach, data was then indexed according to the final framework and interpretations

were then performed by the researchers using matrix generation in NVivo (MJM, AP) and reviewed by LJ and MB, resulting in the final report (Supplementary Figure 2).

Quantitative analysis

Patient characteristics are described in frequencies and percentages with continuous variables presented as mean +/- standard deviation for parametric and median +/- interquartile range for non-parametric variables.

Results

Patient characteristics

Thirty-seven patients were approached for the study, of whom 30 consented and completed an interview. Participants were mostly female (73%), with a mean age of ~50 years and a median asthma duration of ~21 years (Table 1). Most participants were Caucasian (83%). Fourteen of the participants had severe (Global Initiative for Asthma Step 5) asthma, and 14 were 'frequent' exacerbators with ≥3 attacks in the last year. The majority used SABA as reliever therapy.

Qualitative Themes

Four themes are presented below with selected excerpts from interviews (Boxes 1-4) alongside study ID, age, gender and number of attacks in last year: **1) Experience of asthma attacks 2) Impact of asthma attacks 3) Self-management of asthma attacks 4) Understanding of asthma attacks**. A thematic map including identified themes and sub-themes was produced (Supplementary Figure 3).

1) Experience with asthma attacks

Participants were often able to recognise triggers for asthma attacks (table 2). Those who reported allergen-triggered attacks generally reported faster onset times (~1 day) than those identifying triggers related to exercise and stress (3.75 days) and infection (8 days).

Cough was the most common initial symptom of an attack with shortness of breath and wheeze usually described later. Recovery time varied, with almost a third of participants reporting they were not back to their baseline after 4 weeks and some reporting respiratory symptoms beyond the course of therapy provided. Some unfortunately noticed a permanent reduction in lung function (1a, 1b).

The experience of an asthma attack varied among those interviewed. Almost half described similar patterns of symptoms (e.g. dry cough then progressing to worsening shortness of breath and wheezing) with each attack, which varied in clinical severity or onset time (1c-f). Such participants could recognise another attack developing from prior experiences. However, a few found it difficult to distinguish developing attacks from other causes of worsening symptoms such as viral infections and as such, would delay self-management strategies such as escalating treatment or seeking help from healthcare professionals (HCPs).

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1a: *this attack has left me not as well, I would say, as what I normally am. I don't seem to have the energy levels that I normally have* (02, 80 F, 1 attack in last year)

1b: *I still don't feel like I've got back to normal since I've come out of hospital. Whether that's how my lungs are now or, because I feel like when I have a really bad episode, I feel like I drop a little bit each time* (19, 45 M, 10 attacks in last year)

Previous experiences of attacks

1c: *The flare up will start and then I never know whether it's going to be medium or large as I call it.* (04, 58 F, 1 attack in last year)

1d: *There's two sorts of attacks. There's attacks where I don't have an infection and there's attacks where I have an infection. And I always used to start with a cold.....I start to get some mucus, I'm coughing more. I generally feel more unwell in myself. I'll be either hot or sweaty or perhaps a bit of a temperature* (12, 75 F, 6 attacks in last year)

1e: *I think they vary. If I have got a chest infection with asthma, I think it's different to having asthma without a chest infection.....with a chest infection you're coughing and coughing up gunk.....I think you feel more poorly when you've got an infection as well.* (29, 49 F, 3 attacks in last year)

1f: *I ended up in hospital in Z once, because we went to visit a friend of mine who had six cats..... At that particular time I think I was in his house two or three hours, and I was off to the hospital.* (05, 45 M, 1 attack in last year)

Box 1: Illustrative quotes from Theme 1: Experience of asthma attacks

2) Impact of asthma attacks

Most patients described attacks as 'annoying' or 'depressing' (2a, 2b). All of these participants had had previous attacks and the majority had attacks of moderate severity.

By contrast, those experiencing a first attack described these as 'terrifying' 'scary' or 'really worrying' and a couple of patients with previous attacks who had severe or life-threatening attacks feared they might die (2c, 2d). All these patients had severe or life-threatening attacks and almost all were unaware an attack was developing.

Some patients said attacks did not affect them emotionally and a few had learned to be as 'calm' as possible and not panic to help themselves cope throughout the experience despite being admitted to hospital for severe or life-threatening attacks (2e).

Nearly all subjects described fatigue post-attack. This took longer to resolve than all other symptoms and, in some cases, had not improved 3-4 weeks after the attack (2f, 2g). The degree of fatigue did not seem to be related to the severity of the attack or age.

Several subjects felt embarrassed or judged by others due to coughing or changes in voice in public venues and this was especially heightened during the Covid pandemic (2h).

211 Nearly half of all participants described becoming more withdrawn in the period following an attack
 212 (2i, 2j). Some patients with longstanding/severe asthma described more serious long-term
 213 consequences to their social lives of repeated attacks including apprehension of attending social
 214 events, feelings of 'missing out' and jealousy that they couldn't participate in social activities with
 215 friends (2k).

Emotional Impact

2a: *It annoys me more than gets me down. I think it annoys me more than anything because I can't do what I want to do.* (16, 62 M, 4 attacks in last year)

2b: *It makes me feel down. I do feel a bit depressed* (30, 62 F, 1 attack in last year)

2c: *It was really frightening because I'd never experienced anything like this to this degree. I thought I was going to die because I really couldn't breathe.* (13, 24, F, 2 attacks in last year)

2d: *I did ask the nurse if I was dying. I really thought I wasn't going home. [Emotional] The whole experience was scary.* (21, 46, F, 1 attack in last year)

2e: *I go through the whole thing just being as calm as I could possibly be, because in that way you actually cause yourself less stress with it all.* (05, 45, M, 1 attack in last year)

Functional Impact

2f: *I'm normally very, very active, and I don't find, in the daytime I don't seem to have the energy levels that I normally have..... it has left me with this energy problem, which I've never had before.* (02, 60, F, 1 attack in last year)

2g: *I felt really run down and tired and that took me longer to get over, I'm still catching up with things. You know like catching up with washing or just general housework or something because I was so poorly and then because I've been so tired since* (03, 42, F, 2 attacks in last year)

Social Impact

2h: *it's really embarrassing as well when you're around people and you cough and it doesn't sound very nice, and it always makes me feel really self-conscious and really aware of other people and it's even worse now with Covid that everyone looks at you when you cough* (17, 42, F, 3 attacks in last year)

2i: *I don't want to see nobody I just stop in my bedroom* (07, 54, F, 1 attack in last year)

2j: *doing normal things sometimes feels like a real strain. So sometimes you just take the easy way out and don't do it, don't go out or whatever, because you know it's going to be difficult.* (19, 45 M, 10 attacks in last year)

2k: *There's a lot of things that my friends go off and do that I don't partake in.....I never know when I'm going to be feeling well enough to do things with them, so if they've planned a trip to go somewhere it's not something that I'll be comfortable doing because I'm not sure how well controlled my asthma's going to be....I'm missing out on a lot. It makes me jealous that I'm not able to do the same things that they are or get involved with the same activities.* (22, 59, F, 1 attack in last year)

Box 2: Illustrative quotes from Theme 2: Impact of asthma attacks

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220 3) Self-management of asthma attacks

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222 In order to abort AA many patients increased their inhaled treatments to try and relieve symptoms
223 without obvious reference to a plan when their asthma worsened (3a). Some had PAAPs but did not
224 refer to these when unwell. They reacted to certain events with particular actions e.g. starting SCS
225 (3b, 3c), or stated particular timescales after which they would take action (3d). They often managed
226 their asthma by instinct rather than prescription (3e) or relied on unconventional treatments (3f).

227 The numbers of patients with peak flow meters and PAAPs are summarised in Table 1. Almost half
228 did not have a peak flow meter. Some patients stated they checked their PEFR occasionally during
229 periods of worsening asthma or admitted they frequently forgot to do this. Others checked their
230 PEFR but did not use the result to change their treatment or seek help even if this was low (3g).
231 Some explicitly said they put greater emphasis on symptoms or how they felt than the PEFR value
232 (3h, 3i).

233 A few patients said they did not understand what peak flow readings represented or demonstrated a
234 lack of understanding of normal values (3j, 3l). Some were unable to check PEFR when their asthma
235 deteriorated due to the difficulty in performing expiratory manoeuvres when unwell or due to
236 uncontrolled cough (3m). Those who regularly checked PEFR were aware of thresholds/action points
237 and specific actions to take (3v, 3w).

238 PAAP use did not seem to be influenced by factors such as attack frequency, asthma severity, age or
239 gender. Patients who followed PAAPs (Tab 1) had a good level of knowledge about their asthma, signs
240 of deterioration and treatments (3q). Nearly a third of patients had longstanding asthma (>21 years)
241 and had PAAPs but most of these were not using PAAPs as intended. A couple of patients felt their
242 PAAPs (which had not been regularly updated) did not accurately reflect their asthma and peak flow
243 values included as thresholds were unrealistic for everyday use (3m, 3n).

244 *Negative self-management strategies:* behaviours identified included SABA overuse, poor recognition
245 of the risk of adverse outcomes and delaying seeking medical help. Some were aware they had been
246 overusing SABA during attacks (using SABA < every 4 hours or ≥ 10 puffs), whilst others overused SABA
247 with no awareness of this (3o-3q).

248 A few patients demonstrated no/low awareness that their asthma was poorly controlled or severe
249 with frequent attacks. One participant even recognized the risk of poor outcomes associated with
250 attacks but disregarded it (3r).

251 Some participants reported trying to 'push on' 'plough on' 'sit and wait it out' or 'thought it would
252 stop' even though the majority acknowledged that improvement was unlikely (3s).

253 Barriers to seeking help during an AA hospitalisation prioritising other people/commitments, hoping
254 things would get better, trying to avoid hospitalisation or 'wasting time' of HCPs. Issues around
255 barriers to healthcare provision were highlighted with a few stating concerns about being able to get
256 appointments and some felt their GP would not be able to add anything to self-care already
257 implemented. Concerns were raised with communication between secondary and primary care
258 regarding ongoing management and some participants received conflicting information from HCPs on
259 inhaler use and dosages.

260 Patient factors including age, gender, asthma severity, attack frequency, speed of onset and coexistent
261 anxiety and depression did not seem to be associated with negative self-management habits.
262 However, patients with longstanding asthma (>21 years) seemed far more likely to have negative self-
263 management habits during periods of worsening asthma.

264 *Positive self-management attributes:* These included seeking information about asthma attacks and
265 triggers from various sources including online (3t), from respiratory nurses (3u) and regular PEFr
266 monitoring (3v, 3w).

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Ad-hoc increases in therapy

3a: *'I just increased the number of puffs. Kill or cure because like I say, I've never had it that bad before so it's like everything that I had got was going to get thrown at it, like, "Well it's not going to kill me, it's only steroids!'"* (09, 62 F, 3 attacks in last year)

3b: *once the cough gets really productive then I start the steroids, I up everything* (09, 62 F, 3 attacks in last year)

3c: *I took the steroids probably mid-morning when I realised that the nebulisers themselves weren't fully taking away the symptoms..... If I need to take the steroids I'll just take them.* (05, 45 M, 1 attack in last year)

Prioritizing experiential knowledge of attacks

3d: *'I would normally give myself until the end of the antibiotics which is normally a five day course. If it didn't start to improve say about day four, I'd start taking prednisolone.'* (10, 78 M, 4 attacks last year).

3e: *"I took five puffs because I knew all I needed was that. It was just an instinct I suppose in me, knowing when to do it and not."* (12, 75 F, 6 attacks last year)

3f: *If I sit up, take some blue inhaler, have a Paracetamol, have a Gaviscon, read my book for a bit. It might be for an hour or so, hopefully by that time it might just calm down.* (23, 31 F, 6 attacks in last year)

PEFR usage

3g: *"even when I look at it (peak flow reading), I don't think I really think about it."* (04, 58 F, 1 attack in last year)

3h: *"you can feel it anyway. It's a little bit moot as to what it is to be honest, it would have been bad enough."* (05, 45 M, 1 attack in last year)

3i: *"I just think, 'Oh, it's just low at the moment. I'm still getting up and going to work, so I'll carry on'"* (24, 71 F, 1 attack in last year)

3j: *'I don't really understand what it (PEFR) all represents and stuff'* (03, 42 F, 3 attacks in last year)

3k: *'I mean I know that when I get to about three I'm struggling.'* (06, 61 F, 3 attacks in last year)

3l: *"When I get really bad I can't even do my peak flow because it's really hard to blow."* (17, 42 F, 3 attacks in last year)

PAAPs not fit for purpose

3m: <i>"I know what it says but if I followed it I'd be forever going to A&E so I do ignore it a bit. I tweak it a bit.....My peak flow, I think it's if it's 190 it says to go to hospital. If I get 190 at the moment, I get excited."</i> (29, 49 F, 3 attacks in last year) 3n: <i>"if the peak flow drops to a certain level I'm supposed to increase certain things, but my peak flow never really gets to that level. And I find that my asthma doesn't fit in with the asthma plan that I've been given"</i> (30, 62 F, 1 attack in last year)
Negative self-management habits
SABA overuse 3o: <i>"I was perhaps having 30 puffs (of Ventolin) a day"</i> (29, 49 F, 3 attacks in last year) 3p: <i>"I was taking them (puffs of Ventolin) excessively for me..... I would literally go in for maybe two to four puffs every hour or so"</i> (03, 42 F, 3 attacks in last year) 3q: <i>"I probably don't count them. I'll probably just keep using it."</i> (04, 58 F, 1 attack in last year)
Poor recognition of risk of adverse outcomes 3r: <i>"I know that people die from asthma attacks. I know that. So it's me telling myself it's not serious."</i> (24, 65 F, 1 attack in last year)
Delaying seeking help 3s: <i>'I don't know whether it's some misguided belief that it's just a passing thing' 'saying it out loud now, yeah, I don't really know why I'd have waited that long to let it get that bad'</i> (27, 45 M, 7 attacks in last year)
Positive self-management attributes 3t: <i>"it's always been something that I've known about. if I've not got it from my mum who's telling me about it constantly, then the GP from when I was younger, the hospital, the respiratory nurses, so I've had more than enough information. And also I've Googled certain things as well to find out information as well"</i> (01, 28 F, 3 attacks in last year) 3u: <i>"I had a conversation with one of the nurses who said to me that sometimes leaf mould in the autumn can be a trigger for people with asthma.....I've been aware of that as a possible trigger, but obviously I try and be proactive about this, I looked on Asthma UK website and they point out that stress can be a trigger"</i> (18, 65 M, 1 attack in last year) 3v: <i>"It (peak flow) tends to drop before I get any of the symptoms, so it is handy to keep an eye on it"</i> (22, 59 F, 5 attacks in last year) 3w: <i>"I'll use it more frequently to give myself some kind of objective guide to what my chest is actually doing, rather than a simply a subjective sense of, it feels like it's not so good"</i> (18, 65 M, 1 attack in last year)

Box 3: Illustrative quotes from Theme 3: Self-Management

4) Understanding of asthma attacks

Nearly two-thirds of patients said they did not fully understand what asthma attacks are and/or how to manage them or wanted to improve their understanding. This lack of understanding linked to difficulties in recognising symptoms of AAs and delayed seeking of help in some cases.

When asked what could be done to improve asthma attack care the most frequent response was that more education should be provided (4a, 4b). Several patients felt HCPs involved in managing their asthma had given them insufficient, incorrect or conflicting advice particularly regarding escalating treatment when unwell or lacked the knowledge to educate them further (4c, 4d).

More education

4a: *"I think you should make a bit more information what an asthma attack is, because as I say, I've never had one in my life before. I was just in the dark. I just didn't know what was happening"* (11, 70 M, 1 attack in last year)

4b: *"I think there needs to be more education on how dangerous this actually is. It's a threat to people's lives"* (13, 24 F, 3 attacks in last year)

Advice received

4c: *"if it worsens I take more Ventolin than I would normally take. I've had mixed messages, I've had doctors say to me that you should use your other inhaler more often because it's got a steroid in it, that's the Flutiform inhaler."* (10, 78 M, 4 attacks in last year)

4d: *"I had been told by the practice nurse, and I don't know if erroneously, that I shouldn't be using my blue inhaler. Everybody in the hospital when I was in there said, "That's not good advice""* (18, 70 M, 1 attack in last year)

Box 4: Illustrative quotes from Theme 4: Understanding

Discussion

Our results highlight inter and intra-patient variability in the experiences of AAs. For example, a third of participants experienced onset times of less than 48 hours. Recognising differing onset times is important as this could be a point at which individualised care could be given. Patients with 'fast onset' AAs may require rapid treatment escalation with early initiation of OCS whilst those with slower onset AAs could employ different strategies such as quadrupling their ICS dose to try and abort AAs¹⁶. The benefits of person-centred care in asthma are recognised and emphasised in asthma guidelines¹⁷.

The range of emotions associated with AAs is demonstrated. Patients experiencing first-time or severe AAs described these as traumatic events, but the majority found AAs more depressing or annoying. This may help explain certain patient behaviours such as delayed seeking of help and reports of significant numbers of asthma patients in the community with frequent attacks or SABA overuse unknown to secondary care services. Our finding is that prolonged fatigue is common following AA that goes beyond the duration of medical management of an attack, which has not previously been described and is clinically relevant when assessing recovery post-attack.

Similar findings in the barriers to accessing healthcare were also identified in work undertaken by Shum et al in a cohort of 57 patients with airways disease which include accessibility to services and time constraints¹⁸. This also included using complex wording leading to the "medicalisation" of asthma that made it difficult for patients to understand their therapies and suggestive of a better need of quality healthcare interactions.¹⁸

Self-management of asthma can be complex. Asthma requires patients to recognise periods of poor control and adjust their medication accordingly. Professionals looking after those with asthma are

encouraged to empower patients when making decisions. Health behaviours made are underpinned by the principles of self-determination theory based upon the interplay of motivations, perceived well-being and personality¹⁹.

Our results demonstrate marked variation in patients' self-management behaviours during AAs. Self-management strategies were influenced by several factors including patient, healthcare and attack factors (Fig 2). There is clear RCT-based evidence of the efficacy of PAAPs in preventing AAs²⁰. However, in 'real world' practice, prescription rates of PAAPs are poor, content and discussion of these PAAPs is sub-optimal and patient usage is disappointingly low¹¹. Our results suggest that although some well informed and well-motivated patients use PAAPs as prescribed and find these useful, many patients do not use or value PAAPs. Whilst some of this is undoubtedly due to low prescription rates and inadequate poorly discussed PAAPs our findings suggest a significant number of patients value their own experiential knowledge of how to manage AAs above previous advice or PAAPs they have been given.

Patients' reliance on symptoms rather than lung function highlights the discordance between symptoms and lung function as previously reported²⁰ and would explain the low uptake of peak-flow meters identified in our work. Participants described behaviours previously recognised in the National Review of Asthma Deaths as contributing to asthma deaths, including SABA overuse, poor recognition of the risk of adverse outcomes and delay seeking medical help²². Most patients demonstrated a lack of understanding about AA, although patient education is recognised as an essential factor in effective asthma self-management. Studies which adopted different modalities in promoting self-management strategies have been of varying quality in reporting the findings of a systematic review in young adults with asthma and allergies, suggesting more work is needed.²¹

In this study, although participants were recruited from secondary care, some had AAs managed in primary care, improving the generalisability of results. Key characteristics and demographic information were obtained to put context to the responses obtained, such as asthma severity. The study was conducted over a year to incorporate the seasonality of asthma. We recruited participants with a recent asthma attack to reduce recall and responder bias.

Study limitations include recruitment of patients from one UK centre only. Asthma care, especially asthma team input regarding self-management strategies, will likely vary markedly from region to region. Though we considered and actively tried to include patients of different ages, genders, and ethnicities in the study, the experience of female and/or Caucasian patients is probably over-represented, and findings may not be transferable. As the study took place during the COVID-19 pandemic, we included questions to determine the impact of the pandemic on asthma care and/or self-management, but most patients did not feel this affected their experience of attacks.

Conclusion

This study describes the impact of AA and the heterogeneity in patient experience, understanding and self-management approaches related to attacks in unprecedented detail. Our findings have direct implications for future personalised monitoring and treatment strategies aiming to improve the persistently poor outcomes from these serious harmful events.

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410

	Frequency (%)
Mean age (years) (range)	49.6 (24-80)
Sex: female	22 (73.3)
Ethnicity:	
White or White British	25 (83.3)
Asian or Asian British	3 (10)
Black or Black British	2 (6.7)
Age of onset (years) (median, IQR)	23.5 (30.5)
Length of diagnosis (years) (median, IQR)	20.5 (37.5)
Previous hospital admissions for asthma	
Ever	22 (73.3)
In the last 12 months	17 (56.7)
1 admission	13 (43.3)
>1 admission	4 (13.3)

Unscheduled healthcare visits for asthma* in the last 12 months	25 (83.3)
Courses of SCS in the last 12 months	
1	14 (46.7)
2	2 (6.7)
3	7 (23.3)
4	2 (6.7)
5 or more	5 (16.7)
Medications	
<i>Reliever inhaled therapy</i>	
SABA	26 (86.7)
ICS LABA	4 (13.3)
<i>Maintenance asthma therapy</i>	
Fixed dose ICS	2 (6.7)
ICS/LABA	28 (93.3)
LAMA	9 (30)
Theophylline	5 (16.7)
OCS	4 (13.3)
Biologic	4 (Mepolizumab x2, Benralizumab x 1, Omalizumab x 1) (13.3)
Long term antibiotic	2 (Azithromycin x1, Doxycycline x1) (6.7)
<i>GINA¹ Treatment Step</i>	
2	2 (6.7)
3	6 (20)
4	8 (26.7)
5	14 (46.7)
<i>Co-morbidities#</i>	
Gastro-oesophageal reflux disease	10 (33.3)
Rhinitis	8 (26.7)
Eczema	9 (30)
Obesity	13 (43.3)
Obstructive Sleep Apnoea	4 (13.3)
Depression	10 (33.3)
Anxiety	12 (40)
Vocal Cord Dysfunction/Inducible Laryngeal Obstruction	3 (10)
<i>Smoking</i>	
Current smoker	5 (16.7)
Pack years (mean)	11.3
Ex-smoker	12 (40)
Pack years (mean)	9
Never smoked	13 (43.3)
<i>Self-management</i>	
Have peak flow meter:	27 (90)
Use peak flow meter	19
Aware of PEFR thresholds/action points in the self-management plan	7
Unclear about PEFR thresholds/action points	

Do not use a peak flow meter	12
Do not value or forget to use	8
Use pulse-oximeters in preference	6
	2
Prescribed PAAP‡:	
Using PAAP as prescribed	13 (43.3)
	6
Not using PAAPS as prescribed	
Unclear about action points	7
Ignore PAAPs/don't find them useful	4
Forgot they had PAAP	2
	1

ICS = inhaled corticosteroids, LABA = long-acting β -agonist, LAMA = long-acting muscarinic antagonist, OCS = oral corticosteroids, PAAP = personalised asthma action plan, SABA = short-acting β -agonist

[†]Global Initiative for Asthma inhaled corticosteroid level *Emergency Department/primary care/out-of-hours care[†] ‡Personalised asthma action plan. #Some patients had multiple co-morbidities or no co-morbidities

Table 1: Demographics and clinical characteristics of the 30 study participants

Attack Characteristics

<u>Attack Onset</u>	<u>Frequency</u>	<u>Patient Reported Triggers</u>
<24 h	6	Dust x3, Spray, Unclear x2
24-48h	4	Dust, Exercise, Chemical, Unclear
2-3 days	5	Stress x2, URTI, Unclear x2
3-5 days	1	Unclear
~1 week	5	LRTI x2, URTI x2, Unclear
≥2 weeks	9	URT, LRTI, Hay fever, Occupational, Unclear x5
<u>Attack Recovery</u>	<u>Frequency</u>	
0-5 days	8	
5-10 days	9	
10-15 days	8	
>15 days	5	
<u>Attack Severity</u>	<u>Frequency (n=)</u>	<u>Frequency according to asthma severity (n=)</u>

		GINA Step 2	Step 3	Step 4	Step 5
Moderate (received SCS, no hospital admission)	14	0	1	4	9
Severe (Hospital admission)	12	2	6	1	3
Life-threatening (ITU admission)	3	0	0	2	1

Table 2: Patient-reported attack onset times, triggers, recovery times from main symptoms of attacks (excluding fatigue) and clinical severities of the 30 asthma attacks interviewed about in the study