

Original Article

SABA Reliance Questionnaire (SRQ): Identifying Patient Beliefs Underpinning Reliever Overreliance in Asthma

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What is already known about the topic? There is a call to move away from the use of short-acting beta₂ agonists (SABA) alone to manage asthma. Many patients continue to be overly reliant on and overuse SABA. No current assessment exists to evaluate the patient-related risk of SABA overreliance.

What does this article add to our knowledge? This article presents a novel self-assessment tool—the SABA Reliance Questionnaire—to assess perceptions of SABA that can drive overreliance and overuse of SABA. The article reports on the psychometric properties of the SABA Reliance Questionnaire, providing evidence of validity and internal reliability.

How does this study impact current management guidelines? Traditional assessments of asthma control and medication use do not shed any light on the factors influencing asthma outcomes. The SABA Reliance Questionnaire can measure the patient beliefs that drive medication use and asthma control, thus informing interventions to reduce inappropriate medication use and improve control.

BACKGROUND: Patient overreliance on short-acting beta₂ agonists (SABA), with concomitant underuse of inhaled corticosteroids (ICS), is associated with poor asthma control and increased risk of asthma attacks.

OBJECTIVE: To develop and validate a brief questionnaire to elicit patients' perceptions of SABA (eg, belief that asthma is best

managed by SABA alone) that could lead them to be overly reliant on SABA.

METHODS: The 5-item SABA Reliance Questionnaire (SRQ) was adapted from the well-validated Beliefs about Medicines Questionnaire assessing patient perceptions of the importance of, and necessity for, SABA in managing their asthma. The

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Abbreviations used

BMQ- Beliefs about Medicines Questionnaire
ICS- Inhaled corticosteroid
MARS- Medication Adherence Report Scale
mTurk- Amazon Mechanical Turk
SABA- Short-acting beta₂ agonist
SD- standard deviation
SRQ- SABA Reliance Questionnaire
VAS- visual analogue scale

psychometric properties of the questionnaire were studied using Amazon Mechanical Turk, an online survey platform, in 446 people with self-reported asthma. Internal reliability and criterion-related validity were assessed on the basis of relationships between SRQ scores and other variables, including self-reported adherence to ICSs and perceived importance of reliever inhalers.

RESULTS: Internal reliability was good with Cronbach $\alpha = 0.74$. Criterion-related validity was demonstrated by an inverse correlation between SRQ scores and self-reported adherence to ICSs ($r = -0.291$; $P < .0001$), and significant correlation between SRQ scores and perceived reliever importance ($r = 0.216$; $P < .0001$), as well as by significant differences in SRQ scores between those with high and those with low self-reported ICS adherence (adherence to ICS $t = 4.825$; $P < .0001$).

CONCLUSIONS: The SRQ demonstrated acceptable internal reliability, and criterion validity, supporting its potential use as a pragmatic tool for identifying patients whose beliefs are indicative of overreliance on SABA for asthma. © 2020

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Key words: Asthma; Reliever; Short-acting beta₂ agonists; Risk; Questionnaire; Measure; Screening tool; SRQ; Reliance; Control

INTRODUCTION

Asthma is one of the most common long-term conditions worldwide, affecting more than 339 million people globally.¹ Asthma has traditionally been managed pharmacologically using 2 strategies: (1) bronchodilation, providing symptom relief using short-acting beta₂ agonists (SABA), and (2) inhaled corticosteroids (ICSs), to reduce airway inflammation and prevent asthma attacks. Recently, asthma management guidelines have taken a paradigm shift, whereby the importance of anti-inflammatory treatment—in particular ICS—in the early stages of treatment has been reinforced, but crucially, the use of SABA therapy alone is discouraged.² The recent Lancet Commission on Asthma³ and the Global Initiative for Asthma report^{4,5} both advocate for a move away from the use of SABA alone for asthma management. Although SABA provides short-term symptom relief, there is strong evidence that SABA use alone does not protect against asthma attacks, and that regular or frequent use of SABA increases the risk of asthma attacks⁴ and mortality.⁶ The negative effects of SABA overuse can be rapid—the odds of asthma-related admissions are increased by 1.45 in the 3-month period following SABA overuse—and overuse can increase asthma-related costs.⁷

Despite the risks associated with inappropriate SABA use, SABA overreliance remains common⁸ and is typically paralleled by underuse of ICSs. Indeed, ICS adherence rates are typically only 25% to 35%, thus reinforcing risks of SABA overreliance.^{5,9} This inappropriate SABA use may lead to delays in necessary medical review, and increases the risk of subsequent hospitalization and severe attacks of asthma.⁶ However, reducing SABA overreliance is challenging; it requires changes in the behavior of both clinicians (eg, avoiding prescribing SABA monotherapy for asthma, or supply of SABA monotherapy over the counter in countries where SABA is available in pharmacies as nonprescription medicines) and patients (eg, avoiding overreliance of SABA and engaging with anti-inflammatory treatments).²⁻⁴ For clinicians, this may represent a fundamental practice change from years of recommending SABA as the mainstay of reliever treatment in milder forms of asthma, to recommending anti-inflammatory reliever treatment comprising ICS and beta₂ agonists, either in a single combination or as 2 separate inhalers.

Motivating and enabling patients to reduce inappropriate SABA use also has its own challenges. Simply providing information and informing patients about the change in guidelines and asthma management is unlikely to be sufficient to change patient behavior.¹⁰ Many patients understandably feel “attached” to their SABA, mistakenly believing this to be the best way to control their asthma,^{11,12} and thus need to be convinced of their personal need to change treatments. Moreover, they may be unaware that their way of using SABA (eg, more than 3 times a week) is now considered excessive and is now considered a risk to their health.⁴ Discussions between health care professionals and patients that are designed to support patients to adjust their asthma self-management in accordance with guidelines are likely to be more effective if they take account of the patient’s perspective of asthma and its treatment, and address the underlying beliefs influencing how patients use their treatment to manage their asthma.¹⁰ Patients’ perceptions of asthma and treatment often differ from those of health care professionals.¹³ For example, many patients see asthma as a short-term episodic, rather than long-term, condition, and this perception reinforces an overreliance on SABA (for rapid symptom relief) and underuse of ICS.¹⁴ Qualitative studies of adults with asthma found that in patients with high SABA use, SABA overuse “made sense” to them, because SABA gave them the quick symptom relief they desired. High SABA users placed a higher importance on rapid symptom relief than on prevention.^{11,12,15}

Patients with such beliefs may be skeptical about switching from SABA to other asthma management strategies, such as using ICS/formoterol combinations for both maintenance and reliever therapy,¹⁶ even when such a switch is recommended by trusted clinicians acting on evidence-based guidelines. When convincing patients to use less SABA and more anti-inflammatory treatment such as ICS, it may first be necessary to identify and address potentially misplaced beliefs about the importance of SABA.^{17,18} However, the underlying beliefs influencing patient engagement with treatment are often not revealed within time-limited consultations. Therefore, for busy clinicians, the first step toward helping patients recognize the dangers of SABA overuse and change their behavior accordingly is to identify those whose perceptions of SABA place them at risk of SABA overreliance, thus identifying them for early review and intervention.¹⁹

There are currently no validated methods available to systematically assess the beliefs that are likely to drive over-reliance on SABA. The SABA Reliance Questionnaire (SRQ) was developed to assess patient perceptions of their personal need of SABA and whether they see SABA as the best way to manage their asthma. This article describes the development and validation of this new questionnaire—the SRQ—which assesses and identifies patients' key beliefs that drive SABA overreliance.

METHODS

Item development of the SRQ

Statements assessing patients' perceptions of SABA use were adapted from the 5-item Necessity Scale of the Beliefs about Medicines Questionnaire (BMQ).²⁰ The BMQ is a widely used, well-validated and reliable questionnaire that measures patients' beliefs about treatment,²⁰ particularly their personal need or concerns about treatment, and has been widely used in asthma. The statements in the 5-item BMQ Necessity Scale were adapted to generate 5 items that mapped onto the concept of personal need for SABA. The statements were chosen to reflect the beliefs likely to be associated with SABA overreliance, identified from previous research on beliefs about SABA¹² and from consensus discussions with the International Primary Care Respiratory Group. These statements were then reviewed by a multidisciplinary expert panel. The items captured the key beliefs reported in the literature that are linked with SABA overreliance.^{11,12,18} Each of the statements describes a key concept relating to SABA overreliance: symptom relief, anxiety, reliever place in therapy, benefit vs risk, and preference over controller therapy (for access to the actual wording of the items, contact author Professor Rob Horne). The original 5-point Likert response options (*strongly disagree* to *strongly agree*) were retained from the BMQ. This process resulted in the development of the SRQ (see Table E1 in this article's Online Repository at www.jaci-inpractice.org).

A 5-item questionnaire was proposed with the potential to be used for 2 purposes: (1) as a *screening* tool to identify patients who are a priority for intervention (eg, discussions with clinician) to reduce SABA overreliance, and (2) to *identify* the key beliefs driving SABA overreliance that could be targets for modification within the intervention.

In accordance with the BMQ Necessity Scale scoring, each of the 5 items of the SRQ was scored on a 5-point Likert scale, with 1 = strongly disagree and 5 = strongly agree. Total scores ranged from 5 to 25, with higher scores indicating higher necessity beliefs for SABA (ie, higher reliance on SABA).

Testing the reliability and validity of the SRQ

Participant population. Participants were recruited using the Amazon Mechanical Turk (mTurk) platform, an online participant recruitment portal where participants are invited to complete tasks requiring human involvement and are reimbursed with small monetary rewards. This method of conducting studies on mTurk has been increasingly used in research because of its cost-effectiveness, efficiency, reliability, and ability to rapidly recruit a diverse sample of participants while generating findings that appear comparable with those collected via more traditional recruitment means.²¹ In this study, participants self-selected questionnaire completion by responding to the online survey link posted on the mTurk platform, and completed a set of screening questionnaires to confirm study inclusion eligibility. The online questionnaires hosted on mTurk (see below for questionnaire descriptions) were open to participants

who self-reported a diagnosis of asthma and were at least 18 years old. In accordance with the General Data Protection Regulations, no additional demographic data were collected, to ensure a de-identified data set could be used. Participants were reimbursed US\$3 for completing the survey. According to an online review by the UK National Health Service Research Ethics Committee, no further ethical approval was deemed necessary for this study.²²

Item analysis. Descriptive analyses of each SRQ item were conducted to describe the means, standard deviations (SDs), and frequency distributions of participants' responses to each of the 5 items. This item analysis identified the percentage of respondents who responded *agree/strongly agree* to each of the 5 scale items. Frequency distributions for the whole 5-item scale were also calculated. This was based on the participants' mean SRQ scores, calculated by adding the response score for each item, then dividing by the number of items (5) to produce a mean overall score between 1 and 5.

Reliability testing. An internal reliability analysis assesses the consistency of results across items within a questionnaire, and is useful for determining the value that each respective scale item adds to the overall questionnaire. This analysis produces Cronbach α values for each scale item and for the whole questionnaire. Cronbach α values are the widely accepted measure of internal reliability (Cronbach $\alpha > 0.7$ is acceptable), and indicate how closely related a set of scale items are as a group.^{23,24} This enables researchers to determine how necessary it is to include each specific item within the questionnaire.

To assess the overall internal reliability of the SRQ, Cronbach α for the 5 items combined was calculated. This was also calculated for the remaining 4 items, with each item deleted one at a time, to evaluate each item's contribution to the internal consistency reliability of the SRQ.

Validity testing. Validity relates to evaluating whether the questionnaire measures what it intends to measure; that is, how beliefs about SABA importance influence asthma inhaler use. Because there is no "criterion standard" measure of SABA beliefs, validity for the SRQ was judged on the basis of the relationship between the SRQ and other relevant constructs (ie, criterion validity). Criterion validity assesses the extent to which a measure is related to an outcome. Specifically, Pearson correlation coefficients were calculated to explore whether there were significant relationships between the SRQ composite score (based on total participants' responses to the 5 scale items) and the following: perceived reliever importance and a self-report measure of adherence to ICS therapy.

Criterion validity. Criterion validity of the SRQ was assessed in terms of the following hypotheses.

Perceived reliever importance. Because the SRQ was developed to assess patient necessity beliefs driving SABA overreliance, it was hypothesized that higher SRQ scores would be related to higher perceived reliever importance. To assess patients' perceptions of the importance of their reliever inhaler, a visual analogue scale (VAS) was used. Participants rated importance on a scale from 0 (not important at all) to 10 (very important), in response to the question "how important is your reliever (SABA) medication?"

Second, SRQ scores were compared between participants who rated their reliever as very important (based on the VAS for perceived

TABLE I. Means and SDs of each of the SRQ's 5 scale items

Scale item—SABA concept assessed*	Mean $\pm$ SD
1. Using my reliever to treat symptoms is the best way to keep on top of my asthma	3.81 $\pm$ 1.07
2. I don't worry about asthma when I have my reliever around	3.61 $\pm$ 1.06
3. My reliever is the only asthma treatment I can really rely on	3.50 $\pm$ 1.13
4. The benefits of using my reliever inhaler massively outweigh any risks	3.63 $\pm$ 1.02
5. I prefer to rely on my reliever than my preventer inhaler	3.57 $\pm$ 1.10

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reliever importance scores of 8 and above) and those who rated their reliever as low to moderate importance. A sensitivity analysis was conducted using VAS cutoffs of 9 and above, instead of 8 and above, to see whether this would impact findings.

Self-reported adherence to ICS. SABA overreliance is generally associated with poor adherence to ICS (underuse).²⁵ As such, it was hypothesized that high SRQ scores would be associated with lower ICS adherence. The Medication Adherence Report Scale for asthma (MARS; see Table E2 in this article's Online Repository at www.jaci-inpractice.org)^{26,27} was used to assess medication-taking behaviors related to participants' use of ICS: this was adapted to produce a 9-item MARS-ICS scale. Each of the 9 MARS-ICS items represents a medication-taking behavior related to poor adherence, for example, "I only use it when I need it." These items were rated on a scale from 1 (always) to 5 (never), with higher scores indicating better adherence.

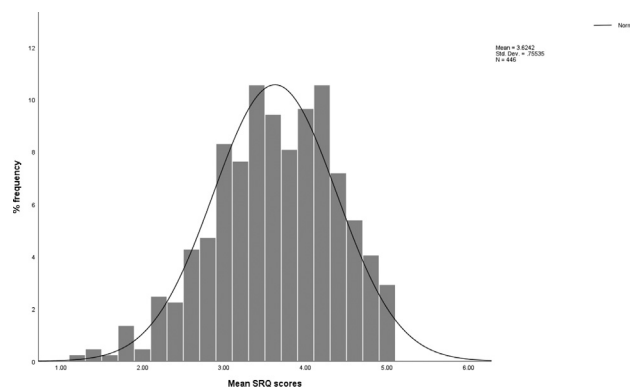
To further demonstrate criterion validity, we conducted an independent-samples *t* test to investigate whether there was a significant difference in SRQ composite scores between those with low and those with high adherence scores on the MARS-ICS. The cutoff scores for low and high adherence were determined by the sample responses to the MARS-ICS by calculating the maximum potential score on the MARS-ICS,^{26,27} and identifying those participants scoring within the highest third (ie, 31 and above) and the lowest third (scoring 24 and below), respectively. Those in the top third were considered to have high adherence; those in the lowest third had low adherence. To check whether using a different definition of high and low adherence would have an impact on the analysis, a sensitivity analysis was conducted using different MARS-ICS cutoff points; high and low adherence groups were defined as those scoring in the top and bottom 30% of the sample (as opposed to the top and bottom third).

RESULTS

A total of 446 participants completed the mTurk survey. The final SRQ contained 5 items that evaluated patients' beliefs about SABA.

Univariate analysis of scale items

Means and SDs. Table I reports on the means and SDs of the participants' scores to each of the 5 scale items in the SRQ. Higher scores are indicative of a stronger personal need for SABA.

**FIGURE 1.** Percentage frequency distributions of participants' mean scores to the overall SRQ on a 5-point Likert scale (N = 446).

Frequency distributions. Figure 1 illustrates the percentage frequency distributions of participants' mean SRQ scores for the whole 5-item scale. The mean for the sample population was 3.6, showing that participants' responses trend slightly more toward *agree/strongly agree*, indicating a higher overall risk of SABA overreliance in this sample when considering the overall SRQ score.

Item analysis of questionnaire items

Figure 2 illustrates the percentage of participants who responded either *agree* or *strongly agree* to each of the 5 scale items of the SRQ. This figure shows that agreement was high (>50% of participants) for each item. Overall, 92.6% of participants scored above the scale midpoint on the SRQ, indicating strong beliefs in their personal necessity for SABA. Item 1 (symptom relief) was the item that most participants agreed or strongly agreed with (71.8%). In contrast, item 3 (reliever place in therapy) had fewer *agree/strongly agree* responses, but still more than half the sample agreed/strongly agreed with this statement. Collectively, the participants' agreement with the statements of the SRQ showed that participants overall held high necessity beliefs about their reliever medication, that is, had high perceptions of personal need for SABA treatment in managing asthma (Figure 2).

Internal reliability analysis

Overall, the SRQ demonstrated good internal reliability (Cronbach $\alpha = 0.74$), according to George and Mallery's rule of thumb.²⁴ Table II presents that the internal reliability of the SRQ was not improved by removing any of the included scale items. This indicates that each of the 5 items was a valuable addition to the scale's overall internal reliability; that is, no items were redundant.

Criterion validity analysis

In line with study hypotheses, SRQ scores were significantly positively correlated with the VAS item "how important is your reliever (SABA) medication?" ($r = 0.216$, $P < .0001$). Those who scored highly on the SRQ, indicating higher overreliance on SABA, also perceived their SABA medication to be important (see Figure 3, A).

There was a significant difference in SRQ scores in patients who rated their reliever as very important on the VAS (≥ 8)

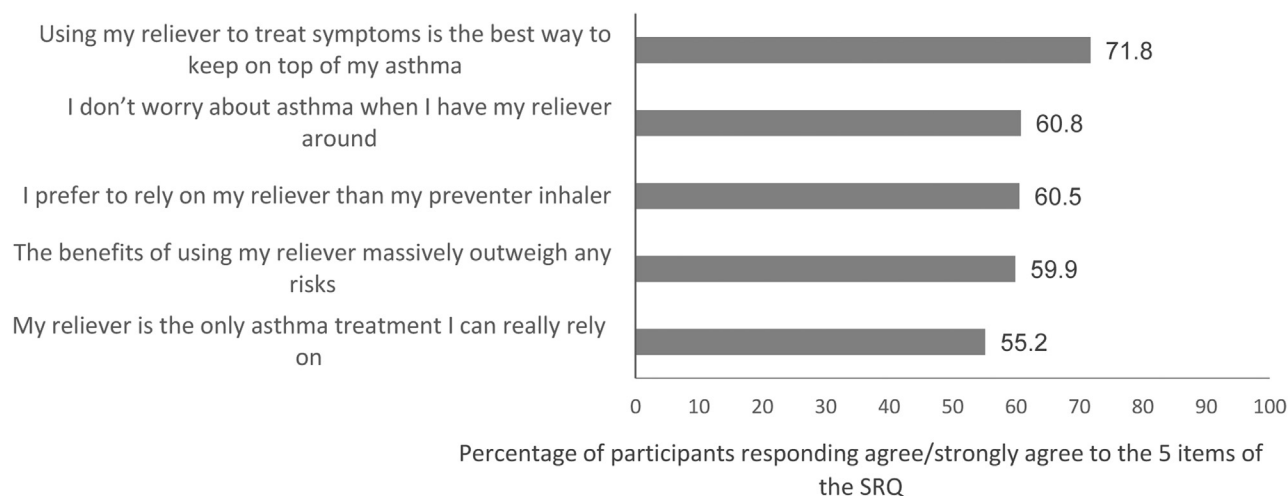


FIGURE 2. Item analysis of the 5 items of the SRQ.

versus low to moderately important (≤ 7) ($t = -5.006$, $P = .037$). Those rating their reliever as very important had higher mean SRQ scores of 18.9 ± 3.9 ($N = 241$) compared with those rating their reliever as low to moderately important, whose mean score was 17.2 ± 3.4 ($N = 205$). The sensitivity analysis conducted with “very important” (defined as importance scores of ≥ 9 on the VAS [as opposed to ≥ 8]) and “low to moderately important” (defined as scores of ≤ 8 [as opposed to ≤ 7]) gave similar significant results.

There was a significant negative correlation between SRQ and MARS-ICS (adherence) scores ($r = -0.291$; $P < .0001$), indicating that patients with stronger beliefs in the personal necessity of SABA (high SRQ scores) were significantly more likely to self-report low adherence to ICS (see Figure 3, B).

The SRQ scores were different between patients reporting high and patients reporting low adherence to ICS ($t = 4.825$; $P < .0001$). As predicted, those with low ICS adherence had significantly stronger beliefs in their personal need for SABA than those reporting high ICS adherence: mean $\pm$ SD SRQ scores for the low ICS adherence group ($N = 156$) were 19.7 ± 2.9 versus 17.6 ± 4.4 for those reporting high adherence to ICS ($N = 144$). The mean difference in SRQ scores between high and low ICS adherence groups was 2.05 (95% confidence interval, 1.21–2.88). The sensitivity analysis using the top and bottom 30% of the MARS-ICS scores as cutoffs to define high and low adherence groups showed similar results.

DISCUSSION

The SRQ is a novel questionnaire assessing patients' beliefs about SABA that might lead them to be overly reliant on SABA and thus inform health interventions to reduce inappropriate medication use and improve asthma management. This is the first article to report on the development and validation of the SRQ – a screening tool to assess patient perceptions of SABA reliever and risk of overreliance. Inappropriate SABA use is associated with worse asthma outcomes^{2,4,6} and is a key intervention target in current asthma management, as highlighted in the recent Lancet Commission on Asthma and the Global Initiative for Asthma guidelines update.^{3,4} However, tackling SABA overreliance is challenging,¹⁷ because this requires changes

TABLE II. Cronbach α of scale if scale item deleted

Scale item – SABA concept assessed*	α if item deleted
1. Using my reliever to treat symptoms is the best way to keep on top of my asthma	0.743
2. I don't worry about asthma when I have my reliever around	0.760
3. My reliever is the only asthma treatment I can really rely on	0.738
4. The benefits of using my reliever inhaler massively outweigh any risks	0.751
5. I prefer to rely on my reliever than my preventer inhaler	0.732

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in patients' behaviors, which are influenced by their beliefs about SABA.^{11,12} An important first step toward tackling inappropriate SABA use is identifying patients who are at risk of overusing SABA. This SRQ is the first tool to systematically and pragmatically assess and identify beliefs that put patients at risk of SABA overreliance. It captures the key findings from the current literature on SABA and insights from practice about the patient beliefs that seem to drive SABA overreliance.^{11,12,28–30} The resulting questionnaire summarizes literature findings and is based on the structure of the BMQ—a well-validated and widely used measure of treatment beliefs. This brief 5-item questionnaire can be used pragmatically to systematically assess and identify patients' beliefs associated with SABA use in practice.

Currently, evaluation of SABA use is limited to using prescribing and/or dispensing data, yet these data are not always easily available and may not be accurate, particularly if patients use more than 1 pharmacy, share SABA inhalers, or obtain SABA without a prescription, for example, in countries where SABA are available over the counter.¹¹ Moreover, although SABA prescribing and dispensing data may provide an indication of *how* patients are using SABA, they do not reveal *why* patients are using SABA in the way they are. This study provides the first evidence to support the use of the SRQ as a potential tool to identify key beliefs about SABA that may need to be addressed if

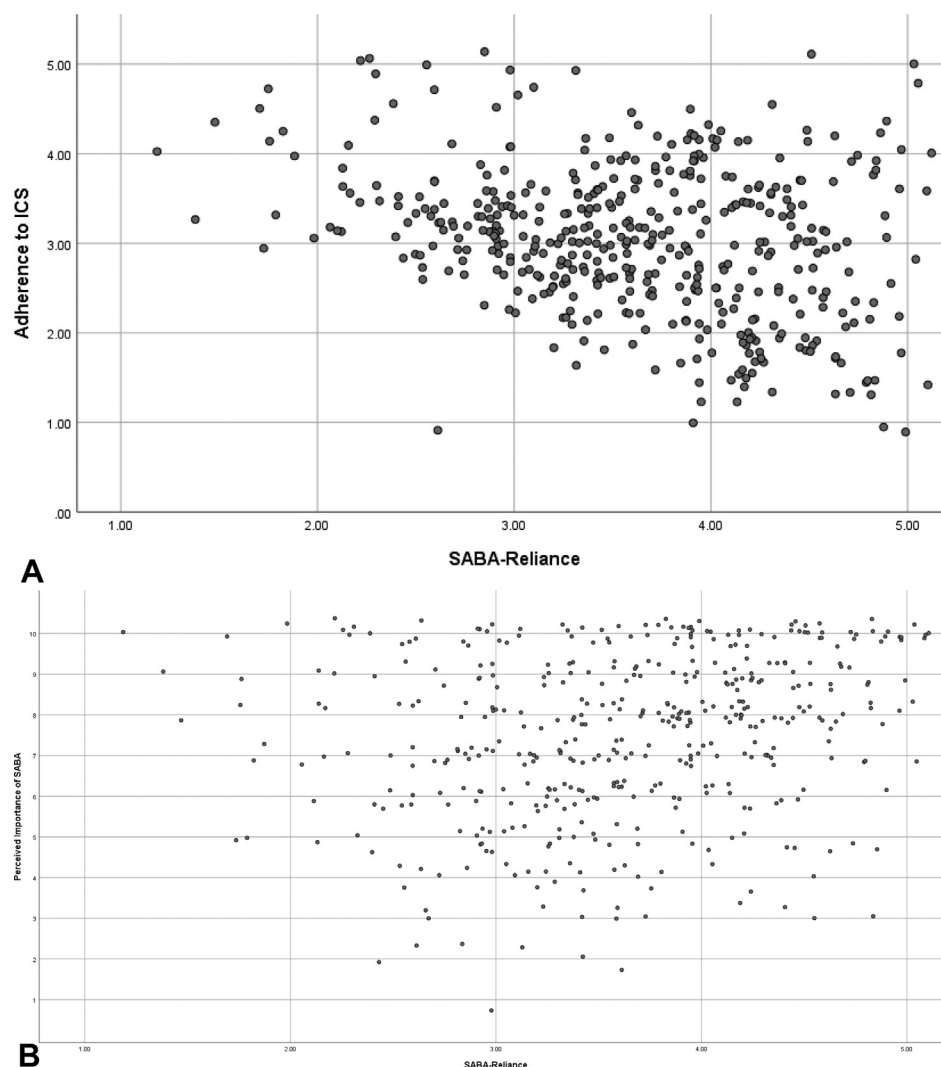


FIGURE 3. (A and B) Scatterplots showing (A) the association between perceived importance of SABA and reliance on SABA, and (B) the association between adherence to ICS and reliance on SABA. Higher adherence (MARS-ICS), higher SABA overreliance (SRQ), and higher perceived importance of SABA (VAS) are indicated.

patients are to be persuaded to reduce their SABA overreliance. The SRQ provides clinicians a brief, pragmatic way to systematically assess the beliefs that underpin SABA overreliance, thus facilitating clinician–patient discussions on what could be targets for intervention in a way that is tailored to the patient. The SRQ can be used with other tools, such as medication possession ratios or other information about patterns of SABA use, to provide insights into the reasons behind SABA overuse, thus informing interventions to modify inappropriate SABA use. For example, the International Primary Care Respiratory Group has developed a “SABA slide rule” as a practical tool to stimulate conversations about SABA use.³¹ The SRQ can be used with the slide rule by taking the conversations initiated with the slide rule further, and exploring the reasons why the individual is overreliant on their SABA.

This study found that the SRQ can differentiate between those with high and those with low ICS adherence. In patients with high SRQ scores, indicative of higher personal need for SABA and risk of overreliance, the risk of poorer ICS adherence

may be higher. This is in line with the hypothesis that patients who rely highly on SABA do so because of a high perceived personal need for rapid symptom relief, and potentially fears using their ICS due to adverse effects with steroids. In this case, using SABA rather than ICS makes more sense, leading to SABA overreliance and ICS underuse.^{2,11,12,18} The potential use of the SRQ in practice is 3-fold: (1) as a screening tool, to identify patients at risk of SABA overreliance based on overall SRQ scores; (2) as an assessment tool, to identify the key beliefs unique to the individual that drive SABA overreliance, based on responses to the individual SRQ items; and (3) as a proxy measure of ICS adherence, which can be confirmed using validated measures of adherence such as the MARS-ICS.

Because the SRQ provides both quantitative (numerical measure of SABA overreliance risk) and qualitative information (about the beliefs driving overreliance), it can be used to monitor and measure changes over time in patients’ beliefs. However, because this study was cross-sectional, as is common with questionnaire validation studies,^{32,33} further research using the

SRQ longitudinally is needed to determine test-retest reliability, how SRQ changes over time, and the predictive validity of the SRQ in relation to SABA use and outcomes.

Initial findings suggest good internal reliability and criterion validity; however, the correlations in the criterion validity analyses were low. This is potentially due to most respondents scoring higher than the midpoint on the SRQ, and the self-reporting nature of the questionnaires used to establish criterion validity. In the absence of a more specific measure of SABA overreliance, our measures of criterion validity were limited to 2 constructs that we hypothesized would be associated with SABA overreliance (ie, adherence to ICS as measured by MARS-ICS, and perceived importance of SABA). Although there is a well-documented relationship between adherence to ICS and SABA use, the direction of this relationship is not consistent in the literature. Some patients may still have a high reliance on SABA but maintain high ICS adherence; for these patients, any relationship between the 2 variables would counter the direction of the hypothesized relationship. Similarly, we used a VAS as a self-reported measure of perceived SABA importance. Again, we did not expect a strong correlation because the item is potentially confounded by some patients who may rate their SABA as very important and rely on it too much, but others may rate it as important but use it judiciously—these people within the sample would pull the findings in the opposite direction to the hypothesized relationship. In addition, because the MARS-ICS and VAS rely on self-reporting, there is a risk of bias. This may have resulted in the small *r* values observed. Although these *r* values would not usually be considered acceptable for proving criterion-related validity, as a preliminary test, we have accepted a smaller *r* value as an indicator of validity in the absence of a more specific measure of SABA overreliance. Further measures of criterion validity are now warranted. More detailed evaluations of the SRQ using objective estimates of actual SABA inhaler use are needed to confirm these initial findings.

Further work is also needed to establish SRQ-score cutoff points above which the patient is identified as “overreliant.” However, these findings provide encouraging early evidence that the SRQ does what it sets out to measure (as shown by its validity) and does so in an internally consistent way (reliability). As with any survey, there is the limitation that the asthma diagnosis could not be confirmed using objective measures because the diagnosis was self-reported. Demographic information, such as asthma severity, treatment information, and duration of diagnosis, was also not known. Because treatment information was not included in the eligibility screening, some respondents may not have received controller treatment before. There may also be differences in SABA overreliance risk between patients on a fixed-dose, combination controller inhaler and patients on ICS only. Further evaluation of the SRQ in clinical samples, and exploration of SRQ scores in patients on different treatment regimens is needed to confirm its validity and reliability in other asthma populations. Because the SRQ was developed in English and SABA overreliance is a global problem, the SRQ will need testing and adapting for use in other countries and cultural settings to consider local variations, such as differences in availability of SABA, what SABA is referred to as locally (eg, reliever vs rescue medication), and different cultural responses to risk.

Future research assessing these parameters is needed to provide more information on the reliability, validity, and potential applications of the SRQ. Nevertheless, our data from this online sample provide preliminary evidence on the use of this tool in assessing the beliefs that underpin SABA overreliance. The SRQ

enables direct capture of the patient’s voice because it is patient self-reported, and allows clinicians to address the beliefs self-identified through the SRQ beyond a simple numerical measure of SABA overreliance risk.

CONCLUSIONS

The SRQ is a novel questionnaire that assesses patients’ beliefs underpinning SABA overreliance. The SRQ demonstrated acceptable internal reliability, and criterion validity. This supports its usefulness as a tool in asthma care, by identifying beliefs that may put patients at risk of SABA overreliance, and flagging those individuals who would benefit from an asthma medication review and behavior change intervention to shift their beliefs about SABA. The SRQ is designed to help patients reflect on how they perceive SABA relative to controller therapy, and to make them aware of attitudes that might lead them to be overly reliant on their SABA. This questionnaire could be used as part of asthma consultations, where health care professionals can screen patients for SABA overreliance, and target behavior change interventions to those at the highest risk, in a way that is individualized to the patient’s beliefs about SABA. The SRQ can support discussions between patients and health care professionals to assist in breaking the cycle of SABA over-reliance. This thus represents an important first step toward addressing the global issue of inappropriate SABA use.

REFERENCES

1. Global Asthma Network. The Global Asthma Report 2018. Auckland, New Zealand: Global Asthma Network; 2018.
2. O’Byrne PM, Jenkins C, Bateman ED. The paradoxes of asthma management: time for a new approach? *Eur Respir J* 2017;50:1701103.
3. Pavord ID, Beasley R, Agusti A, Anderson GP, Bel E, Brusselle G, et al. After asthma: redefining airways diseases. *Lancet* 2018;391:350–400.
4. Global Initiative for Asthma. Global strategy for asthma management and prevention. Fontana, WI: Global Initiative for Asthma; 2019.
5. Reddel HK, FitzGerald JM, Bateman ED, Bacharier LB, Becker A, Brusselle G, et al. GINA 2019: a fundamental change in asthma management: treatment of asthma with short-acting bronchodilators alone is no longer recommended for adults and adolescents. *Eur Respir J* 2019;53:1901046.
6. Patel M, Pilcher J, Hancox RJ, Sheahan D, Pritchard A, Braithwaite I, et al. The use of beta2-agonist therapy before hospital attendance for severe asthma exacerbations: a post-hoc analysis. *NPJ Prim Care Respir Med* 2015; 25:14099.
7. FitzGerald JM, Tavakoli H, Lynd LD, Al Efraij K, Sadatsafavi M. The impact of inappropriate use of short acting beta agonists in asthma. *Respir Med* 2017;131: 135–40.
8. Labrecque M, Laurier C, Champagne F, Kennedy W, Pare M, Cartier A. Effect of age on the conformity rate to short-acting beta-agonist use criteria in asthma. *J Asthma* 2003;40:829–35.
9. Boulet LP, Vervloet D, Magar Y, Foster JM. Adherence: the goal to control asthma. *Clin Chest Med* 2012;33:405–17.
10. Kelly MP, Barker M. Why is changing health-related behaviour so difficult? *Public Health* 2016;136:109–16.
11. Reddel HK, Ampon RD, Sawyer SM, Peters MJ. Risks associated with managing asthma without a preventer: urgent healthcare, poor asthma control and over-the-counter reliever use in a cross-sectional population survey. *BMJ Open* 2017;7:e016688.
12. Cole S, Seale C, Griffiths C. ‘The blue one takes a battering’ why do young adults with asthma overuse bronchodilator inhalers? A qualitative study. *BMJ Open* 2013;3:e002247.
13. Price D, Fletcher M, van der Molen T. Asthma control and management in 8, 000 European patients: the REcognise Asthma and Link to Symptoms and Experience (REALISE) survey. *NPJ Prim Care Respir Med* 2014;24:14009.
14. Halm EA, Mora P, Leventhal H. No symptoms, no asthma: the acute episodic disease belief is associated with poor self-management among inner-city adults with persistent asthma. *Chest J* 2006;129:573–80.

15. De Simoni A, Horne R, Fleming L, Bush A, Griffiths C. What do adolescents with asthma really think about adherence to inhalers? Insights from a qualitative analysis of a UK online forum. *BMJ Open* 2017;7:e015245.
16. Beasley R, Weatherall M, Shirecliffe P, Hancox R, Reddel HK. Combination corticosteroid/ β -agonist inhaler as reliever therapy: a solution for intermittent and mild asthma? *J Allergy Clin Immunol* 2014;133:39-41.
17. Østrem A, Horne R. Reducing asthma attacks: consider patients' beliefs. *NPJ Prim Care Respir Med* 2015;25:15021.
18. Lycett H, Wildman E, Raebel EM, Sherlock J-P, Kenny T, Chan AHY. Treatment perceptions in patients with asthma: synthesis of factors influencing adherence. *Respir Med* 2018;141:180-9.
19. Horne R, Chapman S, Parham R, Freemantle N, Forbes A, Cooper V. Understanding patients' adherence-related beliefs about medicines prescribed for long-term conditions: a meta-analytic review of the Necessity-Concerns Framework. *PLoS One* 2013;8:e80633.
20. Horne R, Weinman J, Hankins M. The beliefs about medicines questionnaire: the development and evaluation of a new method for assessing the cognitive representation of medication. *Psychol Health* 1999;14:1-24.
21. Mortensen K, Hughes TL. Comparing Amazon's Mechanical Turk platform to conventional data collection methods in the health and medical research literature. *J Gen Intern Med* 2018;33:533-8.
22. Central Office for Research Ethics Committees. Governance arrangements for research ethics committees. 2018. Available from: <https://www.hra.nhs.uk/planning-and-improving-research/policies-standards-legislation/governance-arrangement-research-ethics-committees/>. Accessed August 9, 2020.
23. Streiner DL. Starting at the beginning: an introduction to coefficient alpha and internal consistency. *J Pers Assessment* 2003;80:99-103.
24. George D, Mallery P. SPSS for Windows step by step: a simple guide and reference. 11.0 update. 4th ed. Boston: Allyn & Bacon; 2003.
25. Tavakoli H, Mark Fitzgerald J, Lynd LD, Sadatsafavi M. Predictors of inappropriate and excessive use of reliever medications in asthma: a 16-year population-based study. *BMC Pulmon Med* 2018;18:33.
26. Cohen JL, Mann DM, Wisnivesky JP, Horne R, Leventhal H, Musumeci-Szabó TJ, et al. Assessing the validity of self-reported medication adherence among inner-city asthmatic adults: the Medication Adherence Report Scale for Asthma. *Ann Allergy Asthma Immunol* 2009;103:325-31.
27. Chan AHY, Horne R, Hankins M, Chisari C. The Medication Adherence Report Scale (MARS-5): a measurement tool for eliciting patients' reports of non-adherence. *Br J Clin Pharmacol* 2020;86:1281-8.
28. Hand C. Developing a questionnaire to measure patients' beliefs about inhaler treatment: a pilot study. *Prim Care Respir J* 1998;6:40-3.
29. Hand CH, Bradley C. Health beliefs of adults with asthma: toward an understanding of the difference between symptomatic and preventive use of inhaler treatment. *J Asthma* 1996;33:331-8.
30. Hand C, Morley S, Adams M. Patients' beliefs about inhalers: are they compatible with the optimal use of inhalers for the prevention and relief of asthma? *Asthma Gen Pract* 2000;8:9-11.
31. The Primary Care Respiratory Society. Asthma Right Care (ARC) Slide Rule 2019 [updated December 23, 2019]. Available from: <https://www.pcrs-uk.org/asthma-right-care>. Accessed December 23, 2019.
32. Lavrakas PJ. Encyclopedia of survey research methods. Thousand Oaks, CA: Sage Publications, Inc; 2008.
33. Kesmodel US. Cross-sectional studies — what are they good for? *Acta Obstet Gynecol Scand* 2018;97:388-93.

ONLINE REPOSITORY

TABLE E1. The 5-item SABA Reliance Questionnaire*5-point Likert scale with 1 = strongly disagree and 5 = strongly agree*

1. Using my reliever to treat symptoms is the best way to keep on top of my asthma
2. I don't worry about asthma when I have my reliever around
3. My reliever is the only asthma treatment I can really rely on
4. The benefits of using my reliever inhaler massively outweigh any risks
5. I prefer to rely on my reliever than my preventer inhaler

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TABLE E2. Medication Adherence Report Scale**Views about using your preventer inhaler***5-point Likert scale ranging from Always to Never*

1. I only use it when I need it
2. I only use it when I feel breathless
3. I decided to miss out a dose
4. I try to avoid using it
5. I forget to take it
6. I alter the dose
7. I use it as a reserve, if my other treatment doesn't work
8. I use it before doing something which might make me breathless
9. I take less than instructed

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