Assessing and addressing barriers towards MDI use in acute asthma exacerbations at a tertiary pediatric ED in the United Arab Emirates

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Asthma is one of the most common causes of emergency department (ED) visits in children. Therapy delivered through a meter dose inhaler with spacer (MDI + S) is equally as effective as nebulization in mild and moderate asthma exacerbations but was not routinely prescribed in the ED at the largest tertiary center for pediatrics in the United Arab Emirates (UAE). Phase 1 of this cohort study involved a validated survey to evaluate physicians’ knowledge, attitudes and perceptions towards MDI therapy. While 62% of physicians reported that MDI + S was equally effective as nebulizers and 82% believed that they had sufficient knowledge with regard to its use, only 28% prescribed it. Perceived barriers to change of practice included: Lack of clinical practice guidelines (CPG), poor knowledge amongst nurses and physicians, caregivers’ reluctance and a difficult prescription process. Phase 2 consisted of administering the same survey after completing interventions to address the aforementioned barriers. Comparisons were made between the subgroups within phase 1 and statistically significant differences were noted with a p value <.05. The number of physicians who prescribed MDI + S increased from 28% to 41% (p value = .046). Moreover, physicians who believed that convincing parents to use MDI + S therapy would be easy, increased from 35% to 66% (p value < .0001). In conclusion, more physicians reported prescribing MDI + S in Phase 2 while concerns about barriers that exist to change in practice remained similar in both phases showing that consistent and prolonged advocacy is required to achieve long-term compliance.

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1. Introduction

Asthma is the most chronic illness in children worldwide. The global burden of asthma is increasing [1]. Moreover, asthma exacerbations are one of the most common causes of emergency department (ED) visits in children [2].

Studies have shown that bronchodilator administration in the nebulized form is equally as effective as through an meter dose inhaler with spacer (MDI + S) for the management of mild to moderate asthma exacerbations [3]. Cochrane states that MDI + S use can shorten patient stay in the ED, reduce treatment costs and is a more conveniently administered treatment modality [2,3]. MDI + S is also known to lower the risk of developing side effects, including tachycardia and tremor [3]. Furthermore, patient compliance is reported to improve with MDI + S because of the fast and easy administration, and the quick resolution of symptoms [4,5].

Asthma is a considerable health problem in the UAE. In 2010, a local survey found that 53% of the children missed school days because of an asthma exacerbation, while 11% also required hospitalisation [6].

The aim of this study was to assess physicians’ knowledge and attitudes towards the use of MDI + S in the ED for the management of asthma exacerbations in children, at Sheikh Khalifa Medical City (SKMC), which is UAE’s largest paediatric tertiary care facility. We hypothesised that nebulized therapy remains the mainstay of
therapy for mild and moderate acute asthma in our institute. We also hypothesised that the use of MDI + S therapy in the ED may be enhanced by improving staff awareness using targeted interventions.

All physicians caring for paediatric patients in the ED were invited to participate. Initial survey data were analyzed and then used to develop strategies addressing perceived barriers. Strategies included methods to increase awareness through physician education and the expansion of available resources such as a clinical practice guideline (CPG). Upon the completion of the targeted interventions, physicians were resurveyed to assess for potential changes in their knowledge and attitudes towards MDI + S in the ED.

2. Methods

Data collection was divided into two phases between January 2019 and January 2020 and conducted over a six-week period each time. A validated survey was used with permission from the primary authors to assess participants’ approach to treat mild and moderate asthma exacerbations in children aged 1–18 years [7]. Mild and moderate asthma were defined as per the Global Initiative for Asthma guidelines (GINA), as wheeze and/or increased work of breathing without supplemental oxygen requirement [8].

All physicians involved in paediatric care were invited to participate. At SKMC, this includes residents training in General Pediatrics, Emergency Medicine and Family Medicine as well as attending physicians and postgraduates, who are called specialists, who practice in General Pediatrics and in the ED.

IRB approval was obtained from the SKMC ethics committee. A letter of informed consent prior to the survey outlined study objectives and explained that participation was voluntary and anonymous. Participation was anonymous to increase physician contribution while reducing response bias.

The survey questions were preceded by a scenario that describes a child with typical clinical features of a mild to moderate asthma exacerbation. This was followed by 29 questions that examined participants’ approach in the treatment of such a child. Questions explored physicians’ awareness regarding current evidence related to MDI + S and their opinions regarding the impact it may have on nurses delivering the therapy and on patients’ caregivers. The third component examined perceptions with regard to barriers to change of practice. The survey ended with queries with regard to demographic data, including the physicians’ speciality and designation.

The physicians responded through an electronic platform, which was used to facilitate distribution and subsequent data collection. Weekly email reminders and departmental visits were used during both phases to increase participation. To optimise response rate, physicians were also provided the option of responding in real time during clinical duty hours through an electronic device.

The baseline survey is referred to as Phase 1. Phase 1 data were analysed to identify barriers to change and interventions were developed to target each one. First, didactic sessions were used as an intervention to inform physicians regarding the current evidence related to the use of MDI + S in the ED when treating mild and moderate asthma exacerbations, and on how to use the MDI + S. Individual teaching was conducted during physicians’ clinical working hours to increase physician awareness. Other interventions included:

1. Addressing concerns regarding parental expectations through the creation and distribution of educational handouts for the parents regarding the management of asthma while using MDI + S.

2. Addressing beliefs with regard to nurses’ inertia to change through education. ED nurses were informed with regard to benefits and the use of MDI + S. This was performed by a dedicated clinical nurse specialist. The staff was required to complete a competency assessment at the end of training.

3. Streamlining the MDI + S prescription process: Gaps were identified and a steady supply of spacers and MDI + S were made available in the ED.

4. CPG was created, including the definition of an asthma exacerbation, the use, the frequency and the mode of delivery of the medications. It was also posted on the hospital intranet and hard copies were placed at ED workstations.

The second phase was initiated once the above interventions were completed. Phase 2 refers to the survey period following the interventions.

2.1. Data analysis

Physicians were grouped and analysed in two major categories. First, junior physicians were compared to senior physicians who have completed postgraduate training i.e. residents were compared to specialists and attending physicians. Second, physicians were grouped based on their primary discipline i.e. ED physicians were compared to all others.

Only responses from completed surveys were analysed. Grouping of responses matched the survey structure with 3 major categories as follows: knowledge regarding MDI + S use, perceived impact on nurses and families and perceived barriers to change of practice. All responses using the Likert scale were dichotomised into ‘yes’ and ‘no’. The test of proportions was performed when comparing responses between subgroups and between both phases. Comparisons were made between the subgroups within Phase 1 and statistically significant differences were noted with a P value <.05. Phase 2 data were used to note for differences within subgroups before and after the interventions.

3. Results

3.1. Demographics

Total sample size and response rates were similar for both surveys (Phase 1 and Phase 2). A total of 205 physicians were invited to participate in Phase 1 and resulted in a response rate of 53%, while 207 physicians were invited to participate in Phase 2 and resulted in a response rate of 50%.

In both phases, the samples had a comparable number of physicians within the various designations and specialties. They were also equally distributed in terms of postgraduate education and ethnicity (Table 1).

3.2. Phase 1

The majority of doctors were optimistic in terms of their knowledge and skills, as they believed that MDI + S is at least as equally effective as nebulisation for the management of acute asthma exacerbations in the ED. However, approximately two thirds were concerned about side effects (Table 2). When assessing the perceived impact of MDI + S therapy on nurses and families, two thirds of physicians felt that parents will find MDI + S therapy easier. Half of the physicians thought that parents will be equally or more satisfied, while only a third of the physicians felt it will be easy to convince parents to switch from nebulized therapy to
Table 1
Demographics.

| Designation N, (%) | 109 (%) | 104 (%) | P Value |
|--------------------|---------|---------|---------|
| ED physicians      | 38 (35) | 32 (31) | .5      |
| Other physicians   | 71 (65) | 70 (67) | .8      |
| Junior physicians  | 59 (55) | 68 (66) | .1      |
| Senior physicians  | 49 (45) | 35 (34) | .1      |

Undergraduate training N, (%): 109 (104) (0.0003)

- U.A.E & Gulf Cooperation Council (GCC) 68 (62) 69 (65) .5
- Middle East other than GCC 13 (12) 14 (13) .8
- North America 7 (6) 2 (2) .1
- UK/Europe 10 (9) 8 (8) .8
- Indian subcontinent 8 (7) 7 (7) .1
- Others 3 (3) 5 (5) .5

Postgraduate training N, (%): 109 (104) (0.0003)

- U.A.E & GCC 77 (71) 76 (73) .7
- Middle East other than GCC 9 (8) 9 (9) .8
- North America 10 (9) 5 (5) .3
- UK/Europe 7 (6) 8 (8) .6
- Indian subcontinent 3 (3) 0 (0) .08
- Others 2 (2) 6 (6) .1

Table 2
Knowledge regarding efficiency/efficacy of MDI + S

| Longer length of stay | 23 (21) |
| Equal or more side effects | 70 (64) |
| Enough evidence to switch | 83 (76) |
| Equal or more efficacious | 97 (89) |
| Personal knowledge and skills | 90 (83) |

Table 3
Perceived Impact on Nurses and families.

| Easy to convince parents and patients to switch | 38 (35) |
| Toddlers will be less happy | 40 (37) |
| Belief that more of nurse’s time required | 46 (42) |
| Equal or more parent satisfaction | 53 (49) |
| More difficult for nurses | 55 (51) |
| Parents will find it easier | 70 (64) |

Table 4
Most significant barriers to change.

| Concern of increased workload | 82 (75) |
| Physicians do not believe MDI + S is as effective | 82 (75) |
| Cost | 86 (79) |
| Nurses’ inertia to change | 88 (81) |
| Absence of a physician champion | 93 (85) |
| Physicians’ inertia to change | 96 (88) |
| Lack of practice guidelines | 97 (89) |
| Parental expectations | 101 (93) |

3.3. Phase 2

In Phase 2, data were reviewed in the same sub-categories as in Phase 1 including: Physicians’ knowledge with regard to MDI, perceived impact on nurses and/or families as well as perceived barriers to change in practice. Comparisons were made with Phase 1, which was conducted prior to the interventions and the statistically significant differences will be highlighted in this section.

Most importantly, Phase 2 data did reveal a positive outcome related to the study’s primary hypothesis related to whether more physicians would prescribe MDI + S therapy after targeted interventions. The first question of the survey inquired whether the participant is already prescribing MDI + S therapy and had the highest response rate. A positive improvement was noted upon analysing the complete responses; therefore, the question was independently analysed further after including all responses because it had a considerably higher response rate. The number of physicians who prescribed MDI + S increased from 28% to 41% (P value = .046).

Interestingly, subgroup analysis of the knowledge-based questions also showed statistically significant differences. Following the completion of interventions, there was an improvement in all physician subgroups in terms of more accurate knowledge with regard to the use and associated benefits of MDI + S therapy as summarised (Table 6).

Regarding knowledge specifically amongst ED physicians, there were unique differences when comparing their responses from the first and second phases. First, there was a statistically significant improvement with regard to the length of stay (LOS) because 48% had initially believed that MDI + S therapy would lead to a longer LOS, but this was reduced to 21% in Phase 2 (P value = .02). Conversely, they also grew more concerned about nursing time required to deliver MDI + S therapy. This was reflected in Phase 2 where the number of ED physicians with this belief rose from 40% to 68% after the interventions (P value = .02).

With respect to physicians’ perceptions related to the acceptance of MDI + S therapy by nurses and parents, an overall positive impact was noted. Most noteworthy was the number of physicians who believed that convincing parents to use MDI + S therapy would be easy, which increased from 35% to 66% following the interventions (P value <.0001). This positive trend continued specifically amongst junior doctors in whom the number of physicians who believe that MDI + S therapy would lead to higher parent satisfaction increased from 50% to 80% in Phase 2 (P value = .004).

Finally, when reviewing for changes in terms of perceived barriers to practice change, no statistically significant differences were noted.

4. Discussion

The effectiveness of MDI + S therapy when compared with nebulized therapy has been repeatedly proven over the last two...
decades. However, studies have shown that up to 40% of physicians do not practice established evidence-based medicine [9]. This is because clinical evidence is not the only determinant behind a physician’s decision-making [10]. In fact, a physician’s experience level and knowledge as well as patients’ characteristics, expectations and cultural values also play a major role [10]. Moreover, the work environment and available resources such as accessible practice guidelines have an impact on clinical practice [10]. As such, it is recommended to first identify and understand the existing behaviour before attempting to initiate a change [10].

Scott and colleagues studied nine facilities, which were classified as being early adopters, potential adopters and non-adopters based on whether MDI + S therapy was already being used, under consideration for future use or not used at all [2]. They found that participants at both adopter and non-adopter sites reported sufficient knowledge in the administration of treatments using the MDI + S [11]. Similarly, at our institution, whilst 82% of our physicians believed that they have the knowledge and skills to provide treatment using an MDI + S, only 28% reported to prescribe them. This evidence highlights the importance of identifying and addressing institution-specific barriers to promote more effective and improved evidence-based care.

A qualitative study found similar results to ours through the use of small focus groups. More specifically, the study showed concerns amongst physicians and nurses with regard to increased workload, increased equipment costs and the belief that nebulizers are a superior form of bronchodilator delivery [11]. A systematic review by Mudd and colleagues divided perceived barriers as those faced by healthcare providers and those perceived by the patients and parents [9]. Once more the authors reported barriers consistent with those in our sample [9]. This included concerns about time and resources required to educate healthcare staff, the lack of a champion to advocate for change and the concern that parents would resist change [9].

The most significant barrier among our sample during Phase 1 was with regard to parental expectations. Unsurprisingly, nurses and physicians at institutions where MDI + S is part of standard ED therapy have reported considerably more positive beliefs with regard to parent and patient satisfaction [9,11]. Scott et al. reported that 85% of physicians and nurses agreed that it is easy to convince parents with regard to MDI + S therapy versus only 50% at hospitals where it is not in routine use agreed with the same [2]. Likewise, we found that the number of our physicians who believed it would be easy to convince parents to receive MDI + S therapy, increased from 35% to 66% following the interventions (P value <.0001). A locally conducted study explored this point from the parental perspective and found that 52% of surveyed parents at a primary health service in the UAE had poor knowledge about their children’s inhaled medications and 34% of them expressed negative attitudes towards its usage [12]. Therefore, while the physician’s knowledge and practice preferences are important, parental awareness is also required to achieve widespread acceptance of MDI + S therapy. Parental acceptance may be achieved through appropriate counselling and uniform discharge instructions as trialled in our study, where discharge instruction handouts were developed in Arabic and English and included pictures to facilitate medication administration at home.

Eighty-five percent of our physicians did believe that implementing change requires a physician champion and junior physicians were significantly more concerned in this regard (Tables 4 and 5). Similarly, Scott and colleagues also noted that the lack of physician advocacy and leadership were significant barriers to achieve practice change in their sample [2]. As a matter of fact, this theme was common in other similar studies indicating the importance of a team leader when attempting to implement practice change and ensure compliance [4].

Our ED physicians became more concerned with regard to nursing workload in Phase 2 and again this observation was not unique to our study. A similar study suggested that a solution for this may be the addition of respiratory therapists (RTs) in the ED who may reduce the burden on nursing staff [2]. RTs could be useful in administering and monitoring MDI + S therapy while also providing parental education [2].

To conclude, this study is distinctive because it explored physicians’ existing knowledge and perceptions before attempting change. It is the first in the UAE to explore attitudes and practices
with regard to MDI + S therapy in acute asthma management. It is also unique as we proceeded to look for changes in practice by the resurvey of the same physician subgroups.

At the end of this study, our primary hypothesis was proven with a positive outcome as the number of physicians who prescribed MDI + S increased from 28% to 41% ($P$ value $= .046$). Knowledge and skill amongst the majority of physicians also improved following targeted interventions, as more of them believed that MDI + S use can be equally or more effective than nebulized therapy at the end of the study period. Through the course of the study, participants developed more positive views towards parents’ acceptance of MDI + S as a valid treatment modality. Notwithstanding, the concerns with regard to barriers to change remained the same and this suggests that more effort and time is required to achieve change.

5. Study limitations

First, as participants remained anonymous, it was not possible to ensure that the same participants responded during both phases. Secondly, the sample included a dynamic population consisting of residents of different levels of training. However, when interpreting results, a simplifying assumption was made that the views of participants in Phase 1 and 2 would not be materially different as interventions were carried out at multiple times throughout the study period. As such, the lack of replicable results between both sample sets is considered to be low as both groups were similar when analysed based on physician speciality, designation, education and ethnicity.

Data from incomplete surveys were excluded, which may have reduced statistical significance for certain responses. In addition, using written questionnaires may have increased survey uptake. Finally, a larger sample size and longer study duration may have allowed for a more significant impact.

6. Future steps

We hope that the results of this study will promote the adoption of MDI + S therapy in inpatient and outpatient settings at SKMC as well as in other facilities across the UAE. Furthermore, readers may consider including MDI + S use as part of a quality improvement project within their institution to measure uptake while also assessing cost effectiveness and LOS as outcomes.

Ethical statement

This manuscript includes original data that has not been previously published. The premise of this research is original and has not been replicated elsewhere. Institutional review board (IRB) approval was obtained from the Ethics Committee at Sheikh Khalifa Medical City (SKMC). The data collection tool consisted of a validated survey and was used with permission from the primary authors. Participants responded anonymously and voluntarily. Informed consent was taken from all participants. The authors have not plagiarized any data or text within this manuscript. All authors declare compliance with the ethical standards of Elsevier journals as outlined in the publishing ethics policy.

Authorship roles

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   • Conceptualisation.
   • Writing roles: primary author of manuscript.
2. Malcolm Borg: Paediatric Emergency consultant, Division head of emergency.
   • Conceptualisation and supervision of project.
3. Data Collection: assisted in data collection and statistical analysis.
   • Writing roles: review and editing.
4. Salah Eldin Hussein: General Pediatrics Consultant.
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   • Project Supervision.
   • Data validation and assistance with statistical analysis.
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Declaration of competing interest

None.

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Visual abstract

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