Best Evidence Statement (BESt)

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Airway clearance technique with patients with cystic fibrosis

Clinical Question

P (population/problem)	In children with cystic fibrosis (CF)
I (intervention)	does a semi-annual observation and evaluation of patient and/or family airway clearance technique by a respiratory therapist
C (comparison)	compared with no regularly scheduled observation and evaluation,
O (outcome)	improve forced expiratory volume ($FEV_{1)}$?

Target Population:

Children with cystic fibrosis and their parents/caregivers

Recommendation(s) (See Table of Recommendation Strength following references)

1. It is recommended that the airway clearance technique(s) used by children with cystic fibrosis and their parents be observed by a respiratory therapist at least once a year *(Yankaskas 2004 [5], United Kingdom Cystic Fibrosis Trust 2001 [5], Local Consensus [5]).*
   Note: Observation and evaluation of airway clearance technique may indicate that additional instruction followed by re-evaluation is warranted to improve the performance of the child and/or family *(Local Consensus [5])*.

Discussion/summary of evidence

We were unable to identify any evidence in the published research literature that directly addresses the clinical question.

Evidence from Cystic Fibrosis Literature

Two studies with cystic fibrosis patients demonstrate that, despite appropriate education, patients and families may not be following the prescribed treatment regimen. Basketter et al. *(2000 [4b])* assessed whether adult CF patients were adjusting doses of pancreatic enzymes based on the amount of fat in meals and snacks: only 16% of patients in the study adjusted enzyme dosage for the fat content in both meals and snacks. Ievers et al. *(1999 [4a])* suggested that adherence to a prescribed treatment plan for cystic fibrosis may reflect children's and mothers' knowledge/recall of the prescribed treatments. In this study, 19.5% of mothers of elementary school-aged children with CF were unable to correctly identify the prescribed frequency of airway clearance activities *(Ievers 1999 [4a])*.

Evidence from Related Literature

While we were unable to identify published studies that specifically evaluated patient performance of airway clearance techniques (a psychomotor skill used by patients with cystic fibrosis) over time, studies in other patients with chronic illness, such as asthma and diabetes, have demonstrated that patients often perform prescribed psychomotor skills incorrectly.

Asthma and metered-dose inhalers: Numerous studies have demonstrated that children with asthma do not use metered-dose inhalers (MDIs) correctly, despite previous instruction *(Munzenberger 2007 [3b], Chen 2002 [4a], Scarfone 2002 [4a], Walia 2006 [4b], Burkhart 2005 [4b], Minai 2004 [4b], Kamps 2002 [4b], Kamps 2000 [4b])*. Walia et al *(2006 [4b])* and Kamps et al *(2002 [4b])* found that regular observation of MDI technique at each clinic visit maintained and/or improved MDI technique.

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Diabetes and blood glucose testing: Several studies have demonstrated that children with diabetes perform some of the testing steps incorrectly, despite previous instruction *(Perwien 2000 [4a], Wing 1986 [4b])*. Kabadi et al. *(1994 [4b])* found that repeated intensive education during follow-up visits was essential to prevent deterioration of self-monitored blood glucose technique in a group of adult patients with diabetes.

End-stage renal disease and peritoneal dialysis: Russo et al. *(2006 [4b])* observed the exchange technique of adult patients on peritoneal dialysis (PD) at home and found that only 74% of patients performed PD exchanges correctly. The investigators concluded that the chronic nature of PD treatment allowed progressive modification of technique over time as patients became more confident and generally paid less attention to the details of the procedure and advocated regular observation of the patient's and/or caregiver's technique.

Conclusion

Patients with chronic illnesses often perform psychomotor skills incorrectly, despite previous education and training, regardless of level of experience. Periodic observation of the procedure provides an opportunity to identify and correct poor technique *(Local Consensus [5]).*

Health Benefits, Side Effects and Risks

Health Benefits – Some health benefits are expected, based on evidence from other chronic diseases that indicates that regular observation and evaluation of patient/caregiver performance is necessary to maintain proper technique *(Russo 2006 [4b], Walia 2006 [4b], Kamps 2002 [4b], Kabadi 1994 [4b])*.

Side Effects – We were unable to identify evidence in the literature that regular observation and evaluation of psychomotor skill has any adverse effects.

References (Evidence grade in *[ ]; see Table of Evidence Levels following references*)

Note: When using the electronic version of this document, ☜ indicates a hyperlink to the PubMed abstract. A hyperlink following this symbol goes to the article PDF when the user is within the CCHMC network.

1. **Basketter, H. M.; Sharples, L.; and Bilton, D.:** Knowledge of pancreatic enzyme supplementation in adult cystic fibrosis (CF) patients. *Journal of Human Nutrition and Dietetics,* 13(5): 353-61, 2000, *[4b]* ☜ _____.

2. **Burkhart, P. V.; Rayens, M. K.; and Bowman, R. K.:** An evaluation of children's metered-dose inhaler technique for asthma medications. *Nurs Clin North Am,* 40(1): 167-82, 2005, *[4b]* _____ ☜ _____.

3. **Chen, S. H.; Yin, T. J.; and Huang, J. L.:** An exploration of the skills needed for inhalation therapy in schoolchildren with asthma in Taiwan. *Ann Allergy Asthma Immunol,* 89(3): 311-5, 2002, *[4a]* ☜.

4. **Ievers, C. E.; Brown, R. T.; Drotar, D.; Caplan, D.; Pishevar, B. S.; and Lambert, R. G.:** Knowledge of physician prescriptions and adherence to treatment among children with cystic fibrosis and their mothers. *J Dev Behav Pediatr,* 20(5): 335-43, 1999, *[4a]* _____ ☜ _____.

5. **Kabadi, U. M.; O'Connell, K. M.; Johnson, J.; Kabadi, M.; Kabadi, U. M.; O'Connell, K. M.; Johnson, J.; and Kabadi, M.:** The effect of recurrent practice at home on the acceptability of capillary blood glucose readings. Accuracy of self blood glucose testing. *Diabetes Care,* 17(10): 1110-23, 1994, *[4b]* _____ ☜ _____.

6. **Kamps, A. W.; Brand, P. L.; and Roorda, R. J.:** Determinants of correct inhalation technique in children attending a hospital-based asthma clinic. *Acta Paediatr,* 91(2): 159-63, 2002, *[4b]* _____ ☜ _____.

7. **Kamps, A. W.; van Ewijk, B.; Roorda, R. J.; and Brand, P. L.:** Poor inhalation technique, even after inhalation instructions, in children with asthma. *Pediatr Pulmonol,* 29(1): 39-42, 2000, *[4b]* _____ ☜ _____.

8. **Local Consensus:** during BESt development timeframe., *[5]* ☜.

9. **Minai, B. A.; Martin, J. E.; and Cohn, R. C.:** Results of a physician and respiratory therapist collaborative effort to improve long-term metered-dose inhaler technique in a pediatric asthma clinic. *Respir Care,* 49(6): 600-5, 2004, *[4b]* _____ ☜ _____.

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10. **Munzenberger, P. J.; Thomas, R.; and Bahrainwala, A.:** Retention by children of device technique for inhaled asthma drugs between visits. *J Asthma*, 44(9): 769-73, 2007, *[3b]* _____ ☜ _____.

11. **Perwien, A. R.; Johnson, S. B.; Dymtrow, D.; and Silverstein, J.:** Blood glucose monitoring skills in children with Type I diabetes. *Clin Pediatr (Phila)*, 39(6): 351-7, 2000, *[4a]* _____ ☜ _____.

12. **Russo, R. et al.:** Patient re-training in peritoneal dialysis: why and when it is needed. *Kidney Int Suppl*, (103): S127-32, 2006, *[4b]* _____ ☜ _____.

13. **Scarfone, R. J.; Capraro, G. A.; Zorc, J. J.; and Zhao, H.:** Demonstrated use of metered-dose inhalers and peak flow meters by children and adolescents with acute asthma exacerbations. *Arch Pediatr Adolesc Med*, 156(4): 378-83, 2002, *[4a]* _____ ☜ _____.

14. **United Kingdom Cystic Fibrosis Trust:** Standards of clinical care of children and adults with cystic fibrosis in the UK., 2001, *[5]* _____ ☜ _____.

15. **Walia, M.; Paul, L.; Satyavani, A.; Lodha, R.; Kalaivani, M.; and Kabra, S. K.:** Assessment of inhalation technique and determinants of incorrect performance among children with asthma. *Pediatr Pulmonol*, 41(11): 1082-7, 2006, *[4b]* _____ ☜ _____.

16. **Wing, R. R. et al.:** Behavioral skills in self-monitoring of blood glucose: relationship to accuracy. *Diabetes Care*, 9(4): 330-3, 1986, *[4b]* _____ ☜ _____.

17. **Yankaskas, J. R.; Marshall, B. C.; Sufian, B.; Simon, R. H.; and Rodman, D.:** Cystic fibrosis adult care: consensus conference report. *Chest*, 125(1 Suppl): 1S-39S, 2004, *[5]* _____ ☜ _____.

Note: Full tables of evidence grading system available in separate document:

- Table of Evidence Levels of Individual Studies by Domain, Study Design, & Quality (abbreviated table below)
- Grading a Body of Evidence to Answer a Clinical Question
- Judging the Strength of a Recommendation (abbreviated table below)

Table of Evidence Levels (see note above)

Quality level	***Definition***
1a† or 1b†	Systematic review, meta-analysis, or meta-synthesis of multiple studies
2a or 2b	Best study design for domain
3a or 3b	Fair study design for domain
4a or 4b	Weak study design for domain
5	Other: General review, expert opinion, case report, consensus report, or guideline

†a = good quality study; b = lesser quality study

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Table of Recommendation Strength (see note above)

Strength	***Definition***
"Strongly recommended"	There is consensus that benefits clearly outweigh risks and burdens (or visa-versa for negative recommendations).
"Recommended"	There is consensus that benefits are closely balanced with risks and burdens.
No recommendation made	There is lack of consensus to direct development of a recommendation.

Dimensions: In determining the strength of a recommendation, the development group makes a considered judgment in a consensus process that incorporates critically appraised evidence, clinical experience, and other dimensions as listed below.

1. Grade of the Body of Evidence (see note above)
2. Safety / Harm
3. Health benefit to patient *(direct benefit)*
4. Burden to patient of adherence to recommendation *(cost, hassle, discomfort, pain, motivation, ability to adhere, time)*
5. Cost-effectiveness to healthcare system *(balance of cost / savings of resources, staff time, and supplies based on published studies or onsite analysis)*
6. Directness *(the extent to which the body of evidence directly answers the clinical question [population/problem, intervention, comparison, outcome])*
7. Impact on morbidity/mortality or quality of life

Supporting information

Group/team members

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Search strategy

1. **Original Search**
   OVID Databases
   Medline, CINAHL and the Cochrane Database for Systematic Reviews (CDSR)

   OVID Filters

Publication Date	1980 to present
Limits	Humans and English Language
Study Type	highest quality evidence

   Search Terms and MeSH Terms

Patients/Population	Cystic Fibrosis, Diabetes, Asthma , Peritoneal Dialysis
Intervention/Exposure	Respiratory Therapy, airway clearance techniques.
	Patient education, learning
	Educational measurement, evaluation, assessment, reassessment
	Motor skill, psychomotor skill, skill performance
	Blood Glucose monitoring
	Inhalation Device
	Peritoneal dialysis
Outcomes	Forced Expiratory Volume, FEV, FEV1)
	Patient Outcomes

2. **Additional articles** identified from reference lists and clinicians.

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Applicability issues

Outcome planned to be measured is:
Optimized Lung Function: The average (mean) FEV_1% predicted of our population, as measured using each patient's best forced expiratory volume (FEV_1) percent predicted, per quarter.

Complete operational definition is on file.

Copies of this Best Evidence Statement (BESt) are available online and may be distributed by any organization for the global purpose of improving child health outcomes. Website address: http://www.cincinnatichildrens.org/svc/alpha/h/health-policy/ev-based/default.htm
Examples of approved uses of the BESt include the following:

- copies may be provided to anyone involved in the organization's process for developing and implementing evidence based care;
- hyperlinks to the CCHMC website may be placed on the organization's website;
- the BESt may be adopted or adapted for use within the organization, provided that CCHMC receives appropriate attribution on all written or electronic documents; and
- copies may be provided to patients and the clinicians who manage their care.

Notification of CCHMC at HPCEInfo@cchmc.org for any BESt adopted, adapted, implemented or hyperlinked by the organization is appreciated.

Additionally for more information about CCHMC Best Evidence Statements and the development process, contact the Health Policy & Clinical Effectiveness office at: 513-636-2501 or ***HPCEInfo@chmcc.org***.

Note

This Best Evidence Statement only addresses selected aspects of care for the target population. A Best Evidence Statement is not intended to be a comprehensive practice guideline. These recommendations result from review of literature and practices current at the time of their formulation. This Best Evidence Statement does not preclude using care modalities proven efficacious in studies published subsequent to the current revision of this document. This document is not intended to impose standards of care preventing selective variances from the recommendations to meet the specific and unique requirements of individual patients. Adherence to this Statement is voluntary. The clinician in light of the individual circumstances presented by the patient must make the ultimate judgment regarding the priority of any specific procedure.

Reviewed by: Clinical Effectiveness

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