ORIGINAL RESEARCH

Variation in Pediatric Hospitalists' Use of Proven and Unproven Therapies: A Study from the Pediatric Research in Inpatient Settings (PRIS) Network

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BACKGROUND: Undesirable practice variation remains a major concern with the quality of the healthcare system. While care in pediatric hospitalist systems has been demonstrated to be efficient, neither the quality of care nor determinants of variation in pediatric hospitalist systems are well understood.

OBJECTIVE: To measure variation in pediatric hospitalists' reported use of common inpatient therapies, and to test the hypothesis that variation in reported use of proven therapies is lower than variation in reported use of unproven therapies.

DESIGN AND MEASUREMENTS: We conducted a survey of pediatric hospitalists in the US and Canada. Respondents reported their frequency of using 14 therapies in the management of common conditions. Each therapy was determined to be of proven or unproven effectiveness using published critical appraisals. Variation in reported use of proven and unproven therapies was compared.

RESULTS: 67% (213/320) of surveyed individuals participated. Little variability existed in reported use of albuterol and corticosteroids in asthma (4-6% of respondents reported not often using them) and systemic dexamethasone in bronchiolitis (12% of respondents reported using it more than rarely). Moderate to high variation existed in reported use of all other therapies studied. Variation in reported use of proven therapies was significantly less than variation in reported use of unproven therapies ($15.5 \pm 12.5\%$ vs. $44.6 \pm 20.5\%$).

CONCLUSIONS: Substantial variation exists in hospitalists' reported management of common pediatric conditions. Variation is significantly lower for strongly evidence-based therapies. To decrease undesirable variation in care, a stronger evidence base for inpatient pediatric care must be built. ***Journal of Hospital Medicine*** **2008;3:292–298.** *© 2008 Society of Hospital Medicine.*

KEYWORDS: hospitalist, pediatric, variation, variability, evidence-based medicine, research network.

Reduction of undesirable variation in care has been a major focus of systematic efforts to improve the quality of the

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Competing interests: CPL has served as a paid consultant to the District Health Boards of New Zealand, performing an assessment of current working conditions for junior doctors in New Zealand, and providing recommendations on how to improve the safety of scheduling practices. CPL has also received honoraria at several academic medical institutions and conferences to speak about the PRIS research network and evidence based medicine in the care of hospitalized children. No other authors have conflicts of interest to report.

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healthcare system.[1–3] The emergence of "hospitalists," physicians specializing in the care of hospitalized patients, was spurred by a desire to streamline care and reduce variability in hospital management of common diseases.[4,5] Over the past decade, hospitalist systems have become a leading vehicle for care delivery.[4,6,7] It remains unclear, however, whether implementation of hospitalist systems has lessened undesirable variation in the inpatient management of common diseases.

While systematic reviews have found costs and hospital length of stay to be 10-15% lower in both pediatric and internal medicine hospitalist systems, few studies have adequately assessed the processes or quality of care in hospitalist systems.[8,9] Two internal medicine studies have found decreased mortality in hospitalist systems, but the mechanism by which hospitalists apparently achieved these gains is unclear.[10,11] Even less is known about care processes or quality in pediatric hospitalist systems. Death is a rare occurrence in pediatric ward settings, and the seven studies conducted to date comparing pediatric hospitalist and traditional systems have been universally underpowered to detect differences in mortality.[9,12-18] There is a need to better understand care processes as a first step in understanding and improving quality of care in hospitalist systems.[19]

The Pediatric Research in Inpatient Settings (PRIS) Network was formed to improve the quality of care for hospitalized children through collaborative clinical research. In this study, we sought to study variation in the care of common pediatric conditions among a cohort of pediatric hospitalists. We have previously reported that less variability exists in hospitalists' reported management of inpatient conditions than in the reported management of these same conditions by community-based pediatricians,[20] but we were concerned that substantial undesirable variation (ie, variation in practice due to uncertainty or unsubstantiated local practice traditions, rather than justified variation in care based on different risks of harms or benefits in different patients) may still exist among hospitalists. We therefore conducted a study: 1) to investigate variation in hospitalists' reported use of common inpatient therapies, and 2) to test the hypothesis that greater variation exists in hospitalists' reported use of inpatient therapies of unproven benefit than in those therapies proven to be beneficial.

METHODS

Survey Design and Administration. In 2003, we designed the PRIS Survey to collect data on hospitalists' backgrounds, practices, and training needs, as well as their management of common pediatric conditions. For the current study, we chose a priori to evaluate hospitalists' use of 14 therapies in the management of 4 common conditions: asthma, bronchiolitis, gastroenteritis, and gastroesophageal reflux disease (GERD) (Table 1). These four conditions were chosen for study because they were among the top discharge diagnoses (primary and secondary) from the inpatient services at 2 of the authors' institutions (Children's Hospital Boston and Children's Hospital San Diego) during the year before administration of the survey, and because a discrete set of therapeutic agents are commonly used in their management. Respondents were asked to report the frequency with which they used each of the 14 therapies of interest on 5-point Likert scales (from 1=never to 5=almost always). The survey initially developed was piloted with a small group of hospitalists and pediatricians, and a final version incorporating revisions was subsequently administered to all pediatric hospitalists in the US and Canada identified through any of 3 sources: 1) the Pediatric Research in Inpatient Settings (PRIS) list of participants; 2) the Society for Hospital Medicine (SHM) pediatric hospital medicine e-mail listserv; and 3) the list of all attendees of the first national pediatric hospitalist conference sponsored by the Ambulatory Pediatrics Association (APA), SHM, and American Academy of Pediatrics (AAP); this meeting was held in San Antonio, Texas, USA in November 2003. Individuals identified through more than 1 of these groups were counted only once. Potential participants were assured that individual responses would be kept confidential, and were e-mailed an access code to participate in the online survey, using a secure web-based interface; a paper-based version was also made available to those who preferred to respond in this manner. Regular reminder notices were sent to all non-responders. Further details regarding PRIS Survey recruitment and study methods have been published previously.[20]

Definitions–Reference Responses and Percent Variation. To measure variation in reported management, we first sought to determine a reference response for each therapy of interest. Since the evidence base for most of the therapies we

TABLE 1
Therapies and Conditions Studied

Condition	Therapy	*BMJ* clinical evidence Treatment effect categorization*	Study classification
Asthma	Inhaled albuterol	Beneficial	Proven
	Systemic corticosteroids	Beneficial	Proven
	Inhaled ipratropium in the first 24 hours of hospitalization	Beneficial	Proven
	Inhaled ipratropium after the first 24 hours of hospitalization	Unknown effectiveness	Unproven
Bronchiolitis	Inhaled albuterol	Unknown effectiveness	Unproven
	Inhaled epinephrine	Unknown effectiveness	Unproven
	Systemic corticosteroids	Unknown effectiveness	Unproven
Gastroenteritis	Intravenous hydration	Beneficial	Proven
	Lactobacillus	Not assessed	Unproven
	Ondansetron	Not assessed	Unproven
Gastro-Esophageal Reflux Disease (GERD)	H_2 histamine-receptor antagonists	Unknown effectiveness	Unproven
	Thickened feeds	Unknown effectiveness → Likely to be beneficial	Unproven → Proven
	Metoclopramide	Unknown effectiveness	Unproven
	Proton-pump inhibitors	Unknown effectiveness	Unproven

Abbreviation: BMJ, *British Medical Journal.*

studied is weak, it was not possible to determine a "gold standard" response for each therapy. Instead, we sought to measure the degree of divergence from a reference response for each therapy in the following manner. First, to simplify analyses, we collapsed our five-category Likert scale into three categories (never/rarely, sometimes, and often/almost always). We then defined the reference response for each therapy to be "never/rarely" or "often/almost always," whichever of the 2 was more frequently selected by respondents; "sometimes" was not used as a reference category, as reporting use of a particular therapy "sometimes" indicated substantial variability even within an individual's own practice.

Classification of therapies as "proven" or "unproven." To classify each of the 14 studied therapies as being of proven or unproven, we used the British Medical Journal's publication *Clinical Evidence*.[19] We chose to use *Clinical Evidence* as an evidence-based reference because it provides rigorously developed, systematic analyses of therapeutic management options for multiple common pediatric conditions, and organizes recommendations in a straightforward manner. Four of the 14 therapies had been determined on systematic review to be proven "beneficial" at the time of study design: systemic corticosteroids, inhaled albuterol, and ipratropium (in the first 24 h) in the care of children with asthma; and IV hydration in the care of children with acute gastroenteritis. The remaining 10 therapies were either considered to be of "unknown effectiveness" or had not been formally evaluated by *Clinical Evidence*, and were hence considered unproven for this study (Table 1). Of note, the use of thickened feeds in the treatment of children with GERD had been determined to be of "unknown effectiveness" at the time of study design, but was reclassified as "likely to be beneficial" during the course of the study.

Analyses. Descriptive statistics were used to report respondents' demographic characteristics and work environments, as well as variation in their reported use of each of the 14 therapies. Variation in hospitalists' use of proven versus unproven therapies was compared using the Wilcoxon rank sum test, as it was distributed non-normally. For our primary analysis, the use of thickened feeds in GERD was considered "unproven," but a sensitivity analysis was conducted reclassifying it as "proven" in light of the evolving literature on its use and its consequent reclassification in *Clinical Evidence.*(SAS Version 9.1, Cary, NC) was used for statistical analyses.

RESULTS

213 of the 320 individuals identified through the 3 lists of pediatric hospitalists (67%) responded to the

survey. Of these, 198 (93%) identified themselves as hospitalists and were therefore included. As previously reported,[20] 53% of respondents were male, 55% worked in academic training environments, and 47% had completed advanced training (fellowship) beyond their core pediatric training (residency training); respondents reported completing residency training 11 ± 9 (mean, standard deviation) years prior to the survey, and spending 176 ± 72 days per year in the care of hospitalized patients.

Variation in reported management: asthma (Figure 1, Panel A). Relatively little variation existed in reported use of the 4 asthma therapies studied. Only 4.4% (95% CI, 1.4-7.4%) of respondents did not provide the reference response of using inhaled albuterol often or almost always in the care of inpatients with asthma, and only 6.0% (2.5-9.5%) of respondents did not report using systemic corticosteroids often or almost always. Variation in reported use of ipratropium was somewhat higher.

Bronchiolitis (Figure 1B). By contrast, variation in reported use of inhaled therapies for bronchiolitis was high, with many respondents reporting that they often or always used inhaled albuterol or epinephrine, while many others reported rarely or never using them. There was 59.6% (52.4-66.8%) variation from the reference response of often/almost always using inhaled albuterol, and 72.2% (65.6-78.8%) variation from the reference response of never/rarely using inhaled epinephrine. Only 11.6% (6.9-16.3%) of respondents, however, varied from the reference response of using dexamethasone more than rarely in the care of children with bronchiolitis.

Gastroenteritis (Figure 1C). Moderate variability existed in the reported use of the 3 studied therapies for children hospitalized with gastroenteritis. 21.1% (15.1-27.1%) of respondents did not provide the reference response of often/almost always using IV hydration; 35.9% (28.9-42.9%) did not provide the reference response of never or rarely using lactobacillus; likewise, 35.9% (28.9-42.9%) did not provide the reference response of never or rarely using ondansetron.

Gastro-Esophageal Reflux Disease (Figure 1, Panel D). There was moderate to high variability in the reported management of GERD. 22.8% (16.7-28.9%) of respondents did not provide the reference response of often/almost always using H2 antagonists, and 44.9% (37.6-52.2%) did not report often/almost always using thickened feeds

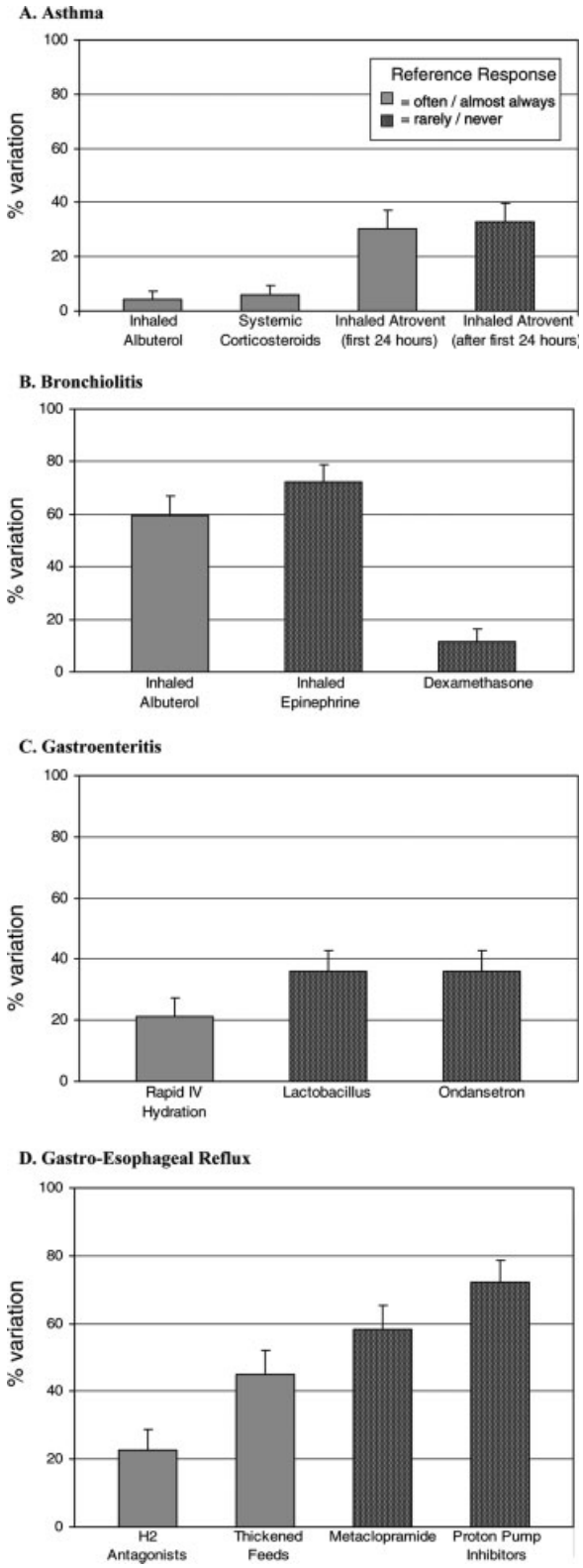

FIGURE 1. Percent variation in reported use of common inpatient therapies. (T bars indicate 95% confidence intervals).

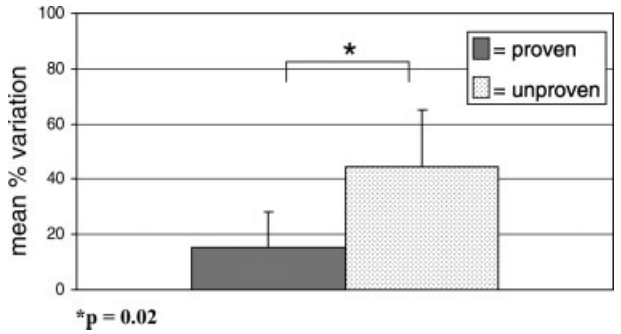

FIGURE 2. Variation in reported use of proven versus unproven therapies (T bars indicate standard deviations).

in the care of these children. 58.3% (51.1-65.5%) and 72.1% (65.5-78.7%) of respondents did not provide the reference response of never/rarely using metoclopramide and proton pump inhibitors, respectively.

Proven vs. Unproven Therapies (Figure 2). Variation in reported use of therapies of unproven benefit was significantly higher than variation in reported use of the 4 proven therapies (albuterol, corticosteroids, and ipratropium in the first 24 h for asthma; IV re-hydration for gastroenteritis). The mean variation in reported use of unproven therapies was 44.6 ± 20.5%, compared with 15.5 ± 12.5% variation in reported use of therapies of proven benefit ($p = 0.02$).

As a sensitivity analysis, the use of thickened feeds as a therapy for GERD was re-categorized as "proven" and the above analysis repeated, for the reasons outlined in the methods section. This did not alter the identified relationship between variability and the evidence base fundamentally; hospitalists' reported variation in use of therapies of unproven benefit in this sensitivity analysis was 44.6 ± 21.7%, compared with 21.4 ± 17.0% variation in reported use of proven therapies ($p = 0.05$).

DISCUSSION

Substantial variation exists in the inpatient management of common pediatric diseases. Although we have previously found less reported variability in pediatric hospitalists' practices than in those of community-based pediatricians,[20] the current study demonstrates a high degree of reported variation even among a cohort of inpatient specialists. Importantly, however, reported variation was found to be significantly less for those inpatient therapies supported by a robust evidence base.

Bronchiolitis, gastroenteritis, asthma, and GERD are extremely common causes of pediatric hospitalization throughout the developed world.[21-25] Our finding of high reported variability in the routine care of all of these conditions except asthma is concerning, as it suggests that experts do not agree on how to manage children hospitalized with even the most common childhood diseases. While we hypothesized that there would be some variation in the use of therapies whose benefit has not been well established, the high degree of variation observed is of concern because it indicates that an insufficient evidentiary base exists to support much of our day-to-day practice. Some variation in practice in response to differing clinical presentations is both expected and desirable, but it is remarkable that variance in practice was significantly less for the most evidence-based therapies than for those grounded less firmly in science, suggesting that the variation identified here is not "justifiable" variation based on appropriate responses to atypical clinical presentations, but uncertainty in the absence of clear data. Such undesired variability may decrease system reliability (introducing avoidable opportunity for error),[26] and lead to under-use of needed therapies as well as overuse of unnecessary therapies.[1]

Our work extends prior research that has identified wide variation in patterns of hospital admission, use of hospital resources, and processes of inpatient care,[27-32] by documenting reported variation in the use of common inpatient therapies. Rates of hospital admission may vary by as much as 7-fold across regions.[33] Our study demonstrates that wide variation exists not only in admission rates, but in reported inpatient care processes for some of the most common diseases seen in pediatric hospitals. Our study also supports the hypothesis that variation in care may be driven by gaps in knowledge.[32] Among hospitalists, we found the strength of the evidence base to be a major determinant of reported variability.

Our study has several limitations. First, the data presented here are derived from provider self-reports, which may not fully reflect actual practice. In the case of the few proven therapies studied, reporting bias could lead to an over-reporting of adherence to evidence-based standards of care. Like our study, however, prior studies have found that hospital-based providers fairly consistently comply with evidence-based practice recommendations for acute asthma care,[34,35] supporting our

finding that variation in acute asthma care (which represented 3 of our 4 proven therapies) is low in this setting.

Another limitation is that classifications of therapies as "proven" or "unproven" change as the evidence base evolves. Of particular relevance to this study, the use of thickened feeds as a therapy for GERD, originally classified as being of "unknown effectiveness," was reclassified by *Clinical Evidence* during the course of the study as "likely to be beneficial." The relationship we identified between proven therapies and degree of variability in care did not change when we conducted a sensitivity analysis re-categorizing this therapy as "proven," but precisely quantifying variation is complicated by continuous changes in the state of the evidence.

Pediatric hospitalist systems have been found consistently to improve the efficiency of care,[9] yet this study suggests that considerable variation in hospitalists' management of key conditions remains. The Pediatric Research in Inpatient Settings (PRIS) Network was formed in 2002 to improve the care of hospitalized children and the quality of inpatient practice by developing an evidence base for inpatient pediatric care. Ongoing multi-center research efforts through PRIS and other research networks are beginning to critically evaluate therapies used in the management of common pediatric conditions. Rigorous studies of the processes and outcomes of pediatric hospital care will inform inpatient pediatric practice, and ultimately improve the care of hospitalized children. The current study strongly affirms the urgent need to establish such an evidence base. Without data to inform optimal care, efforts to reduce undesirable variation in care and improve care quality cannot be fully realized.

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REFERENCES

1. *Institute of Medicine: Crossing the Quality Chasm: A New Health System for the 21st Century.* Washington, D.C.: National Academic Press, 2001.
2. Urbach DR. Baxter NN. Reducing variation in surgical care. *BMJ* 2005;330:1401-1402.
3. Sedrakyan A, van der MJ, Lewsey J, Treasure T. Variation in use of video assisted thoracic surgery in the United Kingdom. *BMJ* 2004;329:1011-1012.
4. Wachter RM,. Goldman L. The emerging role of "hospitalists" in the American health care system. *N. Engl J Med* 1996;335:514-517.
5. Maviglia SM,. Bates D. Hospitalism in the USA. *Lancet* 1999;353:1902.
6. Society of Hospital Medicine. Growth of Hospital Medicine Nationwide. Available at: http://www.hospitalmedicine.org/Content/NavigationMenu/Media/GrowthofHospitalMedicineNationwide/Growth_of_Hospital_M.htm. Accessed April 11, 2007.
7. Terry K. The changing face of hospital practice. *Med Econ* 2002;79:72-79.
8. Wachter RM,. Goldman L. The hospitalist movement 5 years later. *JAMA* 2002;287:487-494.
9. Landrigan CP, Conway PH, Edwards S, Srivastava R. Pediatric hospitalists: a systematic review of the literature. *Pediatrics* 2006;117:1736-1744.
10. Auerbach AD, Wachter RM, Katz P, Showstack J, Baron RB, Goldman L. Implementation of a voluntary hospitalist service at a community teaching hospital: improved clinical efficiency and patient outcomes. *Ann Intern Med* 2002;137:859-865.
11. Meltzer D, Manning WG, Morrison J, Shah MN, Jin L, Guth T, et al. Effects of physician experience on costs and outcomes on an academic general medicine service: results of a trial of hospitalists. *Ann Intern Med* 2002;137:866-874.
12. Bellet PS, Whitaker RC. Evaluation of a pediatric hospitalist service: impact on length of stay and hospital charges. *Pediatrics* 2000;105:478-484.
13. Landrigan C, Srivastava R, Muret-Wagstaff S, Soumerai SB, Ross-Degnan D, Graef JW, Homer CJ, and Goldmann DA. Impact of an HMO hospitalist system in academic pediatrics. *Pediatrics* 2002;110:720-728.
14. Maggioni A, Reyes M, and Lifshitz F. Evaluation of a pediatric hospitalist service by APR-DRG's: impact on length of stay and hospital charges. *Pediatr Research* 2001;49(suppl), 691.
15. Wells RD, Dahl B, Wilson SD. Pediatric hospitalists: quality care for the underserved? *Am J Med Qual* 2001;16:174-180.
16. Ogershok PR, Li X, Palmer HC, Moore RS, Weisse ME, Ferrari ND. Restructuring an academic pediatric inpatient service using concepts developed by hospitalists. *Clin Pediatr (Phila)* 2001;40:653-660.
17. Srivastava R, Muret-Wagstaff S, Young PC, and James BC. Hospitalist care of medically complex children. *Pediatr Research* 2004;55(suppl),1789.
18. Seid M, Quinn K, Kurtin PS. Hospital-based and community pediatricians: comparing outcomes for asthma and bronchiolitis. *J Clin Outcomes Manage* 1997;4:21-24.
19. Godlee F, Tovey D, Bedford M, et al., eds. *Clinical Evidence: The International Source of the Best Available Evidence for Effective Health Care.* London, United Kingdom: BMJ Publishing Group; 2004.
20. Conway PH, Edwards S, Stucky ER, Chiang VW, Ottolini MC, Landrigan CP. Variations in management of common inpatient pediatric illnesses: hospitalists and community pediatricians. *Pediatrics* 2006;118:441-447.
21. Muller-Pebody B, Edmunds WJ, Zambon MC, Gay NJ, Crowcroft NS. Contribution of RSV to bronchiolitis and pneumonia-associated hospitalizations in English children, April 1995-March 1998. *Epidemiol Infect* 2002;129:99-106.

22. Pelletier AJ, Mansbach JM, Camargo CA, Jr. Direct medical costs of bronchiolitis hospitalizations in the United States. *Pediatrics* 2006;118:2418-2423.
23. Van Damme P, Giaquinto C, Huet F, Gothefors L, Maxwell M, Van der WM. Multicenter Prospective Study of the Burden of Rotavirus Acute Gastroenteritis in Europe, 2004-2005: The REVEAL Study. *J Infect Dis* 2007;195 Suppl 1: S4-S16.
24. Akinbami L. The state of childhood asthma, United States, 1980-2005. *Adv.Data.* 2006;1-24.
25. Gold BD, Freston JW. Gastroesophageal reflux in children: pathogenesis, prevalence, diagnosis, and role of proton pump inhibitors in treatment. *Paediatr Drugs* 2002;4:673-685.
26. Luria JW, Muething SE, Schoettker PJ, Kotagal UR. Reliability science and patient safety. *Pediatr Clin North Am* 2006; 53:1121-1133.
27. Wennberg JE and McAndrew Cooper M, eds. *The Dartmouth Atlas of Health Care in the United States*. Hanover, NH, USA: Health Forum, Inc., 1999.
28. Perrin JM, Homer CJ, Berwick DM, Woolf AD, Freeman JL, Wennberg JE. Variations in rates of hospitalization of children in three urban communities. *N Engl J Med* 1989;320: 1183-1187.
29. Wennberg JE, Fisher ES, Stukel TA, Skinner JS, Sharp SM, Bronner KK. Use of hospitals, physician visits, and hospice care during last six months of life among cohorts loyal to highly respected hospitals in the United States. *BMJ* 2004; 328:607.
30. Lee SK, McMillan DD, Ohlsson A, Pendray M, Synnes A, Whyte R, et al. Variations in practice and outcomes in the Canadian NICU network: 1996-1997. *Pediatrics* 2000;106:1070-1079.
31. Nelson DG, Leake J, Bradley J, Kuppermann N. Evaluation of febrile children with petechial rashes: is there consensus among pediatricians? *Pediatr Infect Dis J* 1998;17:1135-1140.
32. Plint AC, Johnson DW, Wiebe N, Bulloch B, Pusic M, Joubert G, et al. Practice variation among pediatric emergency departments in the treatment of bronchiolitis. *Acad Emerg Med* 2004;11:353-360.
33. Thakker Y, Sheldon TA, Long R, MacFaul R. Paediatric inpatient utilisation in a district general hospital. *Arch Dis Child* 1994;70:488-492.
34. Mahadevan M, Jin A, Manning P, Lim TK. Emergency department asthma: compliance with an evidence-based management algorithm. *Ann Acad Med Singapore* 2002;31: 419-424.
35. Moyer VA, Gist AK, Elliott EJ. Is the practice of paediatric inpatient medicine evidence-based? *J Paediatr Child Health* 2002;38:347-351.