Reduction of Inappropriate Hospital Admissions of Children With Influenza-Like Illness Through the Implementation of Specific Guidelines: A Case-Controlled Study

Giulio De Marco, MD; Sebastiano Mangani, MD; Antonio Correra, MD; Stefania Di Caro, MD; Luigi Tarallo, MD; Alessandro De Franciscis, MD; Tom Jefferson, MD; and Alfredo Guarino, MD

ABSTRACT. Background. In an attempt to reduce the burden of influenza-like illness (ILI) on health resources, the Italian Ministry of Health released clinical practice guidelines (CPGs) on ILI management that include specific indications for the admission of children to the hospital. The aim of this study was to evaluate whether application of these CPGs reduced the rate of inappropriate hospital admissions.

Methods. In the first phase, 2 independent observers recorded the number and clinical condition of children presenting with ILI to the emergency department (ED) of a large urban pediatric hospital and the main reasons for hospital admission. The latter were compared with the CPG indications for hospital admission to evaluate appropriateness. One year later (phase 2), we recorded the number of children with ILI admitted to the hospital by pediatricians trained in a 3-hour course on CPGs and by “untrained” control pediatricians.

Results. In phase 1 of the study, 854 children accessed the ED; 318 (37.2%) had ILI. Of the latter, 26.2% were admitted to the hospital, and 33.7% of admissions were inappropriate according to CPG criteria. In phase 2, 16% of the children with ILI were admitted by CPG-trained pediatricians and 25.8% by control pediatricians. The number of inappropriate hospital admissions was higher among control than among CPG-trained pediatricians.


ABBREVIATIONS. ILI, influenza-like illness; ED, emergency department; CPG, clinical practice guideline.

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Influenza and influenza-like illnesses (ILI) are a major health problem in terms of morbidity and mortality worldwide. In the last 2 decades, the number of respiratory infection–related hospitalizations has increased substantially, and influenza is responsible for 20 to 50 million cases per year in the United States. Childhood ILI is associated with a high incidence of outpatient visits and hospitalizations. In particular, the so-called influenza season is marked by an overload of visits to emergency departments (EDs), especially in large urban areas. The increase in ED visits is paralleled by an increased number of admissions that frequently overwhelms the capacity of referral hospitals.

Inappropriate hospital admission is a major health care problem because of its high rate during influenza and ILI epidemics and because of its negative impact on national health resources and patient management. Most studies of inappropriate admissions have been based on application of the Pediatric Appropriateness Evaluation Protocol, a nonspecific tool used to assess compliance with standard criteria for hospital admission and stay. High rates of inappropriate admissions for pediatric diseases in general have been reported in various countries. In Australia and Canada, 24% and 29% of admissions, respectively, were considered inappropriate. In the United States, the rate of inappropriate hospitalizations ranged between 10% and 70% depending on the specialty. Thirty percent of hospital admissions were found to be inappropriate in Italy. Differences in medical practice are associated with differences in admission rates and possibly with inappropriate admissions. A recent study showed a lower admission rate of children by pediatric EDs than by general EDs, suggesting that clinical expertise may influence the rate of hospital admission.

Clinical practice guidelines (CPGs) are a means of improving medical management and reducing the incidence of unnecessary or risky care. It has been shown that implementation of CPGs improved the medical management and reduced the number of hospital admissions of children with bronchiolitis. It is not known whether CPG implementation could reduce the number of inappropriate hospital admissions for ILI.

The Italian Ministry of Health has produced a series of evidence-based CPGs aimed at improving medical practice nationwide and reducing health
care costs. This series, available online,\(^9\) includes CPGs for the management of ILI with specific indications for the hospital admission of children. We conducted a 2-phase study to investigate the appropriateness of hospital admissions of children with ILI. Phase 1 consisted of a prospective observation in a large Italian pediatric hospital to assess the incidence of inappropriate hospital admissions in children with ILI evaluated according to the specific CPGs. In phase 2, we used a case-control design to test the hypothesis that CPG implementation, through a training course administered to physicians working in the ED, reduces the rate of inappropriate hospital admissions.

**METHODS**

**Study Design**

The study was performed prospectively over 2 consecutive influenza seasons in a major pediatric hospital in Naples, Italy, that serves ~500,000 individuals. The study consisted of an observational phase conducted during the 2001–2002 influenza season and an intervention phase conducted during the 2002–2003 season in which the CPG was implemented (Table 1).

Two pediatricians acted as independent observers in the hospital ED. They were not members of the hospital staff but were clinical monitors for a separate epidemiologic study on influenza that was being conducted in the ED. Consequently, staff pediatricians were unaware that the observers were collecting information about hospital admission. Therefore their decision to admit or discharge a child was unlikely to be influenced by the observers. The independent observers were trained in a 2-step process: (1) they were interviewed to test their knowledge of the management of children with acute respiratory symptoms; and (2) they were involved in designing the study protocol and trained in the methodology of recording data. The independent observers identified all children (<16 years of age) presenting to the ED and classified their reason for presentation. They also classified reasons for all admissions. Once children were admitted to the hospital, they were referred to the division of pediatric infectious diseases. Informed consent was obtained for all children.

**Phase 1: Observation**

Data were collected on 12 previously selected sample days (the first Wednesday and Sunday of each month) during 6 months that included the influenza season (November 2001 to April 2002). In Italy, children have free access to their family pediatricians during working days. Thus, in selecting Wednesdays and Sundays for our evaluation we were able to compare children accessing the ED when the family pediatricians were available and when they were not. Each day consisted of 24 hours of observation.

All children presenting at the ED were enrolled in the study, and the reasons for presenting were recorded. For children with a clinical diagnosis of ILI, the observers recorded age, gender, time at presentation, educational level of the mother, presence of cohabiting smokers, distance between home and hospital, and the presence of risk factors and clinical parameters listed in the CPG as indications for hospital admission. In children admitted to the hospital, the main reason for hospitalization, indicated by the staff pediatrician, was also recorded. To determine appropriateness after admission, 2 authors (G.D.M. and S.M.) matched clinical parameters and/or presence of risk factors, recorded by the independent observers for each child, with CPG indications for hospital admission. This comparison was made “blind” to the decision of the staff pediatrician (admission versus discharge). Appropriateness was defined as adherence to CPG indications for hospital admission.

**Phase 2: Intervention**

Phase 2 of the study was conducted from December 2002 to February 2003 (Table 1). Of the 11 pediatricians working in the ED, 6 were new consequent to the yearly rotation of duties and were included in phase 2. None of the pediatricians in the ED were aware of the CPGs. Pediatricians were allocated randomly into 2 groups. Group 1 was trained to comply with the CPGs, and group 2 served as the control. Pediatricians in the 2 groups did not significantly differ by age (mean: 41.3 vs 39 years), male-to-female ratio (2:1), years of practice (10.3 vs 8 years), or work hours (equal number of total and nocturnal turns per month).

Two weeks before starting the enrollment of children, group 1 attended a 3-hour training course designed by the authors that consisted in presentation of the CPGs, scientific evidence and rationale for CPG application, and a discussion with case simulations.

All children with ILI accessing the ED over 28 consecutive days between January and February 2003 were prospectively enrolled in the study. Based on the observation of hospital accesses in phase 1, observation time was from 8 am to 8 pm to include the majority of children accessing the ED. For all children with ILI, observers recorded age, gender, presence of risk factors, and the clinical parameters listed in the CPGs as indications for admission. In children subsequently admitted to the hospital, the main reason for hospitalization, as indicated by the staff pediatrician, was recorded. As in phase 1, of the study the clinical monitors were unaware of the CPGs.

**Definition and CPGs**

ILI was clinically defined as an acute (≤72-hour) febrile (≥37.8°C) disease with respiratory symptoms.\(^{20–22}\) The CPGs for the management of ILI were produced on behalf of the Italian Ministry of Health by a panel of experts including G.D.M., T.J., and A.G. They are based on an analysis of the pertinent literature and on recommendations graded according to the level of proof and strength of recommendations.

The CPG indications for hospital admission are based on 3 sets of parameters: (1) clinical condition (ie, severity of illness and presence of risk factors [age <3 months, chronic respiratory or cardiac diseases, renal failure, cystic fibrosis, diabetes, congenital or acquired immunodeficiency, neoplastic disease]); (2) use of specific procedures that could only be performed in the hospital, such as oxygen administration or intravenous rehydration; and (3) inability of parents to cope with the problem. Hospital admission is recommended if 1 of the following conditions are present: (1) respiratory distress with a respiratory rate of >70 breaths per minute and/or peripheral oxygen saturation of <90%; (2) presence of neurologic symptoms, including the first episode of febrile seizure; or (3) severe dehydration requiring intravenous fluid administration. Admission is not specifically recommended but considered “appropriate” if at least 1 of the following indications is present: (1) respiratory distress with a respiratory rate of 60 to 70 breaths per minute and/or peripheral oxygen saturation of 94% to 90%; (2) presence of host-related risk factors; (3) inability of parents to cope with the problem or an explicit request for hospital admission by parents or accompanying person; or (4) need for specific hospital procedures.

**TABLE 1.** The 2 Phases of the Study

<table>
<thead>
<tr>
<th>Period</th>
<th>Phase 1: Observation</th>
<th>December 2002 to February 2003</th>
<th>Phase 2: Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical population</td>
<td>November 2001 to April 2002; 12 sample days</td>
<td>All pediatricians attending the ED observed</td>
<td>Three emergency pediatricians who were trained in the use of CPGs and 3 control pediatricians</td>
</tr>
<tr>
<td>Pediatric population</td>
<td>All children seen in the ED</td>
<td>All children with ILI seen in the ED</td>
<td>All children with ILI seen in the ED</td>
</tr>
<tr>
<td>Outcome parameters</td>
<td>Total number and admission rates and appropriateness of admissions according to CPGs</td>
<td>Total number and admission rates and appropriateness of admissions according to CPGs</td>
<td>Total number and admission rates and appropriateness of admissions according to CPGs</td>
</tr>
</tbody>
</table>
Phase 1: Observation

During the sample days, a total of 854 children accessed the ED (435 males; mean age: 35.1 months; range: 0–180). Most children (502 [58.8%]) presented with respiratory symptoms. Gastrointestinal symptoms (133 [15.6%]), rashes (95 [11.1%]), injuries (44 [5.2%]), and neurologic symptoms (26 [3%]) were the other main reasons for presenting. Among children with respiratory symptoms, 351 (41.1%) matched the definition of ILI (184 males; mean age: 29.1 months; range: 0–180) (Table 2). Most were observed during daytime hours (279 [79.5%] vs 72 [20.5%] during night hours; \( P < .001 \)). There were no significant differences in the mean number of children seen on a Wednesday or a Sunday (28.7 vs 29.8 per day, respectively). There was a significantly higher admission rate for children with ILI than for children presenting with other complaints (92 of 351 vs 38 of 456; \( P < .0001 \)).

Analysis of risk factors for hospital admission showed that the mother’s educational level, presence of cohabiting smokers, and distance from the hospital did not affect the admission rate. A younger age (0–3 months) was significantly associated with an increased risk for hospital admission (odds ratio: \( 6.26; 95\% \) confidence interval: 2.69–14.57; \( P < .05 \)). There were no significant differences between children enrolled in the 2 phases of the study in terms of age, male-to-female ratio, and prevalence of risk factors. The baseline features of children seen by CPG-trained pediatricians and control pediatricians were also similar (Table 2). Demographic features of CPG-trained and control pediatricians were similar also. The overall admission rate for ILI was 20.1% (157 of 782) in the intervention phase and was significantly lower than the 26.2% recorded in phase 1 of the study (\( P < .05 \)). The reduction was entirely related to changes in admission rates by CPG-trained pediatricians. As shown in Fig 2, 73 (16%) of the 457 children examined by CPG-trained pediatricians were admitted to the hospital. Conversely, control pediatricians admitted 84 (25.8%) of the 325 children with ILI (Fig 2). Thus, implementation of CPG coincided with a significant reduction of the total number of hospital admissions (\( P < .001 \) vs control pediatricians and vs admissions in phase 1 of the study) (Fig 2). The admission rate for children seen by control pediatricians in phase 2 was identical to that observed in phase 1 (Fig 2).

As shown in Fig 3, CPG implementation reduced the rate of inappropriate admissions. Again, the rates of inappropriate admissions in phase 1 were similar to those in the control pediatricians in phase 2 (Fig 3). Last, we examined the reasons for admission in the 2 groups of children seen by CPG-trained pediatricians and control pediatricians (Fig 4). The number of children admitted because of severity of their clinical condition was much lower for CPG-trained pediatricians. However, as shown in Fig 4, the number of children admitted because of parental inability to cope with the disease or because of an explicit request for hospital admission was much higher in the group of CPG-trained pediatricians than in “untrained” pediatricians (\( P < .05 \)). There was no difference in inappropriate admissions between children presenting at the ED because of ILI. All inappropriate admissions were related to the child’s clinical condition. The main specific clinical reasons for admission are shown in Fig 1.

Phase 2: Intervention

To test the hypothesis that CPG implementation could reduce inappropriate admissions, all children with ILI were enrolled for 28 consecutive days starting at the onset of the influenza peak (January 2003). A total of 782 children with ILI accessing the ED were enrolled (447 males; mean age: 32.4 months; range: 0–183). A total of 457 children were seen by pediatricians trained in CPG implementation, and 325 children were seen by control pediatricians. There were no significant differences between children enrolled in the 2 phases of the study in terms of age, male-to-female ratio, and prevalence of risk factors. The baseline features of children seen by CPG-trained pediatricians and control pediatricians were also similar (Table 2). Demographic features of CPG-trained and control pediatricians were similar also. The overall admission rate for ILI was 20.1% (157 of 782) in the intervention phase and was significantly lower than the 26.2% recorded in phase 1 of the study (\( P < .05 \)). The reduction was entirely related to changes in admission rates by CPG-trained pediatricians. As shown in Fig 2, 73 (16%) of the 457 children examined by CPG-trained pediatricians were admitted to the hospital. Conversely, control pediatricians admitted 84 (25.8%) of the 325 children with ILI (Fig 2). Thus, implementation of CPG coincided with a significant reduction of the total number of hospital admissions (\( P < .001 \) vs control pediatricians and vs admissions in phase 1 of the study) (Fig 2). The admission rate for children seen by control pediatricians in phase 2 was identical to that observed in phase 1 (Fig 2).

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### TABLE 2. Baseline Features of Children With ILI Enrolled in the Study

<table>
<thead>
<tr>
<th>Phase 1: Observation</th>
<th>No. of Children</th>
<th>Male/Female (Ratio)*</th>
<th>Mean Age, mo*</th>
<th>Range, mo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children seen by pediatricians</td>
<td>351</td>
<td>184/16 (1.1:1)</td>
<td>29.1</td>
<td>0–180</td>
</tr>
<tr>
<td>Phase 2: Intervention</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children seen by pediatricians exposed to CPGs</td>
<td>457</td>
<td>267/190 (1.4:1)</td>
<td>32.5</td>
<td>0–179</td>
</tr>
<tr>
<td>Children seen by pediatricians not exposed to CPGs</td>
<td>325</td>
<td>180/145 (1.24:1)</td>
<td>33.7</td>
<td>0–183</td>
</tr>
</tbody>
</table>

* \( P = \) not significant among the 3 groups of children enrolled in the phases of the study.
ence in children admitted for a specific hospital procedure (Fig 4). Again, there were no differences between specific reasons for admission of children seen by control pediatricians and children admitted during phase 1 of the study.

DISCUSSION

We evaluated the effects of implementation of a specific CPG on admission criteria for children with ILI in a case-controlled study. We used the CPG indications to evaluate the appropriateness of management of children with ILI in terms of admission after accessing the ED. Our working strategy differed from previous studies in 2 aspects: (1) unlike the widely applied general protocols (eg, Pediatric Appropriateness Evaluation Protocol),6–8 the CPG indications for hospital admission were tailored for pediatric ILI and are based on recent data; and (2) the data records came from a direct, case-controlled, prospective observation by specifically trained independent observers rather than from a retrospective record consultation. Using this innovative strategy, we observed a rate of inappropriate admissions >30%. It is interesting to note that almost 10% of all ILI-affected children accessing the ED were admitted to the hospital, which is consistent with the high social burden of ILI.

Given these findings, we designed a study to test the hypothesis that CPG implementation could reduce the number of inappropriate hospital admissions. A lack of knowledge about guidelines on the part of physicians may be a major problem in guideline implementation.23 To improve the attitude of clinicians toward CPG application, it is important that the CPGs be developed in collaboration with the users.24 We applied a simple implementation strategy consisting of a 3-hour course, during which CPGs were described, possible problems in their ap-
plication discussed, and cases simulated. Although we did not evaluate illness outcomes, CPG implementation consistently reduced the overall number of admission for ILI. In fact, the number of inappropriate admissions by CPG-trained pediatricians was almost half that by control pediatricians. The reduction was the result of a decrease in the number of children inappropriately admitted because of mild symptoms. It is interesting to note that among the CPG-trained pediatricians there was a relative increase in the number of inappropriate admissions because of the “inability of parents to cope with problem” or because of an “explicit request” for hospitalization. This increase may be because trained pediatricians cited a CPG indication to justify admission of children for whom they felt the admission was “somehow” necessary. Even if this is the case, the overall rate of inappropriate admissions was reduced substantially in the CPG-trained group.

Based on national data for hospital admissions (2002; data not shown), we estimate that >20 000 children are admitted inappropriately every year for acute respiratory infections in Italy, whereas nationwide CPG implementation could prevent as many as 8000 admissions of children with ILI per year, which would help to improve medical care and optimize health resources. We feel that this simple, inexpensive, and well-received approach for CPG implementation, just before the influenza season, could have a major impact in reducing inappropriate hospital admissions of children with ILI.

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REFERENCES


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