

# Quality Improvement in Pediatric Well Care with an Electronic Record

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## Abstract

For the past 4 years the pediatric office of Children's Health Specialists has used an electronic medical record (EMR). The EMR has forms for the routine well child visits recommended by the American Academy of Pediatrics (AAP) [1] and instruction sheets with key information on development and safety as recommended by "Bright Futures" [2]. In this study the completeness of well visits, instruction distribution, immunizations and lead testing were examined for all children in our practice with birthdays in 1998. When children did get to the office they did get their instruction sheets on child development and safety and were well immunized. Children who had insurance coverage to pay for in-office lead testing were 42.6 times more likely to have blood lead testing done: Risk Ratio 42.6, lower limit 10.6, upper limit 171.3. Insurance coverage and regulatory changes would likely increase lead screening markedly in high risk populations. Our implementation of our EMR has helped us to deliver high quality pediatric well child care but external obstacles limit the completeness of the care.

## Background

Well child care in outpatient pediatrics has multiple problem areas to address. Biologic and physical progress must be observed and documented; then immunizations and nutritional information must be given for optimal child health. Currently experts are recommending and parents are demanding documentation and information on psychological development and injury prevention at each well child visit [3]. Paper charts quickly become thick and cluttered with multiple forms and laboratory reports. To help meet these demands Children's Health Specialists of Auburn, NY began an electronic medical record (EMR) in the spring of 1997. At that point our records were adequate for a solo pediatrician but in the summer of 1997 another pediatrician was to join the practice. This EMR was an added

on to our billing system so was already prepopulated with demographic, diagnosis, procedure and immunization data. We feel that we have saved money on storage and clerical costs while improving the quality and accessibility of our records. The time required to complete the EMR is about the same as with our old paper check list forms but the results are far more legible and organized than our previous paper records. For our practice with about 200 to 250 patient visits a week using 4 examination rooms the cost for the added equipment (10 networked PC's) and software leased over 5 years added about \$1000 per month to our expenses. Software and hardware maintenance is extra at about \$500 per month. Dial up record access by PC had been used for 4 years before the addition of the EMR.

The EMR has form set up capability and record areas for immunizations and laboratory. Forms were created for well visits at ages 2 weeks old, and at 2, 4, 6, 9, 12, 15, and 18 months old. History and physical forms included age appropriate development and safety questions. Questionnaires may be printed up before or when the patient and family are in the waiting room and filled out by the parent. The results are usually entered on the EMR by the nurse in the electronic questionnaire form on one of the networked PC's or may be entered by the physician when the history and physical forms are filled out in the examination room. The development and safety questions appear in that form as a pop up box that may be checked off to mark the responses. For each age, the nurse prints instruction sheets with the patient's height, weight, length and head circumference with percentiles and the patient's name. The development and writing of the history and physical forms and the instruction sheets took about 6 months of spare time for the author of this report. The arrival of the new pediatrician to the practice made it possible for the author to complete the project. The guidelines of the AAP [1] and the "Bright Futures" Project [2] were used for references for the forms and

instruction sheets. The initial use of these forms started by September 1997 and by January 1998 the clerks, receptionists, nurses and physicians were using them regularly. By the summer of 1998 the office was using the LeadCare machine developed and manufactured by the ESA, Inc. with funding from the CDC (Centers for Disease Control). This small easy to operate machine tests the blood lead levels from small blood samples obtained by fingerstick. It is run by the nurses and has a quality control program run by the Wisconsin State Laboratory and funded by the CDC. Our quality control results have been consistently good. Once in 2 years the machine needed servicing. For each kit of sample testing tubes and electrodes there is a control specimen and daily we use an electronic control to be sure the machine's electric calibration is correct. Some insurance companies reimburse for this test. NY State Medicaid lacks reimbursement for it. We charge \$30 for a serum lead test while most commercial laboratories in our area charge \$40 or more. Some managed care insurance companies may pay less if they have special contracts with laboratories but often these laboratories lack a presence or even a pick up service in our small city. Our county is over 200 years old with many houses with lead paint and patients with lead toxicity.

#### Method

To determine the completeness of our care for our patients all children with birth dates in 1998 were studied. A list with the name and address for each patient was printed up and then the EMR for each patient was reviewed. Our system contained 443 patients with birth dates in 1998. To be eligible for this study the patient had to be one of our regular patients from 2 weeks to 18 months old or more. Of the 443 patients that had been entered on our EMR only 208 met the study criteria. About 60 had transferred in at an older age. About 60 had transferred out before 18 months old. About 40 were seen when we were on call for the other 3 pediatricians in the city. About 50 were seen only when newborns at our hospital in the city with about 500 births a year. The county has about 900 births a year. There are about 4 other hospital within 40 miles of the city but only one in the city and county. Our practice covers only the hospital in our city.

About 10 were only seen in the hospital when on call. About 10 were in the EMR but had never been seen. They may have had appointments that they missed or may have had siblings who came to our practice but failed to ever make appointments.

For eligible patients the tabulations of the number of: well visits, instruction sheets printed, immunizations given, and missed appointment letters printed were done. Also tabulated were the record of a parent refusing a chickenpox vaccine (Varivax), accepting the chickenpox vaccine, Medicaid status, whether the patient had insurance coverage of lead testing in the office, whether lead testing was done and whether lead testing was ordered. Well visits from 2 weeks to 21 months old were counted by inspection of the EMR. A total of 8 visits was possible. Well visits, instructions given, missed appointment letters, lead levels done or ordered were counted only if done before 22 months old, since part of quality is timely health care. For each of these 8 visits an accompanying instruction sheet may have been printed and recorded. The immunization records were viewed from the EMR and our signed paper copy of the immunization record was reviewed for 12 of the 208 eligible patients when the EMR appeared incomplete for the number and time of the visits. The EMR then was corrected as needed. Immunizations were considered complete if discussion and refusal of the vaccine took place or if the vaccine was given. Only 3 patient families (all with a parent in the NY Chiropractic College) refused all vaccines and 5 others refused only the chickenpox vaccine of the 208 studied. The maximum number of immunizations for this time period at our office was 16. This included 3 hepatitis B starting at 2 weeks old, 4 DTaP (DTP with acellular pertussis), 4 Hib (haemophilus influenza type B conjugate), 3 polio vaccines (first 2 IPV {inactivated}, and third IPV or OPV {oral}), and usually at 15 months old an MMR (measles, mumps and rubella) and Varivax (chickenpox vaccine). Missed appointment letters were sent out if the patient failed to contact us when a scheduled visit was missed. The letters show in the patient's document area of the EMR. The EMR documented in the immunization area refusals for the chickenpox vaccine and if the patient had chickenpox (2 did have it before 15 months old when we usually give the vaccine). A documented refusal, chickenpox in the patient,

or receiving the vaccine all counted toward vaccine completeness. The patient was considered to be on Medicaid if they were ever eligible from 2 weeks old to 21 months old. If the patient had insurance coverage to do lead in the office that patient was marked as lead testing being possible in office. Medicaid patients were the largest group to lack coverage to pay for in office lead testing. Lead test reports from outside laboratories, from WIC (Women, Infants and Children) nutrition program, and our own office were put on the EMR. Any test done before 21 months old was considered as being done and complete. Our office usually did lead testing with a complete blood count between 9 and 12 months of age. If the patient's insurance failed to cover them or the family wanted to go to the laboratory for the lead test this was done through a lab order entered and printed from the EMR.

If immunizations or lead testing were note to be incomplete messages were sent in the EMR to nurses or receptionists to contact the family. Any corrections to or additions in the completeness of the pediatric care brought on by this study were not tabulated in this study, since only our routine office practices were being evaluated.

Data analysis was done using EpiInfo 2000 on a PC. This program was downloaded (about 44 MB) from [WWW.CDC.gov](http://WWW.CDC.gov) by cable modem. It is available without charge by download or for a fee by CD-ROM with a printed manual by mail. Risk ratio for 2x2 tables was done by Taylor series.

## Results

Patients who got to the office got immunizations and instruction sheets, but lead testing was only done adequately if insurance enabled the test to be done at the office.

Immunizations were available to all at minimal costs due to the Vaccine for Children (VFC) Program that we used in our office. If insurance failed to cover a standard vaccine the VFC allows the office to give the vaccine with only an administration fee charge. Of the 149 patients who made all 8 regular well visits 98% had their 16 vaccines by 21 months old. Of the 29 that had 7 well visits 55% had 16 vaccines and 97% had 13 or more vaccines.

Vaccines <16 16

<7 visits	21	9
7,8 visits	16	162

The risk ratio for having less than 16 vaccines when having less than 7 well visits is 7.79 (lower limit 4.6, upper 67.6). Overall 82.2% of our 208 regular patients got the complete set of 15 vaccines.

The patients who were Medicaid eligible at any time had the highest risk of making less than 7 visits.

Visits	<7	7,8
Medicaid	23	52
Non-Medicaid	7	126

The risk ratio for having less than 7 well visits for Medicaid patients is 5.83 (lower limit 2.6, upper 12.9). For Medicaid patient 31% had less than 7 well visits versus only 5% of non-Medicaid patients. When patients did come in they did get the instruction sheets through the efforts of the nurses:

Instructions	<7	7,8
<7 Visits	30	0
7,8 Visits	5	173

The risk ratio for having less than 7 instruction sheets for patients with less than 7 visits was 35.6 (lower limit 15.0, upper 84.5) despite the availability of the sheets any time on any visits. For those attending 7 or 8 well visits 97.3% received 7 or 8 instruction sheets. For all patients 85.6% did receive 7 or 8 instruction sheets. Again as with vaccines the Medicaid population is at more risk for missing out on well child instruction due to the problem of getting those patients to attend well visits. This is despite repeated letters sent out for missed appointments.

Letters sent	>0	0
Medicaid	55	20
Non-Medicaid	37	96

The risk ratio of getting 1 or more missed appointment letters for Medicaid patient families is 2.64 (lower 1.94, upper 3.58). Even in the Medicaid population of 75 there is still a solid group of 20 regular appointment keepers. Patients never requiring a missed appointment letter were 55.8% of the 208.

Despite 89% of the Medicaid patients attending 5 or more well child visits the rate of lead testing in these patients is much poorer than in the other patients who may have lead testing done in the office. With 5 or

more well visits they must have been in the office at least for the 9 month or older visit when lead testing might be done. They also had available a County Lead Screening Clinic free of charge to all and the WIC Program of food supplements to the poor which did lead testing at their offices on the 12 month visit when Federal regulations required a hemoglobin test.

Lead test	lacking	done
Uncovered	37	26
Covered	2	143

The relative risk of lacking a lead test by 21 months old for patients without insurance for in office testing is 42.6 (lower limit 10.6, upper 171.3) by the Taylor series. Clearly for families who have to go beyond their routine health visits, compliance with optional health testing for their children is quite poor. On the other hand 26 of 63 families who had to go outside the office did manage to get the testing done. To further examine this relationship a multivariate analysis was done. Lead tests being done was mostly explained by the ability to do in-office testing (F –test 96) with some more explanation of variance by adding the “number of well visits” variable (F-test 70) to the equation. Despite economic barriers the persistent families did get the lead testing done more often.

#### Comments

Using an EMR, at Children’s Health Specialists of Auburn, NY, helped to deliver quality pediatric well child care. Our vaccine rates compare quite favorably to the National Immunization Survey (NIS) for 1997 [4]. The NIS does telephone surveys of 19 to 35 month old children and ascertains whether than have completed a series of 11 vaccines: 4 DTP or DT, 3 polio, 1 measles, and 3 Hib. For children 29 to 35 months old completion rates ranged from 69% to 86% (median 77%) with higher completion rates in high income and high pediatrician to population ratio areas [5]. Our area is low to medium income and with few pediatricians per population. Getting 82.2% of all our patients 16 vaccines by 21 months old is much better than the NIS median level of 77% getting only 11 vaccines by 29 to 35 months old. For our regular attendees the 98% completion rate is excellent considering illnesses that occur with well visits that might cause vaccination delay. Our delivery of patient instruction sheets helps fulfill the demand of many parents for age appropriate health, development and safety information [3]. The Commonwealth Fund “Survey of Parents with Young Children” found that only 62% of parents received information on newborn care, 35% on crying, and

23% on learning encouragement [3]. Overall 85.6% of our 208 regular patients received 7 or 8 instruction sheets over the first 21 months of life and for those who attended 7 or 8 well visits 97.3% received 7 or 8 sheets. Some patients may have ignored them but nurses and physicians often answer questions at the well visits. The instruction sheets serve as a standard script for the nurses and physicians to follow or focus on. The sheets also could be mailed to the parents if they left them behind or they were printed after they had left or requested them in-between visits. For the 145 patients who had financial coverage for in-office lead testing 98.6% and for all patients 81% had a lead test by 21 months old. For the 63 who lacked insurance coverage for in-office lead testing (which included all the Medicaid patients at 9 to 21 months old) only 41% had lead testing done but this compares favorably to the Third National Health and Nutrition Examination Survey (NHANES) for 1988 to 1994 which showed that only 10% of high lead children 1 to 5 years old on the survey had ever had routine lead testing through their well child care or in any other way [6]. The Advisory Committee on Childhood Lead Poisoning Prevention (ACCLPP) notes that only 19% of Medicaid enrolled young patients had ever had lead testing and that these children accounted for 83% of the children on the NHANES who had high lead levels over 10 microgm/dl [7]. The quality successes of our practice are only in part due to the EMR. To operate any system of care with quality takes the dedication and time of receptionists, clerks, nurses and physicians. Wager, Lee, White, Ward, and Ornstein note that EMR use in many practices fails to help improve quality [8]. Plume, Dysinger and Batalden note that change must come with leadership planning to help the functional micro-systems of the organization to focus on and deal with quality issues [9].

Despite our best efforts within our practice we have definite problems in delivering quality care to patients who fail to show up for appointments here or get laboratory testing at outside sites. For the 30 patients with less than 7 visits only 30% had the complete set of 16 vaccines and none got 7 or 8 of the complete set of 8 instruction sheets. For the 63 patients who lacked insurance that would cover in office lead testing only 41.3% got their lead test done at any site. Practically this is a tough problem to address since these non-compliant patients also have poor health care funding and/or life styles. Of the 30 patients with less than 7 well visits 77% were on Medicaid at some point. Medicaid barely pays for our regular overhead, and outreach efforts by or for private physicians lack funding. Patients that miss appointments or fail to schedule them may lack any

known contact mechanisms. Often our reminder letters are returned "moved, left no address" and we lack current working phone numbers for the patient. With managed care and decreased laboratory reimbursement by regular insurance, in-office laboratory testing is becoming less feasible. We have one insurance company that covers about 5% of our patients but lacks any contracted laboratory in the area that will do lead testing or will even pick up blood that we draw without reimbursement. They suggest our patients be given laboratory order for a site 50 miles from our practice. The ACCLPP recommends that states should change policies to ensure that Medicaid enrolled young children are screened for lead [7]. Besides the 208 regular patients that we followed from 2 weeks to 18 months old we had some contact with 235 other children born in 1998. Many patients have problems with continuity that may lead to poor quality of care [10]. We try to print or fax our EMR information on these patients to their regular physician but often patients move or change practices without record transfers. We have a secure dial up modem access available to our EMR but other pediatricians and emergency room physicians that see our patients when we are off duty have failed to use this valuable information. Most physicians are so used to dealing with patients without complete data that they often just try to live with our ignorance rather than correct it. This will take changes in our provider micro-systems. Leaders must encourage small groups of dedicated providers working together to improve the quality of care for high-risk groups.

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