Evidence-Based Medicine in the EMR Era
Jennifer Frankovich, M.D., Christopher A. Longhurst, M.D., and Scott M. Sutherland, M.D.

Many physicians take great pride in the practice of evidence-based medicine. Modern medical education emphasizes the value of the randomized, controlled trial, and we learn early on not to rely on anecdotal evidence. But the application of such superior evidence, however admirable the ambition, can be constrained by trials’ strict inclusion and exclusion criteria — or the complete absence of a relevant trial. For those of us practicing pediatric medicine, this reality is all too familiar. In such situations, we are used to relying on evidence at Levels III through V — expert opinion — or resorting to anecdotal evidence. What should we do, though, when there aren’t even meager data available and we don’t have a single anecdote on which to draw?

We recently found ourselves in such a situation as we admitted to our service a 13-year-old girl with systemic lupus erythematosus (SLE). Our patient’s presentation was complicated by nephrotic-range proteinuria, antiphospholipid antibodies, and pancreatitis. Although anticoagulation is not standard practice for children with SLE even when they’re critically ill, these additional factors put our patient at potential risk for thrombosis, and we considered anticoagulation. However, we were unable to find studies pertaining to anticoagulation in our patient’s situation and were therefore reluctant to pursue that course, given the risk of bleeding.

A survey of our pediatric rheumatology colleagues — a review of our collective Level V evidence, so to speak — was equally fruitless and failed to produce a consensus.

Without clear evidence to guide us and needing to make a decision swiftly, we turned to a new approach, using the data captured in our institution’s electronic medical record (EMR) and an innovative research data warehouse. The platform, called the Stanford Translational Research Integrated Database Environment (STRIDE), acquires and stores all patient data contained in the EMR at our hospital and provides immediate advanced text searching capability.1 Through STRIDE, we could rapidly review data on an SLE cohort that included pediatric patients with SLE cared for by clinicians in our division between October 2004 and July 2009. This “electronic cohort” was originally created for use in studying complications associated with pediatric SLE and exists under a protocol approved by our institutional review board.

Of the 98 patients in our pediatric lupus cohort, 10 patients developed thrombosis, documented in the EMR, while they were acutely ill. The prevalence was higher among patients who had persis-
tent nephrotic-range proteinuria and pancreatitis (see table). As
compared with our patients with lupus who did not have these
risk factors, the risk of thrombosis was 14.7 (95% confidence in-
terval [CI], 3.3 to 96) among pa-
tients with persistent nephrosis
and 11.8 (95% CI, 3.8 to 27)
among those with pancreatitis.
This automated cohort review was
conducted in less than 4 hours
by a single clinician. On the ba-
sis of this real-time, informatics-
enabled data analysis, we made
the decision to give our patient
anticoagulants within 24 hours
after admission.
Our case is but one example
of a situation in which the exist-
ing literature is insufficient to
guide the clinical care of a pa-
tient. But it illustrates a novel
process that is likely to become
more much more standard with the
widespread adoption of EMRs
and more sophisticated informa-
tics tools. Although many other
groups have highlighted the sec-
ondary use of EMR data for cli-

cal research,\textsuperscript{2,3} we have now seen
how the same approach can be
used to guide real-time clinical
decisions. The rapid electronic
chart review and analysis were
not only feasible, but also more
helpful and accurate than physi-
cian recollection and pooled col-
league opinion. Such real-time
availability of data to guide deci-
sion making has already trans-
formed other industries,\textsuperscript{4} and the
growing prevalence of EMRs along
with the development of sophisti-
cated tools for real-time analysis
of deidentified data sets will no
doubt advance the use of this data-
driven approach to health care de-

civery. We look forward to a fu-
ture in which health information
systems help physicians learn from
every patient at every visit and
close the feedback loop for clini-
cal decision making in real time.
Did we make the correct deci-
sion for our patient? Thrombosis
did not develop, and the patient
did not have any sequelae related
to her anticoagulation; truthfully,
though, we may never really
know. We will, however, know
that we made the decision on the
basis of the best data available
— acting, as the fictional detect-
ive Nero Wolfe would say, “in
the light of experience as guided
by intelligence.”\textsuperscript{5} In the practice
of medicine, one can’t do better
than that.

Disclosure forms provided by the authors
are available with the full text of this article at
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From the Division of Rheumatology (J.F.),
the Division of Systems Medicine (C.A.L.),
and the Division of Nephrology (S.M.S.),
Department of Pediatrics, Stanford Univer-
sity School of Medicine, Palo Alto, CA.

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1. Lowe HJ, Ferris TA, Hernandez PM, We-
ber SC. STRIDE — an integrated standards-
based translational research informatics plat-
form. AMIA Annu Symp Proc 2009;Nov 14:
391-5.

2. Prokosch HU, Ganslandt T. Perspectives
for medical informatics: reusing the elec-
tronic medical record for clinical research.

3. Gunn PW, Hansen ML, Kaelber DC. Under-
diagnosis of pediatric hypertension — an
example of a new era of clinical research
enabled by electronic medical records. AMIA
Annu Symp Proc 2007;October 11:966.

4. Haley A, Norvip P, Pereira F. The Unrea-
sonable Effectiveness of Data. IEEE Intell-

5. Stout R. In the best families. New York:

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\textsuperscript{2} In all cases, the sentences surrounding the keywords were manually reviewed to determine their relevance to our patient. Pancre-
atitis was defined as an elevated lipase level (twice the upper limit of normal) coexisting with abdominal pain. We used the word “aspirin” as a proxy for antiphospholipid antibodies, since it is standard practice at our institution to give all patients with these antibodies aspirin; if “aspirin” was found in the chart, than antiphospholipid-antibody status was confirmed by investigating the laboratory results.

<table>
<thead>
<tr>
<th>Outcome or Risk Factor</th>
<th>Keywords Used to Conduct Expedited Electronic Search</th>
<th>Prevalence of Thrombosis (95% CI)</th>
<th>Relative Risk (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome — thrombosis</td>
<td>“Thrombus,” “Thrombosis,” “Blood clot”</td>
<td>10/98 (10)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Thrombosis risk factor</td>
<td>Heavy proteinuria (&gt;2.5 g per deciliter)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present at any time</td>
<td>“Nephrosis,” “Nephrotic,” “Proteinuria”</td>
<td>8/36 (22)</td>
<td>7.8 (1.7–50)</td>
</tr>
<tr>
<td>Present &gt;60 days</td>
<td>“Urine protein”</td>
<td>7/23 (30)</td>
<td>14.7 (3.3–96)</td>
</tr>
<tr>
<td>Pancreatitis</td>
<td>“Pancreatitis,” “Lipase”</td>
<td>5/8 (63)</td>
<td>11.8 (3.8–27)</td>
</tr>
<tr>
<td>Antiphospholipid antibodies</td>
<td>“Aspirin”</td>
<td>6/51 (12)</td>
<td>1.0 (0.3–3.7)</td>
</tr>
</tbody>
</table>