At HPG, we are specialists in assisting health systems that have chosen Cerner Millennium® as their strategic HIS. In this three-part whitepaper on Optimizing FirstNet® we asked Dr. Michael Fossel, MD, Consulting Physician, Clinical Adoption for HPG, to share his experience on this important topic.

Emergency departments rely on speed: all emergency department solutions – such as FirstNet® or PowerNote™ – must be optimized to reflect the need for an efficient and rapid workflow. This is not only crucial to the users – physicians and nurses – but equally crucial to both patient flow and patient safety. Any delay in emergency care increases patient risk. In the emergency setting, as opposed to most other areas, care must not only be efficient, but as rapid as possible. One uncommon system design decision – with unfortunate consequences -- is to restrict the user to a single ED patient chart at a time. Although usually done with the intent of decreasing risk or error, the outcome is frequently just the opposite: an increase in patient risk due to the physician’s workflow being constantly disrupted in the midst of clinical action, when physicians are forced to close the chart they’re working in, and open and close a second chart to handle the interruption before they can return to the first chart and try to resume their prior clinical workflow. Overall, any considerations of design, build, and customization of FirstNet® or PowerNote™ must reflect the need for both efficiency and speed. This is equally true for all three primary roles of any EHR:

- Viewing data (Part 1)
- Placing orders (Part 2)
- Documenting (Part 3)

**Part 1 – Viewing data**

**Viewing data on the tracking board:**

Finding data slows down if there is either too much or too little data on the screen. The optimal screen displays exactly what is needed and no extraneous “visual clutter”. Every effort should be made to reduce extraneous data whenever there is no rationale for inclusion (such as patient risk, confusion, etc.).
Example: Some MPAGE® designers have used unnecessary units for vital signs. In one typical case, the blood pressure was given in two lines. The first line showed a number followed by “systolic blood pressure in mm Hg”; the second line showed a number followed by “diastolic blood pressure in mm Hg”. This not only slows patient care, but increases patient risk. Optimal display would be “140/90” with no units listed. The units are understood, unambiguous, and only serve to distract and interfere with visual processing.

Example: The same error occurs with laboratory values. Most physicians pause and have to think about the units for serum potassium, but they can instantly tell if a value is abnormal. Optimal display of a potassium value would be “4.3” without any initial units displayed (although they are viewable with a hover exposure which displays both the units and the abnormal values).

Example and exception: Temperatures are a similar example to that of vital signs and laboratory values, even without specifying the scale used. There is never a case of clinically mistaking a Fahrenheit body temperature for a Centigrade body temperature, as the two scales are so far apart that there is no clinically survivable range between the two markedly different scales. Optimally, temperature would therefore be given in “degrees” (with a specification of oral, rectal, etc.), even without specification of the scale used (e.g., F versus C). The same is NOT true for patient weights, in which the scale used (pounds versus kilogram) is routinely critical, since both scales can extend almost to zero in routine patients (e.g., neonates) and since routine adult weights overlap on these two scales. Weights must therefore include units.

The issue of “visual clutter” recurs on the tracking board, where most ED’s have too many columns and icons for the view on the physician tab, slowing visual processing and physician workflow. Tracking board tab views should be optimized to present useful information only. Each column should be reviewed for its necessity and ruthlessly pruned unless of clearly proven value.

Example: many tracking boards display icons showing that a urine has been ordered. This conveys no useful information to the physician who ordered it, who is already aware of the order. The icon is useful for the nurse tab view and it may be useful in some busy academic departments (when physician care is shared by both attendings and residents, although physicians tend to rely on the orders view within the chart, rather than the events icons on the tracking board for this information).

Too little information can also be a risk and can slow the workflow. Concerned with issues regarding confidentiality and HIPAA violations, some tracking boards will display no patient name information (not even initials). This has occasionally resulted in procedures (particularly respiratory therapy and radiology tests) being done on the wrong patient. Patient safety and optimal workflow require that the tracking board display sufficient information to support routine patient care.
例：在一家 ED 中，患者姓名列仅使用首字母和姓氏。在一个四个月的期间内，三位 ED 患者分别收到了不合适的呼吸护理和两位 ED 患者收到了不合适的放射学检查。这些错误的发生是因为两位字母的首字母频繁地重复，技术人员（呼吸科和放射科）仅仅确认正确的首字母。在另一案例中，患者本人误解了问题，当被适当问及确认其全名时，她没有听到技术人员问什么而错误地确认了一个不正确的患者姓名。尽管有医院法律顾问的担忧，及出于患者安全的考虑，政策被改变为使用一个姓名列与一个首字母和全姓氏的患者。

附加的列也可能是有价值的，尤其是共签列，这可以有效地用于两种常见情况：使用分诊单据和需要由处理医生签字，以及使用住院医师或中级护理人员和需要他们监督及/或共签这些单据。

查看病人图表中的数据：

在病人图表中，视图（例如结果视图，生命体征表，等）应被调整以提供支持快速和有效流程所需的最佳信息量。虽然患者体重可能不是一个“生命体征”，它通常在生命体征的背景下被评估，将它添加到这个视图中可以支持更有效的流程。同样地，它可以被有效地用于添加“相关结果”作为在订单窗口上的一个面板视图，因此当订购 CBC 时，医生可以同时查看最后已知的 Hgb，等。仔细调整的信息——支持有效和快速流程——在 ED 紧急情况表上尤其重要。

总结（ED 紧急情况表®）。理想的设计应当确保这个视图仅包含进入考室前必需的信息，而排除所有其他信息。默认设计的 ED 紧急情况表往往包括主要的投诉（例如“胸痛”），但忽略了分诊护士的重要短叙事（例如“左臂钝痛 2 小时，伴恶心”）这非常关键，以支持有效的 ED 评估和治疗。

在另一极端，过敏信息很少需要，因为它已经存在在横幅条上，而其他剩余面板应被评估以仅包括初始医生评估时必需的信息。例如，家族病史通常不重要到应该包含在这个紧急情况表®上。有用？是的，但它通常会减慢 ED 医生的快速流程模式。理想的紧急情况表®是简短的，极其信息丰富的，且没有任何额外信息。
Part 2 – Placing orders

Placing orders: the MOEW

Ordering should require the fewest possible clicks, scrolls, or tabs. The order of preference from the least to the most efficient way to place orders or pull up order sets (PowerPlans™) is:

- Search (i.e., type in a name): this demands the most clicks and wastes time
- Favorite folders: relatively efficient if the physician constructs favorite folders
- Use of home folders: this is the most efficient method

Use of the search function is not only the slowest method of locating orders or order sets, but it is also the most prone to error in choice and details. While the use of favorites folders is relatively efficient, many physicians never construct such folders and this method also fails to “push” care toward evidence-based selections of orders. The most efficient and appropriate method of choosing orders is to have the most common orders and order sets available immediately upon opening the MOEW (Modal Order Entry Window). MPages® are an efficient and useful interface (much preferred by practicing physicians) and should be considered as an essential part of the orders process. Cerner® has developed the “Quickorders MPPage® Component” and other health systems have developed Custom MPages® devoted entirely to rapid order entry (Look for more on this in a future paper dedicated to MPages®). These standard and custom versions can make a real difference in the ED. In all cases, the optimal MOEW:

- Shows all routinely ordered (e.g., daily) orders and order sets immediately.
- Shows these orders categorized by use (e.g., medications, labs, radiology, etc.).
- Does not show ANY uncommon orders (e.g., used once a month).

Every orderable on the MOEW is fully defaulted in for every OEF; when a common order (e.g., a chest x-ray) has two commonly selected OEF’s (e.g., the reason for exam of either chest pain or dyspnea), both of these are placed on the MOEW as separate orderables to ensure that a single click can be used to place the most common orders.

Placing orders: orderables

Orderable design is generic and not peculiar to the emergency setting, but the usual constraints are all the more important in the emergency department. In regard to synonyms, for example, common usage should dictate nomenclature rather than either local usage or intra-departmental usage.

- Poor usage: names based on a single department, such as radiology or laboratory.
- Borderline: names based on local usage (e.g., “banana bag” for IV multi-vitamins).
- Good usage: names based on global or national patterns of usage (e.g., CBC)
Poor usage is particularly a problem when it derives from long-term usage within a particular department and bears no relationship whatsoever to common clinical use. This is apt to occur when the department that runs the test (e.g., a radiology procedure or an immunoglobulin test) uses nomenclature that does not reflect common usage among clinical physicians who are trying to order the test.

- Example: The morning of conversion in a busy ED, the physician tried to order an ultrasound of the leg to rule out a deep venous thrombosis. This is commonly called a “Doppler”, but the test could not be located under this name, nor under ultrasound, US, vein, leg, DVT, vascular, or several other terms. Sixteen minutes of both patient and physician time were wasted (and patient risk increased) before the radiology department informed the physician that “this test must be ordered as an NV” (for non-vascular). Accepted clinical synonyms decrease time and risk.

**Placing orders: order set design**

The key design criteria for an efficient, usable, and safe order set is that it be lean, well-organized, and require no needless clicking to place routine orders. The single feature that is relatively peculiar to the emergency department is the requirement that all the order sets (PowerPlans™) must be set to “auto-initiate”, since the planning phase is never used within the ED (although it is commonly used to admit patients from the ED).

- Example: An ED had a PowerPlan™ for “ED Acute Abdomen Pain” that consisted of eleven screens, of which six screens contained only antibiotics. These had been included by a PowerPlan™ committee (without ED representation) who felt that the entire list of antibiotics “might be useful”. As a general rule, any orderable that “might be useful” should always be deleted.

Optimally designed order sets are never more than two screens in length and all routine orders are defaulted as checked, with all routine OEF’s defaulted to standard values. A good order set never has any “missing required details”.
Part 3 – Documentation/Conversion Strategy

Documentation (PowerNote™ and Dragon):

Emergency department documentation generally incorporates both an electronic template (PowerNote™) and voice recognition (Dragon). These two solutions work well together, but there are several points that can improve usage:

❖ Most training emphasizes how to create macros, but not which macros to create. Most adept clinical users emphasize the use of the following:

  o “Layered” macros, in which a set of macros are constructed in layers, allowing the user to “hone in” on a finding. For example, the first layer in the physical examination might specify that a superficial but broad physical exam was done and was normal. The second layer in the cardiac portion of the exam might specify that a detailed and comprehensive cardiac exam was normal. The third layer might be that an S4 was found. In this example, the entire exam (most of the exam was normal but superficial, the cardiac exam was normal and detailed, but there was an S4 murmur) requires only three clicks to document.

  o Positive macros, in which common constellations of exam findings are used to specify a likely diagnosis. Many adept clinical users, for example, have four standard macros for the abdominal exam: normal, LLQ tenderness, RLQ tenderness, and RUQ tenderness. These suggest the following, respectively: no pathology, diverticular-like findings, appendicitis-like findings, and hepatic/gall bladder findings. Coupled with specific exceptions and additions, these allow the user to “hone in” on a complete examination with fewer clicks.

  o Procedure macros, in which routine procedures can be added and documented with a single click. Typically, these include endotracheal intubations, suturing (simple, complex, and with dermal adhesive), anterior shoulder relocation, digit relocation, lumbar puncture, etc. While physicians differ in approach and different ED’s may use different procedures, each physician in each ED generally performs certain routine procedures in the same way every time, making it easy to document procedural details, followed by exceptions and additions as warranted.

❖ Most adept ED physicians, although taught to type or use the outline to find the template desired, actually use either the “recent” tab or the “favorites” tab, either of which is more efficient than other approaches, unless the triage nurse is accurate in choosing a reason for visit that suggests the appropriate template.

❖ In navigating PowerNote™, do not scroll or click, but use the table of contents to rapidly find the paragraph desired and move it to the top of the panel.

❖ Never use “save and close” unless it is unavoidable. This step merely slows down the workflow when the physician has to reopen the chart.
Macros work well for the review of systems and the physical examination, but do not work well for either the history of present illness or for medical decision making. It is easy to use macros to document an intubation, but typing or voice recognition is needed to explain why the patient was intubated.

Both PowerNote™ and Dragon work best if:

- The physician is fully trained, preferably under a clinical instructor.
- The physician has support for the first week of use.
- The physician receives supplemental (re) training after 2-6 weeks of use.

There are a number of “navigation tricks” and other ways of ensuring user efficiency. It is important that physicians master these “tricks” and that they be reevaluated for their use and retrained if necessary.

“How to Convert or not…that is the question”

Big-bang CPOE, PowerNote™ and Dragon versus one-at-a-time introduction:

Generally, a conversion is more successful if done one-step-at-a-time. However, many ED’s have converted simultaneously with CPOE, PN, and Dragon. Success correlates with the wishes of the ED staff: those that push to have access to all of these solutions at once will do well; those that have reservations about going live with everything at once will have significant problems. This is related to the stress of the department and the perception of the project by the clinical users and a good project leader will follow the wishes of the users in this regard. In general, however, the most successful ED’s generally start with CPOE, then follow with PowerNote™ at a later date, usually after several weeks. Note that for reasons of patient safety, CPOE must be all-or-nothing, but this is not true of electronic documentation, which can be started gradually. While most hospitals start PowerNote™ (and often Dragon) on a single day, others have allowed certain physicians to use PowerNote™ or have suggested that each physician begin with a small number of PowerNotes™ per day, then increase that number as they increase their speed and comfort. The same is true for Dragon, which is generally started on a single day, but can be introduced on a more gradual basis. The key requirement is that the conversion be done in such a way as to minimize user stress, consistent with patient safety.