

Electronic Health Records and Performance Metrics.

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Electronic health records and performance metrics.

Agenda

Background

Systems Engineering EHR Performance

Performance Metrics

Recommendations

Wrap Up



Background

Electronic health records and performance metrics

Background

- In order for an Electronic Health Record to be successful it must maximize clinician efficiency (according to Kaiser Permanente* “The Reality of EMR Implementation: Lessons from the Field” [url: http://xnet.kp.org/permanentejournal/fall04/reality.html](http://xnet.kp.org/permanentejournal/fall04/reality.html))
- Recent reports indicate availability issues with EHR are preventing proper patient care
 - Can not document via an EHR if it is down
- An emphasis on performance (availability and speed) will need to be in place to make EHRs successful
- In order to accomplish this, performance metrics will need to be developed, monitored, and acted upon
- Performance metrics will need to be meaningful, collectable, actionable, and developed and agreed upon by all stakeholders

* “The Reality of EMR Implementation: Lessons from the Field”
[url: http://xnet.kp.org/permanentejournal/fall04/reality.html](http://xnet.kp.org/permanentejournal/fall04/reality.html)

Systems engineering EHR performance

Electronic health records and performance metrics

Systems engineering EHR performance

- To make an EHR perform well, you have to figure out where the performance bottlenecks are
- A systems engineering analysis should be conducted to understand the performance of an EHR:
 - Need to understand what performance means and to whom
 - Need to understand current environment
 - Need to define the performance metrics based on the above

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Need to understand what performance means and to whom

Performance means different things to different groups:

- Developer: System works as designed within operational requirements with minimal errors
- Hospital Commanders: Performance is measured by the amount of patients that can be seen by a typical provider per day (more patients = more revenue)
- Chief Information Officer (CIO): Performance means system availability (uptime) and latency (speed of the EHR)
- Providers – The system allows me to do my job with minimal interruption, and “I can complete today’s appointments today”
- Patients: “I was seen by a provider without delay or interruption”

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Need to understand state of the current environment

EHRs are not stand alone systems but are 'systems of systems'

- Software
- Desktop/Virtual Environment
- Server/Cloud
- Network
- Users



EHRs work in either “closed” or “open” environments

- Closed environments = All systems are under the command of one person (aka the CIO)
- Open systems = Each systems controlled by multiple commands each with their own agenda
- For example, EHR communications must traverse multiple networks: hospital LAN, Campus Area network, Local Area network, and Wide Area network

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Types of performance metrics

- In order to understand the performance of an EHR we need to look at performance metrics
- Performance metrics should be determined with input from all stakeholders
- Performance metrics need to be both meaningful and agreed upon by all stakeholders
- For performance metrics to be meaningful they should be reasonable, collectable, and measureable
- Performance metrics should be real time (network/server monitoring) or near real time (EUD metrics)
- Performance metrics should be analyzed and acted upon to be meaningful
- Performance metrics center around availability, reliability, and latency (speed)

Performance metrics

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Performance metrics



Availability

- % System Uptime
- % System Downtime
 - Types of downtime events
 - Scheduled
 - Network
 - Server
 - Power

Reliability

- Can users log in

Latency

- % Network latency
- % Network packet loss
- Network utilization
- CPU/RAM, I/O utilization report
- Network monitors

EHR Performance metrics

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Network metrics

Network performance should be measured in terms of availability, latency and packet loss

PING tests could be run to collect these metrics but they are not enough to determine network performance

- PINGs only use a single or a small number of packets so the granularity is not useful for an hour to hour performance monitoring effort
- PING Tests can be useful, over time though, to trend performance issues.

More robust tools should be utilized when capturing network performance metrics

There are a number of COTS tools currently available to monitor/collect network performance metrics

- What's Up Gold
- Riverbed appliances

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Server metrics

Performance metrics of a server platform can be accomplished using the operating systems built in performance monitors

- Individual CPU/RAM utilization report
- Individual CPU, RAM, I/O, Network monitors

Once individual performance metrics are captured derived metrics can be determined (based on current Industry best practices)

- Avg. Queue Times (avg. time of disc transfer)
- I/Os per disc
- Disc queues per spindle (indicates performance bottlenecks)

Derived metrics give a much better 'health of the system' and can be automated

Other server performance metrics that need to be considered are availability/reachability

- Is the server up and can the EUDs reach it
- COTS products are readily available

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EHR performance metrics

End User Device

- Seconds/Transaction time (measures how long an EHR function takes)
- Version of the EHR software
- EUD Configuration

User/Clinic

- Amount of booked appointments/day
- Amount of completed appointments/day
- Amount of no-show, cancelled, walk-in appointments/day

Systems

- Amount of users
- Amount of users logged in
- Number of Clinics
- Types of Clinics

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End user device metrics

Metric: Sec/Tx = Amount of time used to complete a defined transaction *

- Multiple transactions will need to be identified to monitor
- Metric(s) should be created with end user input
- Metric should capture at a minimum time per transaction, end user, EUD, Date of the Start/Stop times, details on the transaction (e.g. amount of data returned, count of item returned, etc.)
- Metric gives best view into EHR performance

Version of EHR software installed

- Will tell you if latest software is installed

Current configuration of the EUD:

- Software specs (confirm software is most current/installed correctly)
- Hardware specs (e.g. installed RAM)

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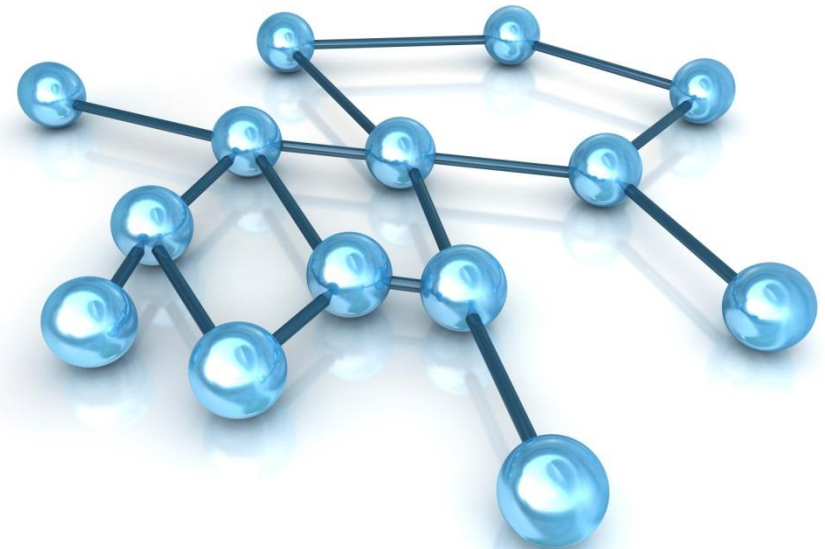
EHR performance metrics

User/Clinic data metrics can lead to more precise derived performance metrics

- Amount of booked appointments/completed appointments – Determines if the end user is completing their appointments everyday
- Amount of completed appointments/day
- Amount of no-show or cancelled appointments/booked appointments – Determines the amount of idle time in a clinic
- Amount of walk-in appointments/booked appointments – Determines if a clinic needs more resources to help workload
- Amount of booked appointments – Determines work load for a clinic

System metrics

- Number of users/number of users logged in
- Number of clinics/users – number of users per clinic
- Number of logged in users/availability (or network latency) – determines capacity



Next steps

Electronic Health Records and Performance Metrics

Recommendations

- EHR should have meaningful performance metrics
- In order for performance metrics to be meaningful they must be concise on what they mean, be collectable, and be agreed upon by all stakeholders
- Once the metrics have been identified, collection methods must be determined
 - COTS products
 - Built in products
- Once collected the metrics need to be analyzed
- Once analyzed they need to be reported
 - Real time
 - Trends
- Analyzed metrics must then be acted on

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