Towards a Clean Safe Infection-free (CSI) Hospital - implementing a rapid MRSA screening program at Emergency Department

Dr Prabha Krishnan
Dr Brenda Ang
1) I wake up inspired to go to work every morning
2) My talents are recognized and developed
3) I have the autonomy to make changes to be more effective at work
4) My colleagues are like my family
5) My dreams can be fulfilled here
6) Great work & care are carried out daily

1) Care good enough for myself & my loved ones
2) Easy to understand, navigate & use
3) Hassle free to patients, families & caregivers
4) Care, services & information are seamlessly linked
5) Where appropriate, reliable & safe care are the norm
6) Where care is coordinated and delivered with genuine concern

A recognised key asset & resource by our population – A GREAT INSTITUTION

Chart 1a: TTSH Bed Occupancy
26 Aug 12 - 24 Sep 12

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TTSH Operational Beds (End Of Week)</td>
<td>1,960</td>
<td>1,960</td>
<td>1,099</td>
<td>1,041</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A recognised key asset & resource by our population – A GREAT INSTITUTION

TTSH in 2016 – Towards a Great Institution

Delivering Patient Centric Care
A Benchmark Institution
A Great Place to Work
A Living, Learning and Teaching Organisation

1) Areas of clinical & operational excellence
2) Leader in innovation & processes
3) Delivering services beyond expectations
4) Leading in quality & safety
5) An employer of choice

1) Embrace knowledge
2) Where learning & unlearning is not feared
3) A culture of inquiry, trust & confidence that embraces change
4) Values and uses knowledge management to make informed decisions
5) Continuously improves itself to better serve our patients

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A recognised key asset & resource by our population – A GREAT INSTITUTION
TTSH Vision 2016 is to be A Great Institution

A Great Place for WORKING
We are valued and engaged in making a difference.

A Great Place for LEARNING
We embrace and share knowledge to build a living, learning and teaching organization.

A Great Place for HEALING
We deliver the care our patients value.

A Great Place for BECOMING THE BEST
We innovate and benchmark to lead in patient care.

What Patients Value from a Great Healthcare Institution

<table>
<thead>
<tr>
<th>Patients Value:</th>
<th>Patients Expect:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good Outcomes</td>
<td>Proper communication of the right diagnosis and to be seen through the best possible treatment plans.</td>
</tr>
<tr>
<td>Safe Care</td>
<td>An environment where professional, safe and gentle care is delivered through the entire patient journey.</td>
</tr>
<tr>
<td>Co-ordinated Care</td>
<td>Empathy of their journey as patients and this journey to be made as easy as possible.</td>
</tr>
<tr>
<td>Value for Money</td>
<td>Their time to be respected and not to go through duplicate processes.</td>
</tr>
<tr>
<td>Being Valued as an Individual</td>
<td>To be treated as family members, whose needs and feelings are heard and attended to and their opinions are considered.</td>
</tr>
</tbody>
</table>
Measures taken at TTSH to address this problem

• Creation of MRSA cohort ward
• Enhanced hand-washing campaigns
• Presentation of data to front users
• Implementation of Universal inpatient MRSA screening
Existing state of MRSA acquisition

The Model of Improvement

1. What changes can we make that will result in improvement?
   Creative IDEAS
2. How do we implement the improvement?
   small cycle tests and PDSA
Active surveillance

• Targeted screening done in high-risk areas
• Extended to all inpatients by 2010
• Purpose of universal screening
  – Early detection
  – Cohort MRSA-positive patients
  – Reduce transmission
Active surveillance implementation

- **Initiated in October 2010**
  - For all inpatients (implemented in phases; hospital wide in April 2011)
  - Nasal, axilla and groin swabs collected upon admission to wards
  - Culture results available in 24 – 48 hours
  - Transfer to cohort wards initiated

Active surveillance IMPLEMENTATION

- **Initiated in October 2010**
  - For all inpatients (implemented in phases; hospital wide in April 2011)
  - Nasal, axilla and groin swabs collected upon admission to wards
  - Culture results available in 24 – 48 hours
  - Transfer to cohort wards initiated

Chromogenic agar method
### Time Wastage

**Time spent in admitting a patient**

<table>
<thead>
<tr>
<th>Role</th>
<th>Nurse</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activities</td>
<td>Prepare a bed for the coming case</td>
<td>10 mins</td>
</tr>
<tr>
<td></td>
<td>Receive pt</td>
<td>10 mins</td>
</tr>
<tr>
<td></td>
<td>Do an entry NAG swab for pt</td>
<td>10 mins</td>
</tr>
<tr>
<td></td>
<td>Interview/orientate pt for the nursing assessment</td>
<td>20 mins</td>
</tr>
<tr>
<td></td>
<td>Nurse in charge need to check pt for the skin condition</td>
<td>10 mins</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Role</th>
<th>PSA</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activities</td>
<td>Update the SAP system for the admission</td>
<td>10 mins</td>
</tr>
<tr>
<td></td>
<td>Prepare all the paper work for the new admission</td>
<td>10 mins</td>
</tr>
<tr>
<td></td>
<td>Inform team Dr to see the new case</td>
<td>5 mins</td>
</tr>
</tbody>
</table>

**Total time spent**: 85 mins

### Time Wastage

**Time spent in transferring a patient**

<table>
<thead>
<tr>
<th>Role</th>
<th>Nurse</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activities</td>
<td>confirm with the receiving end for the timing of transfer</td>
<td>5 mins</td>
</tr>
<tr>
<td></td>
<td>Prepare pt &amp; inform family for the transfer</td>
<td>10 mins</td>
</tr>
<tr>
<td></td>
<td>Do an exit NAG swab if pt is negative on Entry</td>
<td>10 mins</td>
</tr>
<tr>
<td></td>
<td>Transfer pt over and handover to receiving ward</td>
<td>20 mins</td>
</tr>
<tr>
<td></td>
<td>Nurse in charge need to check pt for the skin condition</td>
<td>10 mins</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Role</th>
<th>PSA</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activities</td>
<td>Book a bed from BMU</td>
<td>5 mins</td>
</tr>
<tr>
<td></td>
<td>Plan transfer in SAP system</td>
<td>5 mins</td>
</tr>
<tr>
<td></td>
<td>Receiving ward do actualization of the transfer in SAP</td>
<td>5 mins</td>
</tr>
</tbody>
</table>

**Total time spent**: 70 mins
Time Wastage

For the doctors, the main issues (following decision for cohorting) are:

1. For the transferring team, to ensure that the transfer summary is updated (depending on complexity of case, this would take 15-20 minutes)

2. For the receiving team, the doctor will have to review the case following transfer - again depending on complexity of case, this may take 15-30 minutes)

Ward Nurse initiates isolation

- Patient admitted
- Day 1: screening
- Day 2/3: Results available
- ICNs collate positives
- Notify wards
- Ward Nurse initiates isolation
- Patient cohorted
- Nurse checks Medical condition
- Patient/caregiver agree
- BMU re-assigns bed
- Nurses, porters Transfer patient
- Patient isolated
- Substantial resources required. Major source of stress for nurses and other ward staff
- Unhappy Patient, staff
- Dr disagrees to Shifting pt
- Get Dr to agree pt
Non-Compliance to BMU Transfer Requests

Appropriate placement eliminates time required to attempt to “negotiate” the patient move. Sets expectations upfront.

Suggested proposal

- **Continuous rapid molecular screening system**
  - Approval by Senior Management in 2011
  - Nasal swab collected and tested round-the-clock at the satellite laboratory at ED
  - Use of continuous random access PCR system
  - Results are auto-routed to BMU system for assignment of patients to appropriate wards
Use of an expensive test
Justified?

How cost effective is

Universal screening (PCR or culture) with patient cohorting compared with base case of no active surveillance without patient cohorting.

Data source

Active Surveillance data
  CA and HA colonization rates by floor in the period Oct 10 – Jun 11 excluding 1st month.

Matched case-control study of SGH & NUH
  Differential outcomes (extended ALOS, patient charges, mortality) of infected versus uninfected patients.

TTSH cost data
  TTSH per bed-day cost, activity based costing for screening, transfer and cleaning effort.
**Data - Infected versus uninfected patients**

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Infected (N=181)</th>
<th>Uninfected (N=351)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-hospital mortality</td>
<td>14.4%</td>
<td>1.4%</td>
<td></td>
</tr>
<tr>
<td>Median LOS (days)</td>
<td>32</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Hospitalization costs (US$)</td>
<td>18.1 k</td>
<td>4.5 k</td>
<td>Total hospital billed charges incl. bed day cost, consult, investigations, proc &amp; med.</td>
</tr>
<tr>
<td>Health related quality of life</td>
<td>0.34</td>
<td>0.63</td>
<td>EQ-5D summary index. Done at discharge.</td>
</tr>
</tbody>
</table>

About 6 month data pooled from SGH and NUH (from Sep 07).

Prospective case-control study comparing MRSA infections with uninfected.

Matched by age, gender, ethnicity, discipline, Charlson score, APACHE II.


2 – Acute Physiology & Chronic Evaluation based on 12 physiological parameters

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**Using data**

MRSA infections during active surveillance

Clinical cultures in 3 month period (Apr 11 – Jun 11) ~ 162

Taking this as equivalent to MRSA infections, we expect 640 infections (annual) with active surveillance

Transmission from cohorted ward

Assume that % of transmission from cohorted ward ~ 30%

ALOS

TTSH ALOS = 7 days

Proportion of patients who are successfully cohorted

% of CA patients who are cohorted ~ 70% (ICD/BMU input)

Effective ALOS of CA patients in clean ward before cohorting ~ 3.5 days
Method: Economic model showing cost drivers and extent of resource use.

Summary of cost-effectiveness analysis

PCR is more cost effective than screening by ‘Culture + 70% cohorting’ at current CA prevalence of 8%.

Neither culture or PCR interventions are cost saving;

$50k per QALY gained is effective; $35 k per life saved – we save more lives by spending more.

PCR has the roughly the same cost effectiveness as ‘Culture + 100% cohorting’ which however is quite operationally not feasible due to double transfers.

PCR may not be cost effective, if and when, CA prevalence is reduced to about 1%, given the same transmissibility patterns and cost environment.
Recommendations

Implement PCR for universal screening at ED.

Designate 140 beds for near full cohorting rate.

Monitor HA rates after PCR rollout and investigate any residual sources of transmission e.g. transmission from cohorted ward.

NEW STRATEGY

• Screen for MRSA before admission to wards
  – Done at Emergency Department (ED) as 90% admissions (130 – 140 per day) are through ED
  – BMU to assign bed based on MRSA status

• Purpose
  – To improve cohorting
  – To improve patient satisfaction
  – Reduce post-admission transfers
**Putting Evidence Into Practice**

**Evidence-Based Medicine**
- Questioning
- Skills in EBM
- Evidence Resources
- Time (substitution)

**Patient Choice**
- Decision Aides
- Education
- Compliance Aids

**Suggested proposal**

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Introducing Change Concepts to Stakeholders

• Understand people, how they operate, how they interact, how they learn
• Understand psychology to help build the will for change
• Different methods available to help in the change management process

Pilot study at ED

MRSA PCR Trial @ ED 15 - 19 Aug 2011 (9 am - 3 pm)

<table>
<thead>
<tr>
<th>Date</th>
<th>Total screened</th>
<th>Total Negative</th>
<th>Total Positive</th>
<th>Total Inc</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-8-2011</td>
<td>33</td>
<td>3</td>
<td>29</td>
<td>3</td>
</tr>
<tr>
<td>16-8-2011</td>
<td>34</td>
<td>2</td>
<td>32</td>
<td>2</td>
</tr>
<tr>
<td>17-8-2011</td>
<td>28</td>
<td>2</td>
<td>29</td>
<td>1</td>
</tr>
<tr>
<td>18-8-2011</td>
<td>31</td>
<td>2</td>
<td>29</td>
<td>1</td>
</tr>
<tr>
<td>19-8-2011</td>
<td>39</td>
<td>0</td>
<td>39</td>
<td>0</td>
</tr>
</tbody>
</table>

"We like the teamwork idea, but Mr. Superstar won’t let us play with his ball!"
CHALLENGES we faced …

• Additional manpower - the busy Emergency Department estimated an increase of 18 nurses!

• Constraints of space

• Source of Funding

Microbiology staff buy-in:

• Existing 7am to 10pm shift work to 24/7

• Away from main lab-site location of new PCR lab

• Collecting nasal swabs from ED patients
Invited LEAN, SIX SIGMA expert

- Established contact with all categories of staff involved including Clinical Director, House-keeping in charge and many others
- Interviews
- Location determined
- IT matters
- Convincing presentation to Senior Management – advantages of rapid screening in TTSH setting

Pilot Value Stream Mapping ED

Additional areas of opportunity for waste reduction which will be impacted with Rapid PCR are as follows, and recommend working in concert with the Kaizen team to perform current state VSM and future state VSM:
- Nursing Patient Management Process
- Housekeeping Normal Clean and Terminal Clean Process
- Pharmacy Process
- Bed Management Bed Allocation and Transfer Process
SETTING UP THE SERVICE
PHYSICAL LOCATION

• Determine the location to perform the assay
  - Set up satellite lab at ED
  - Identify room in ED
  - Renovate the room
SETTING UP THE SERVICE MANPOWER

- Medical Technologist (MT)
  - Additional manpower required
  - Expanded job scope
  - Change in operational hours
  - Training and competency
  - Short time frame to build up manpower capability

WORKLOAD VARIATION in ED over 24 HOURS

AVERAGE NUMBER OF RAPID MRSA PCR TEST REQUEST BY HOUR
Patient confirmed for admission

Med Tech performs MRSA screening (Nasal swab ONLY)

- Result ready within 2-3 hrs and auto-routed to BMU
- When pt refuses to be swabbed, Med Tech to document under EDWeb remarks

- Result MRSA Negative
  - Admit to non-MRSA cohort ward

- Result MRSA Positive
  - Admit to MRSA cohort wards/cubicles

- Result MRSA Inconclusive
  - Admit to non-MRSA cohort ward – result taken as NEGATIVE

Pt admitted at appropriate location

Narrow window of opportunity with reduced bed occupancy following Chinese New Year, to start screening program at
VERY FIRST CASE OF MRSA-PCR @ ED!

And the report was ready
TAT : 1hr 15 mins

Outcomes and Measurements
RESULTS OF IMPLEMENTATION TRANSFER OF PATIENTS

- Reduced from average of 7.4% per month in 2011 to 2.9% in 2012

Unnecessary MRSA patients transfer rate (%)

- Year 2012 MRSA Cohort and Non-cohort cases
- Ward renovation work ongoing

RESULTS OF IMPLEMENTATION COHORTING

- Increased from 68.6% to 84.4% in 3 months
RESULTS OF IMPLEMENTATION
RESULT TURNAROUND TIME

Maintained at 90% within 2 hours of sample collection

![Graph showing TAT for MRSA rapid turnaround time.]

RESULTS OF UNIVERSAL SCREENING:
ACQUISITION RATE

- Initial reduction in MRSA clinical acquisition rate

![Graph showing quarterly MRSA clinical acquisition rates from April 2011 to June 2012.]

Included main TTSH, CDC 1, CDC 2 & Subacute Wards data
Included MRSA HA clinical data (1st positive blood culture included)
MRSA PCR screening implemented @ ED on 16 Jan 2012
MRSA ASC implemented hospital wide in Apr 2011
Tests help hospital cut bug infections

Patients with potentially deadly bug are warded separately from others.

Acknowledgement

- CMB and Senior Management
- Infection Control and HAIE team
- Emergency Department
- Bed Management Unit
- iHIS
- Suppliers
- Laboratory Medicine