A collaborative approach to antimicrobial stewardship

The role of nurses

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Statement on Potential Conflict of Interests

I declare that:

• **Clinical Research:** as a doctor researcher, I participate in studies sponsored by:
  – MSD
  – Sanofi-Aventis

• **Presentations:** as guest speaker, I take part in the events sponsored by:
  – GSK
  – Pfizer
  – MSD

• **Consulting:** as a member of advisory boards, I participate in meetings with:
  – Takeda pharmaceuticals

I do not own shares of any of these pharmaceutical companies.

My prerequisites to participate in these activities are the autonomy of scientific thought, independence of opinion and freedom of expression, aspects that this company respects.
Scope of the presentation

• Introduction

• Why do we all need antimicrobial preservation as a matter of urgency?

• How & why did we get to this point?

• What is antimicrobial stewardship (AMS)?

• Covering more territory to fight AMR: The role of the nurse

• Design and implementation of AMS in daily practice in South Africa without infectious disease resources & expertise

• Conclusion
Introduction
Initiatives have been implemented within acute care settings to promote prudent antibiotic prescribing that have primarily targeted the practices of pharmacists and doctors within this context.

Very little consideration has been afforded to the contribution nurses can make to the management of antimicrobials and how this may impact the development of AMR and healthcare associated infections (HCAIs).

It has been suggested that AMS teams collaborate with infection control teams, including infection control nurses, however this is primarily for multidisciplinary data exchange, and the potential contribution nurses can make to the management of antimicrobials on the ward remains under-explored.
Why do we all need antimicrobial preservation as a matter of urgency?
A global problem requiring a global solution
Outbreaks involving carbapenemase resistance genes in South Africa: XDR Gram-negative infections

Brink et al. *SAMJ* 2012; 102(7): 599-601
Emergence of OXA-48 and OXA-181 Carbapenemases among Enterobacteriaceae in South Africa and Evidence of In Vivo Selection of Colistin Resistance as a Consequence of Selective Decontamination of the Gastrointestinal Tract

Adrian J. Brink, Jennifer Coetzee, Craig Corcoran, Cornelis G. Clay, Danusha Hari-Makkan, Rachael K. Jacobson, Guy A. Richards, Charles Feldman, Louise Nutt, Johan van Greune, J. D. Deetlefs, Karin Swart, Lesley Devenish, Laurent Poirel and Patrice Nordmann

Emergence of colistin-resistant OXA-48 carbapenemases in *K. pneumoniae*

The final antibiotic Rubicon – Pan-drug resistant Gram-negative infections

Emergence of plasmid-mediated colistin resistance (MCR-1) among *Escherichia coli* isolated from South African patients

J Coetzee, C Corcoran, E Prentice, M Moodley, M Mendelson, L Poirel, P Nordmann, A J Brink

Colistin preservation is a matter of urgency

- A countrywide surveillance program of RSA poultry farms revealed that colistin resistance in \textit{E. coli} strains increased substantially - 19 of 24 (79%) colistin-resistant cultures from the last quarter of 2015 contained MCR-1.

- It was surmised that this sudden increase was likely due to the selection of MCR-1-containing strains where colistin was being used.

- Plasmid-mediated MCR-1 was subsequently been detected in clinical isolates of colistin-resistant \textit{E. coli} from hospitalized (n=3) and outpatient based (n=6) patients in South Africa.

- The national and global significance of sudden spread of MCR-1 and the attendant loss of colistin has profound public health implications, and confirms the continuum between colistin use in feed animals and colistin resistance in slaughtered animals, food for human consumption, colonized humans, and infected patients.

Poirel et al. AAC 2016 (In print)
How & why did we get to this point?
Collateral damage

• The word "collateral" comes from medieval Latin *collateralis*, from *col-* "together with" + *lateralis* (from *latus*, *later-* "side") and is otherwise mainly used as a synonym for "parallel" or "additional" in certain expressions ("collateral veins" run parallel to each other) and "collateral security" (means additional security to the main obligation in a contract).

• The first known usage of the term "collateral damage" in this context occurred in a May 1961 article written by T. C. Schelling entitled "DISPERSAL, DETERRENCE, AND DAMAGE"

• Collateral damage is damage to things that are incidental to the intended target.

• It is frequently used as a military term where it can refer to the accidental or unintentional killing or wounding of non-combatants and/or destruction to non-combatant property during attacks on legitimate enemy targets

Schelling T. *Operations Research* 1961;61:363
Consequences of inappropriate antibiotics: Collateral Damage

- Excessive use e.g. long duration or combination therapy
- Inappropriate drug administration e.g. viral RTI
- Suboptimal dosing e.g. loading doses or under-dosing or ARC

Collateral damage

- Selection of drug-resistant organisms
- Infection with MDR pathogens
- Super-infection with fungal pathogens
- CDI, *Clostridium difficile* infection
What is AMS?
What is AMS

• Stewardship was originally made up of the tasks of a domestic steward, from *stīġ* (house, hall) and *weard*, (ward, guard, guardian, keeper). Stewardship in the beginning, referred to the household servant’s duties for bringing food and drink to the castle’s dining hall.

**Antimicrobial stewardship (AMS) is a concept that has emerged that embodies the appropriate use of antibiotics with the goal of:**

- Optimising patient outcomes
- Whilst reducing the emergence of resistant bacteria

• The term continues to be used in many specific ways, but it is also used in a more general way to refer to a responsibility to take care of something belonging to someone else.

• To be a steward, and or act in steward to something, is known as stewardship.
Antimicrobial stewardship programmes: the need for wider engagement

Esmita Charani, Alison H Holmes

- Where this expertise is not consistently provided, other healthcare professionals and specialties can initiate activities and develop ASP with contribution from specialists that effectively bring about a positive change in antimicrobial prescribing and infection management programmes.

- Perhaps considering antimicrobial stewardship as a patient safety and availability of care issue, it should not be restricted to specialists.

- The ICU OR ward nurse as a “champion steward”?

Skills beyond ID & Clinical microbiology is required

- Increasingly, physicians and pharmacists without specialized infectious disease training as well as other healthcare providers, such as infection preventionists, are engaged in successful stewardship activities in a variety of settings, including academic and community acute care hospitals and long-term care institutions and outpatient clinics.

- Furthermore, skills beyond medical infectious diseases and microbiology knowledge are critical in starting and maintaining an ASP, such as understanding how to implement change and how to measure the success of a program.
The Critical Role of the Staff Nurse in Antimicrobial Stewardship—Unrecognized, but Already There

Richard N. Olans,1 Rita D. Olans,2 and Alfred DeMaria Jr3

<table>
<thead>
<tr>
<th>Timely antibiotic initiation</th>
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<tbody>
<tr>
<td>Medication reconciliation</td>
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**Daily (24 h) clinical progress monitoring**

<table>
<thead>
<tr>
<th>Progress monitor and report</th>
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<tbody>
<tr>
<td>Preliminary micro results and antibiotic adjustment</td>
<td>•</td>
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<tr>
<td>Antibiotic dosing and de-escalation</td>
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Considering nurses’ role

<table>
<thead>
<tr>
<th>Patient safety &amp; quality monitoring</th>
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<tr>
<td>Adverse events</td>
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<td>Change in patient condition</td>
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<td>Final culture report and antibiotic adjustment</td>
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<tr>
<td>Antibiotic resistance identification</td>
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| Clinical progress/patient education/discharge                            |   |   |   |   |   |
| IV to PO antibiotic, outpatient antibiotic therapy                       |   |   |   |   |   |
| Patient education                                                        |   |   |   |   |   |
| Length of stay                                                           |   |   |   |   |   |
| Outpatient management, long-term care, readmission                      |   |   |   |   |   |

Edwards et al. *Clinical Infectious Diseases* 2016;62:84–9
Covering more territory to fight resistance

“The role of the nurse in AMS
• Where resources are lacking, inclusion of nurse practitioners in AMS programmes may improve the effective use of antimicrobials.

• Nurses are in an ideal position to monitor and audit prescriptions due to the nature of their work; however, their role in the multidisciplinary team is not clear.

• Nurses work at multiple levels within the clinical setting, playing a key role in patient safety and have the most consistent presence as patient carer.

Aspects of Antimicrobial Management associated with antimicrobial resistance (AMR) and other patient outcomes in which nurse involvement could impact.

<table>
<thead>
<tr>
<th>Aspect of Management</th>
<th>Associated Risk</th>
<th>Potential Nurse Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment Specificity</td>
<td>Use of broad spectrum antibiotics is a major contributory factor to developing CDI and AMR. Broad spectrum antibiotics should be avoided when possible (Lespirit &amp; Brun-Buisson, 2008).</td>
<td>Additional support and training of nurses could ensure treatment is in line with microbiology results, and use of broad spectrum antimicrobials is limited where possible.</td>
</tr>
<tr>
<td>Duration of treatment</td>
<td>Prolonged duration of antimicrobial treatment is a risk factor for development of CDI, and may increase AMR(Knox et al, 2002; MacDougall &amp; Polk, 2005; Lespirit &amp; Brun-Buisson, 2008)</td>
<td>In collaboration with doctors and pharmacists, nurses can ensure antimicrobials are prescribed for appropriate duration.</td>
</tr>
<tr>
<td>Route of antimicrobial administration</td>
<td>Early switching from intravenous antimicrobial therapy to oral treatment decreases length of hospital stay, reduces risk of AMR and decreases workload on nurses (Oosterheert et al, 2006; Mertz et al, 2009)</td>
<td>Nurses can monitor IV antimicrobial prescriptions and engage physicians and pharmacists in discussion regarding de-escalation to oral therapy.</td>
</tr>
</tbody>
</table>
Considering nurses’ role

| Aspects of Antimicrobial Management associated with antimicrobial resistance (AMR) and other patient outcomes in which nurse involvement could impact. |
|---|---|---|
| Surgical prophylaxis | Timing of administration and duration of surgical prophylaxis often occurs outside best-practice guidelines (Bratzler et al, 2005) which decreases impact on post-surgical infections and increases AMR (Harbarth et al, 2000) | Through collaboration with doctors and pharmacists, nurses can ensure antimicrobials are prescribed for appropriate duration. |
| Timing of antimicrobial administration | Prompt and timely administration of antimicrobials may be associated with increased survival to hospital discharge. (Kumar et al, 2006). | Through increasing nurse’s awareness and training in AS programmes, it is likely that they will improve antimicrobial administration practices |
| Therapeutic drug monitoring | Sub-optimal antibiotic concentrations contribute to the development of antimicrobial resistance (Thomas et al, 1998). Therapeutic drug monitoring should occur for antibiotics that perform optimally within a specific ‘therapeutic level’, and prescriptions titrated accordingly. | Nurses could contribute through monitoring of blood results and working with physicians to ensure doses are in-line with recommended guidance |
| Outpatient Antibiotic Therapy (OPAT) | OPAT decreases patient’s length of stay in hospital, reduce risks for transmission of HCAIs and decreases associated costs (Gilchrist et al, 2008; Hitchcock et al, 2009). | Engaging nurses in decision making regarding a patient’s suitability for OPAT may result in more proactive and efficient use of this service and improve associated outcomes. |

One way of formally defining the cardinal role of nurses is implementation of a care bundle for antimicrobial stewardship to improve adherence to evidence-based quality indicators and thus improving antimicrobial utilisation.

Definition of a Bundle

A small set of evidence-based interventions for a defined patient segment/population and care setting that, when implemented together, will result in significantly better outcomes than when implemented individually.

Theory of change: Why do bundles produce better outcomes

Using bundles and all-or-none measurement changes the way care is provided in important ways:

- Bundles change the assumption that evidence-based care is being delivered reliably (most HCWs assume that the bundle elements are being reliably performed on their patients)
- Bundles promote awareness that the entire care team must work together in a system designed for reliability (working as a team in new ways)
- Bundles promote the use of improvement methods to redesign care processes (action planning)

Resar et al. IHI Innovation Series white paper. Cambridge, Massachusetts: IHI 2012
Defining the nurses role: AMS bundles

- There are four criteria that distinguish care bundles from check lists or care pathways:

  1. The changes in the bundle are all necessary; so if there are four changes in the bundle and one is removed, the results would not be the same.

  2. The changes in the bundle are all based on evidence.

  3. The changes are clear-cut and involve all or nothing measurement such that each change can be recorded as a yes or no answer.

  4. Bundle changes occur in the same space and time, and can be delivered by the same clinical team.

The study consisted of two phases: intervention (when a stewardship pharmacist was involved in patient care) and control (when no stewardship pharmacist was involved).

The primary outcome measured was compliance with the care bundle's quality indicators, which included:

- Documentation of treatment rationale
- Collection of appropriate culture specimens according to institutional and national guidelines
- Appropriate empirical selection of antibiotics according to institutional and national guidelines at initiation of antibiotic therapy
- De-escalation, and selection of appropriate agents for definitive therapy during antimicrobial therapy.

Defining the nurses role: AMS bundles


Table 2.
Compliance with Quality Indicators of Antibiotic Use

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Control Phase</th>
<th>Intervention Phase</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appropriate cultures collected</td>
<td>70/80 (87)</td>
<td>76/80 (95)</td>
<td>0.09</td>
</tr>
<tr>
<td>Appropriate empirical therapy</td>
<td>55/80 (69)</td>
<td>65/80 (81)</td>
<td>0.06</td>
</tr>
<tr>
<td>Appropriate deescalation(^a)</td>
<td>41/57 (72)</td>
<td>52/58 (90)</td>
<td>0.01</td>
</tr>
<tr>
<td>All indicators concurrently</td>
<td>13/80 (16)</td>
<td>43/80 (54)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

- In some or all of these process measures, nurses could have played an equally NB role.
• Overall 10 pharmaceutical care actions were required to optimise 1 prescription.
• Hence from a resource point of view, could audit of some of the process indicators not be delegated to nurses?
• For most of the process indicators, adherence could have been enhanced by high-care nurses.
• The pharmacist made a significant contribution to improving adherence to evidence based antimicrobial prescribing quality indicators agreed by the multidisciplinary team.
Considering the following measures, nurses are best suited in collaboration with pharmacist, to review compliance with process indicators for:

- Bacteriological specimens
  - Nurses to ensure cultures are taken before initiation of antimicrobials
- Allergy status
  - Nurses to ensure allergies documented at time of prescription & monitor any new allergies/antibiotic side effects
- Guideline compliance
  - Nurses to ensure choice, route, dosage incl. loading doses and alternative dosing strategies (e.g. prolonged infusions) administered according to institutional guidelines and directives
  - Nurses to ensure timeous antibiotic administration ("hangtime")
- Renal impairment dose adjustment
  - Nurses to ensure clinician aware of CrCL <50 ml/min to enable dose adjustment
• Considering the following measures, nurses are best suited in collaboration with pharmacist, to review compliance with process indicators for (cont..):

• Documentation
  • Antibiotic prescription chart
  • Nurses to ensure the indication for prescribing of antimicrobial treatment is documented
  • Nurses to ensure the intended duration is documented

• Therapeutic drug monitoring
  • Nurses to ensure trough levels are collected prior to next dose (e.g. vancomycin)

• De-escalation
  • Nurses to ensure IVI to oral switch according to local directives (e.g. temperature < 37.8°C Celsius for 24 hours)
Another bundle that might be useful as part of a multifaceted intervention to improve antibiotic use in hospitals, is reassessment of empirical antibiotic therapies 24–96 h after the treatment was started.

In this D3 intervention, 5 measures were selected for documentation in the medical notes:

- Was there an antibiotic plan (name, dose, route, interval of administration and planned duration)?
- Was there a review of the diagnosis?
- If positive microbiological results were available, was there any adaptation of the antibiotic treatment, for example streamlining or discontinuation?
- If the patient was initially started on intravenous (iv) antibiotic therapy, was the possibility of iv–oral switch documented?
- All or nothing compliance to the above four

In an attempt to improve the documentation of antibiotic reassessment, they introduced a “prompt”, a sticker of the elements of the bundle using a plan-do-study-act approach.

Pulcini et al. JAC 2008;61:1384-1388
In order to provide guidance for educational programmes, nurse practitioners’ knowledge, attitudes and perceptions (KAP) about antibiotic use and resistance, is crucial. However, very limited information has been published globally.

In this survey of hospital-wide nurse practitioners, including those working with and without patients, regarding knowledge:

- Critical care NPs scored higher than those in other specialties (82% vs 64%; \( P < 0.002 \))
- Those whose primary setting was in the inpatient area scored higher than the ones who spent most of their time in outpatient care settings (76% vs 61%; \( P < 0.042 \))

Supporting the nurses’ role

Abbo et al. *J for Nurse Practitioners* 2012:8:370-6
As the authors pointed out, the policy implications include:

- University nurse practitioner programs should develop collaborative efforts to incorporate more antimicrobial stewardship education into their curricula.

- In the near future, educational modules with clinical scenarios could be used to reinforce awareness of the importance of appropriate antimicrobial prescribing as part of board recertification and to maintain hospital/license practicing privileges.

- Departments of Health and nursing schools could develop collaborations for ambulatory care settings where a significant amount of antimicrobials are prescribed in the community.
START FROM WHERE PROTEGE IS: NOT WHERE YOU WANT HIM/HER TO BE!

MENTOR IS
- Generous
- Candid
- Honest
- Passionate
- Authentic
- Energetic
- Devoted
- Bold

PRACTICE
- Focused Listening
- Meaningful Reflection
- Sincere Communication

MENTORING IS
- A Learning Partnership
- A Journey of Collective Discovery

the art of mentoring

Q: MENTORING is an honor
EXCEPT FOR LOVE
THERE IS NO GREATER GIFT
OTHER THAN THE
GIFT OF GROWTH

~ Marshall Goldsmith

SKILLS OF A MENTOR
- Balance
- Truth
- Trust
- Abundance
- Passion
- Courage
- Ethics

Courtesy slide Dr Dena vd Bergh Netcare
Design and implementation of AMS in daily practice in South Africa utilizing existing resources
Models for AMS improvement

Innovation Series 2003

The Breakthrough Series
IHIl’s Collaborative Model for Achieving Breakthrough Improvement

Fathima Paruk, Guy Richards, Juan Scribanne, Sats Bhagwanjee, Mervyn Mer, Helen Perrie

<table>
<thead>
<tr>
<th>Antibiotics prescribed</th>
<th>62 (72.9)</th>
<th>120 (73.6)</th>
<th>182 (73.4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inappropriate empiric antibiotic</td>
<td>27 (43.5)</td>
<td>73 (60.8)</td>
<td>100 (54.9)</td>
</tr>
<tr>
<td>De-escalation practised</td>
<td>9/27 (33.3)</td>
<td>12/61 (19.7)</td>
<td>21/88 (23.9)</td>
</tr>
<tr>
<td>Inappropriate duration of antibiotics</td>
<td>33 (53.2)</td>
<td>98 (81.6)</td>
<td>131 (72.0)</td>
</tr>
</tbody>
</table>

Paruk et al. *SAMJ* 2012;102:613-616
Antibiotic prescription practices in South Africa

Paruk et al. *SAMJ* 2012;102:613-616
Netcare AMS model for improvement

- Benchmarking against Israel, India, EU the mean overall group antibiotic consumption was very high at 101.38 DDDs/100 patient days

- Using an adaption of the Boston Breakthrough Series Collaborative we implemented a basic AMS program over 3 phases across 47 hospitals using a pharmacist-driven prospective audit and feedback strategy based on the Paruk et al PPS of antibiotic use in RSA ICUs.

- Five “low-hanging fruit” process measures were targeted
Does telling people what they have been doing, change what they do?
## Process measures targeted for non-specialised audit

Picking the “low-hanging” AMS fruit

<table>
<thead>
<tr>
<th>“Low-hanging fruit” intervention</th>
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<tbody>
<tr>
<td>1 More than 4 antibiotics at the same time</td>
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<tr>
<td>2 More than 7-days of antibiotic treatment</td>
<td></td>
</tr>
<tr>
<td>3 More than 14-days of antibiotic treatment</td>
<td></td>
</tr>
<tr>
<td>4 Double – redundant antibiotic cover</td>
<td></td>
</tr>
<tr>
<td>5 Cultures not done prior to commencement of empiric antibiotics</td>
<td></td>
</tr>
</tbody>
</table>
1. Identify a particular area or issue in the hospital - need for improvement
   “Higher order goals”

2. Define collective goals for a group-wide AMS:
   e.g. sustainable reduction in overall antibiotic consumption by 10%
   (outcome goal)

3. Define five “low-hanging fruit” interventions based on local and international guidelines and best practice

1. Identify a particular area or issue in the hospital - need for improvement “Higher order goals”

2. Define collective goals for a group-wide AMS: e.g sustainable reduction in overall antibiotic consumption by 15% (outcome goal)

3. Define five “low-hanging fruit” interventions based on local and international guidelines and best practice

Netcare AMS model for improvement

1. Identify a particular area or issue in the hospital - need for improvement “Higher order goals”

2. Define collective goals for a group-wide AMS: e.g sustainable reduction in overall antibiotic consumption by 15% (outcome goal)

3. Define five “low-hanging fruit” interventions based on local and international guidelines and best practice

- n=47 hospitals.
- 1. Form multi-disciplinary ASP committees
- 2. Present model to each participating institution by the quality improvement director
- 3. Modify if required.
- 4. Seek endorsement by doctors

Learning Session 1

Step-wise implementation cycles at all participating hospitals

Learning Session 2

Measurement and feedback

Learning Session 3.....53

Step-wise implementation cycles at all participating hospitals

“Protected” stewardship time was enforced and mandated i.e. pharmacists (one or more) would be allowed time, according to the size of the hospital, to conduct audit rounds of patients on antibiotics. Netcare AMS model for improvement

After obtaining permission from the front-line doctors, pharmacists recorded interventions weekly on standardized templates which were submitted monthly via email to the project manager.

Multidisciplinary teams consisted of clinicians, hospital-, pharmacy-, nursing-(and theatre) managers, pharmacists, (peri-operative and surgical ward nurses) including infection prevention practitioners (IPPs).

Physicians & Surgeons

Hospital, Nursing & Pharmacy managers

ICU nurses

Information System Specialist

Pharmacist 1-3 monthly feedback to multidisciplinary antibiotic teams

PM monthly feedback on improvements (or otherwise) as well individualized goal setting to enable self-monitoring and action planning.
Does telling people what they have been doing change what they do?

- Over 2 years of standardized measurement, in the post implementation phase, 116,662 patients on antibiotics were reviewed, with 7,934 interventions recorded for the five designated examples of “low-hanging AMS fruit”, indicating that almost one in fifteen prescriptions required pharmacist intervention.

Focus to reduce excessive prescribing should not focus on ICU alone – the other units collectively have more consumption

- Excessive duration represented the majority (39.2%) of pharmacist interventions.

- The model had a significant impact on antibiotic consumption, with a reduction in mean antibiotic DDD/100 patient days from 101.38 to 83.04 in the pre- and post-implementation phases, respectively, representing an 18.1% reduction in overall consumption (p < 0.001).
Does telling people what they have been doing change what they do?

<table>
<thead>
<tr>
<th>Targeted interventions</th>
<th>% of pharmacist interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cultures not done prior to commencement of empiric antibiotics</td>
<td>37.4% (2971/7934)</td>
</tr>
<tr>
<td>2. More than 7 days of antibiotic treatment</td>
<td>32.9% (2615/7934)</td>
</tr>
<tr>
<td>3. More than 14-days of antibiotic treatment</td>
<td>6.3% (501/7934)</td>
</tr>
<tr>
<td>4. More than 4 antibiotics at the same time</td>
<td>9.3% (739/7934)</td>
</tr>
<tr>
<td>5. Concurrent “double” or redundant antibiotic coverage</td>
<td>13.9% (1108/7934)</td>
</tr>
</tbody>
</table>
Does telling people what they have been doing change what they do?

18.1% reduction in DDD

Pre-implementation phase (16m)  Implementation phase (24m)  Post-implementation phase (20m)

Using a similar model other AMS strategies can be targeted
This was a prospective multicenter study in 33 South African hospitals from 1 July 2013–30 August 2014.

In this QI initiative, using the same model the tools of healthcare improvement spread methodology were used to shorten the time from prescription to administration of antibiotics (within one hour) in 33 hospitals.

A total of 32,985 patients who received IVI antibiotics were assessed for hang-time compliance with first doses of new antibiotic orders. Over the 60-week period, 21,069 patients received antibiotics within an hour following prescription and were assessed as hang-time compliant.

The change in improvement of “hang-time” compliance following implementation of the hang-time process improvement protocol was 41.2% pre-intervention in week 1 to 78.4% post-intervention in week 60 (p<0.0001).

Messina et al. Infect Dis Therap 2015;4:S5-S14
The aims of the 2 ½ yr study were to implement an improvement model for PAP utilizing existing resources to achieve a reduction in surgical site infections (SSIs) across a heterogeneous group of 34 urban and rural South African hospitals.

Similar methodology i.e. Netcare adaption of IHI model targeting compliance to 4 antibiotic measures (Drug choice, Drug dose, Drug timing, Drug duration). Results:

- For 70 weeks of standardized measurements and feedback, 24 206 surgical cases were reviewed.
- The baseline survey revealed a composite compliance of 66.8% (95% CI, 64.8%-68.7%) and a mean group SSI rate of 2.46 (95% CI, 2.18-2.73).
- Compared to the pre-implementation phase, there was a significant improvement in compliance with all process measures.
- Composite compliance increased by 24.7% to 83.3% (95% CI 80.8%-85.8%) (P<0.0001) whilst the SSI rate decreased by 19.7% to a mean of 1.97 (95% CI 1.79-2.15) (P=0.0029).
Improving compliance to peri-operative antibiotics prophylaxis measures in order to decrease SSI rates

<table>
<thead>
<tr>
<th>Process measures</th>
<th>Indicators</th>
</tr>
</thead>
</table>
| **Drug choice:**  
Was the antibiotic chosen compliant with the Netcare guideline for that procedure?  
In patients with β-lactam allergies, was the chosen alternative compliant with the Netcare guideline? | Rate of compliance with antibiotic choice relative to the surgery type or with the alternative agent |
| **Drug dosage:**  
a. Was the prescribed dose of the antibiotic consistent with the Netcare guideline?  
b. In case of cefazolin, gentamicin and vancomycin, was **weight-based dosing** compliant with the Netcare guideline? | Rate of compliance with the antibiotic dose or with weight-based dosing where indicated |
| **Drug administration:**  
Was the antibiotic administered within **60 minutes** prior to surgery? | Rate of compliance with administration within 60 minutes |
| **Drug duration:**  
a. Was the antibiotic administered as a single dose?  
b. Was the **antibiotic re-dosed** where applicable?  
c. Was the antibiotic given for duration longer than 24 hours? | Rate of compliance with the administration of a single dose and/or re-dosing and/or discontinuation within 24 hours after initiation of surgery. |
Mean rate of compliance with the process measures during the pre and post implementation phases

Brink et al. *J Antimicrob Chemother* 2016 (Submitted for publication)
The mean monthly surgical site infection rate during the pre- and post-implementation phases

Mean SSI rate 2.46
Mean SSI rate 1.97

$\Delta P = 0.0029$
The role of nurses in the Netcare adaptation of the IHI model?

• Nursing service (and unit) managers became part of multi-disciplinary AMS committee’s

• Thus involvement was upfront during presentation of the QI model in each participating institution by the QI

• In the “low-hanging AMS fruit” intervention:
  • The majority of interventions were in wards (75%) not ICU (25%)
  • Excessive duration was the most common intervention
  • One of the process measures, “cultures not done prior to commencement of empiric antibiotics”, was the responsibility of nurses to ensure culturing before infusion

• In the “hang-time” intervention (improving time from prescription to infusion):
  • Not only did the nurse had to record time of initiating infusion but had to ensure that clinician wrote up the time of prescription
The role of nurses in the Netcare adaptation of the IHI model?

- In the peri-operative prophylaxis improvement model besides IPPs, theatre managers, peri-operative and surgical ward nurses, were part of collaboration to improve compliance to:
  - **Drug choice** – Who is best suited to know if pt is allergic to β-lactams?
  - **Drug dose** – Who provides the weight for weight-based dosing (vancomycin)?
  - **Drug timing** - Who is best suited to ensure antibiotic is given within 1 hour?
  - **Drug duration** – Who will know if antibiotic is appropriately re-dosed in theatre or after surgery continued for > 24 hours?

- During institutional action planning in the PAP intervention, changes to improve compliance to administration within 1 hour prior to surgery, included amongst others:
  - Making infusions available at the patient’s bedside, either in the ward or in theatre prior to induction
  - Directing doctors where prompts and reminders were used on patient and theatre files
  - As well as eventually allocating the responsibility and accountability for administration to the anaesthesiologists and anaesthetic nurses.
The role of nurses in the Netcare adaptation of the IHI model?

• In the peri-operative prophylaxis improvement model (Cont)
  
• In fact, during onsite visits by the AMS project manager during external audits, it was apparent that most patients did receive antibiotics within the required time frame, but the lack of an explicitly documented incision time was the cause of the noncompliance in the majority of cases.
  
• Subsequently, the theatre nurse documented time of incision
Design and implementation of AMS in daily practice in South Africa utilizing existing resources

Role of nurses
The role of the critical care nurse in the implementation of an antimicrobial stewardship programme in a resource-limited country

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A pre- and post-intervention interventional study design was followed where various interventions were implemented to establish which of these interventions can be implemented successfully by nurses with a meaningful impact on an AMS programme.

Du Toit B (Unpublished)
The role of the nurses in the study was to implement a checklist and monitor on a daily basis whether there was adherence to the elements detailed on the checklist.

They were furthermore responsible to ensure that the interventions stipulated on the checklist were executed. The nurses were responsible for the following:

- Collect specimens prior to the commencement of an antimicrobial
- Ensure that an antimicrobial was administered as soon as possible after a prescription was written
- Remind the treating physician to de-escalate once an organism was cultured and the resistance pattern was known
- Remind the treating physician to review the necessity of treatment duration as well as the necessity of the invasive device
The role of the ICU nurse

- 25% improvement in compliance with cultures before antibiotics

Du Toit B (Unpublished)
The role of the ICU nurse

Figure 4.15: Duration of therapy

- 275% improvement in compliance with excessive duration

Du Toit B (Unpublished)
The role of the ICU nurse

Figure 4.17: Assessment of device removal

- 25% improvement in compliance with device removal

Du Toit B (Unpublished)
The role of the ICU nurse

Figure 4.18: Hang time

- 41% improvement in compliance with “hangtime”

Du Toit B (Unpublished)
The role of the ICU nurse

The study found that ICU nurses:

- Despite the fact that they are not responsible for making decisions regarding the type of antimicrobial that is prescribed, measures such as duration of therapy can be audited by ICU nurses and interventions implemented, and thus they play a cardinal role in ensuring adherence to the principles of the programme.

- Utilizing a checklist with specific evidence-based measures on a daily basis can assist with the implementation of and compliance to an AMS programme.

- Are a cost-efficient resource.

- Should be an essential part of an AMS team.

- Require additional training about AMS and IPC, and that training should involve not only nurses, but extended to doctors and pharmacists, as well.
Conclusions
A collaborative approach to antimicrobial management

A team of individuals?

Or one synchronized team?
In designing and implementing AMS in hospitals, realization that skills nurses offer are critical in initiating and maintaining a sustainable AMS.

Currently, elements of AMS such as:

- Monitoring duration
- Indication for antimicrobial treatment
- Instigating prompt de-escalation from intravenous to oral therapy
- Monitoring for drug allergies and side effects
- Monitoring therapeutic levels
- Ensuring timely administration of antimicrobials
- Following up on missed doses

Have primarily fallen into the work remit of physicians and pharmacists.
• However, with review of medication charts being part of routine professional practice and as the primary healthcare worker within the hospital setting to administer medications:
  
  • Nurses are in a key position to collaborate with AMS teams and contribute to the multidisciplinary management of antimicrobials throughout acute and ward settings
  
  • For these initiatives to positively and sustainably impact on outcomes, it is necessary to gain a contextual understanding of the barriers and facilitators to nurses contributing to AMS, and how this aspect of the nursing role may be developed in the future.
  
  • Given the need for wider engagement in AMS programmes, should one not consider similar to “Antibiotic steward pharmacists”, dedicated “Antibiotic steward nurses” to supervise compliance to antibiotic process measures and indicators, by supporting nurses taking care of their patients on antibiotics
A large proportion of healthcare workers consist out of nurses and their role and contribution in the implementation of AMS programmes should be recognised and acknowledged.

In order to implement a successful AMS programme, all disciplines within a healthcare setting have to be included in the implementation of the programme.

Senior nurses should be included as core members of an antimicrobial stewardship team.