**Supplementary Material**

**Towards a framework approach to integrating pathways for infection prevention and antibiotic stewardship in surgery: a qualitative study from India and South Africa**

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Detailed methods

Data collection methods

This study was conducted across adult gastrointestinal and cardiovascular and thoracic (CVTS) teams in two surgery referral university hospitals with established AMS in SA (21,22) and India (14,23). Hospital A in Cape Town is a 950-bed government funded teaching hospital which in addition to being a tertiary centre, provides non-tertiary services to the local population. Hospital B in Kerala is a not-for-profit charitable 1350-bed tertiary centre. Between July 2018 and August 2019, researchers conducted an ethnographic study involving non-participant observations, interviews, and documentary analyses using a data collection guide (14,16). In India the data were gathered by EC, VN, and S Surendran. In South Africa the data were gathered by CB, EC and OM.

*Ethnographic observations*

The ethnographic study design included non-participant direct observations, interviews and documentary analysis (Appendix 1). Researchers conducted the observations on the wards, and face-to-face interviews with key informants. Detailed, descriptive notes of observations were collected. Separate reflective notes were kept detailing the observer’s perceptions and interpretations of what was recorded. Handover sheets, multidisciplinary team meeting notes and the policy and guidelines on antibiotic prescribing were collected to provide contextual knowledge of the processes. These different methods supported cross-validation and triangulation of the findings.

*Face-to-face interviews*

Healthcare professionals and patients (considered to be well enough to be interviewed) participating in the observations were invited to participate in a follow up face-to-face interview. Written consent was obtained from the patients and staff prior to the interviews. Staff and patients were interviewed at a time convenient for them. The interviews were semi-structured with an interview guide (15), and were audio-recorded and transcribed verbatim and anonymised prior to analysis. The interviews of patients took place at their bedsides in the hospital or in outpatient clinics, when patients came back for follow up appointments.The interviews were semi-structured with an interview guide for healthcare professionals (Appendix 2), and one for patients (Appendix 3) developed through review of literature, and drawing upon previous work of the research team (11).

In India, several interviews were conducted in the Malayalam dialect. These interviews were transcribed in Malayalam, the transcriptions translated to English, and then back-translated again to Malayalam (by VN and S Surendran) for accuracy. One patient interview in SA was conducted in English and Afrikaans and the transcription was translated by OM. All other interviews were conducted in English.

*Case studies*

Case studies were generated by in-depth documentary analysis of patient medical records using a piloted template. Data on all variables (e.g., microbiology results, antibiotics prescribed, medical history, surgical interventions) were collected. The healthcare professional, carer and patient experience was captured through focussed interviews.

Data analysis

The data were analyzed using classic grounded theory approach(26), using mainly inductive methods of inquiry. Grounded theory relies on simultaneous data collection and analysis, in an iterative manner that enables theory construction and does not rely on existing frameworks for analysis. The analysis aimed to explore categories and relationships within the data collected. During focused coding, a constant comparative method was used for the analysis of the emerging categories and themes(27) aided by Nvivo 11 software. The data from observations, documentary analysis, and interviews were open coded to identify key categories, which were developed into themes. The analysis was conducted using an iterative and recursive process of moving between the coded data, data collection in the field, and the higher-level themes, until the themes and the relationship between the themes reached saturation (i.e. no new themes or inter-relationships between them were identified).

**Appendix 1: Ethnographic data collection guide**

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| **Episode of Observation** | **Ward practice** | **Ward Rounds** | **Multidisciplinary Meetings** | **Shadowing individuals** |
| **Data Collected** | Duration  The time of day  A general description of the ward layout  Number of bay and side beds  A description of the activities taking place  A description of the people working on the ward  The patterns of activity | Duration  People in attendance  Who lead the ward round  The number of wards visited  The number of patients visited  What was discussed – who lead the discussions, who contributed  What tools were used e.g. electronic prescribing, smartphones  What tasks were identified  Who was responsible for carrying out tasks  What interactions there were with patients  What interactions there were with other healthcare professionals  What each member of the team did during the ward round i.e. what they contributed or if not contributing what they were doing  Any emotions expressed or felt  My contribution, if any, to the activities e.g. pulling curtains, getting gloves for consultant  Any disruptions to the activity | Duration  Meeting type e.g. Morbidity & Mortality meetings  Who attended  What was discussed  Who lead the discussion  Who contributed to the discussion  What, if any, data was used or presented  Who presented the data  Any emotions expressed or felt | Duration  Type of activity e.g. nurse medication administration  Any dialogue between observer and participant  Any disruptions to the activity  The interactions of the healthcare professional with patients and other members of staff  Places visited  Tools used e.g. guidelines, electronic systems  My contribution, if any, to the events taking place e.g. helping the pharmacist/ doctors with the electronic prescribing trolley |

**Appendix 2: Healthcare Professional Interview Guide**

**Research study:** Antibiotic use across Surgical Pathways - Investigating, Redesigningand Evaluating Systems (ASPIRES Study)

Work Package two: Roles and Context, an ethnographic research of the surgical patient pathways in Cape Town: Part of an ESRC funded project optimising antibiotic use along the surgical pathway

**Healthcare professional sample interview questions (to be developed and piloted) –** *These are template guiding questions and will be supplemented**by any points that are raised during the ethnographic observations*

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| **Category of enquiry** | **Sample questions** |
| **Opening questions:** | 1. **Can you describe your role in the surgical pathway within your team?** |
| **Roles and responsibilities – antibiotic prescribing/management** | 1. Thinking about surgical antibiotic **prophylaxis** – who is responsible for this in your opinion in the surgical pathway?  * Do you think this is clear within your team? * How is this delegated? * How does it work in practice?  1. What factors influence when you decide to start **therapeutic** antibiotics for your patients?  * What factors influence/determine when and how you review the antibiotic prescriptions for your patients? * What factors influence/determine when you decide to stop antibiotic prescriptions for your patients?  1. Who is **responsible** in your team for antibiotic prescribing decisions post-surgery?  * How is this delegated? * How does this work in practice?  1. Do you think you personally have a role or responsibility in determining how antibiotics are used for patients being cared for by your team/specialty? What does this involve? 2. How easy is it to work with other members of your team to make decisions about antibiotic use? What roles do other staff members play? 3. Does the patient have a role to play?   If yes   * In what way?  1. Who within your team would you say has the most influence on your antibiotic prescribing decisions (or your role in the way antibiotics are used)? 2. What do you think about the way antibiotics are used in this hospital for surgical patients?  * Can it be improved? If yes, * How can it be improved?  1. **What influences how you allocate the available resources both human and economic?** 2. Are you aware of any **policies or guidelines** in your organisation/specialty for antibiotic prescribing? How effective do you think these are? 3. What is your point of reference if you wanted to seek more information about using antibiotics? 4. Do you get any feedback about the way antibiotics are used in this hospital? 5. What are the **external (if any) influences such as policy, governance, inspections** on the way antibiotics are used within your team/ hospital? 6. **What or who influences** how much priority you give to antibiotic prescribing and management? 7. Thinking across the surgical pathway, where along the pathway do you think it is critical in terms of antibiotic prescribing? |
| **Roles and responsibilities – infection management including SSI** | 1. To what extent is infection prevention and control in surgical patients a high priority in your day-to-day work? Why? 2. Do you think you personally have a role or responsibility in preventing infection in surgical patients? What does this involve? 3. How easy is it to work with other members of your team to try to prevent infections? What roles do other staff members play? 4. Does the patient have a role to play? In what way? 5. Thinking across the surgical pathway, where along the pathway do you think is critical in terms of infection prevention and control? 6. Who do you see as having **responsibility** for preventing infection at this stage? 7. How well do things work in this hospital in relation to avoiding infections in surgical patients? Why? What are the main problems? 8. What do you see as the **external (if any) influences such as policy, governance, inspections** on the infection management procedures within your specialty/the surgical pathway in your hospital? 9. **What or who influences** how much you priority you give to infection prevention and management?    1. **What influences how you allocate the available resources both human and economic?** 10. Are there any **policies or guidelines** in your organisation for infection prevention and management?     1. Do you use some sort of checklist at any point in the surgical pathway?     2. What has been your experience of using these checklists? 11. Are you aware of any data on surgical site infection rates and/or infection outbreaks in the patients within your specialty? What about within your hospital?  * Would you like to receive data on surgical site infections in your patient group? |
| **Reporting structures and data – antibiotic prescribing and infection prevention and control** | 1. Is there a **reporting structure** for antibiotic use and prescribing within your specialty?    1. What about within the hospital? 2. What are the **quality indicators**, if any, for antibiotic prescribing at specialty level? 3. **Who** measures these? 4. How are indicators **reported**? How often? 5. How much of the data collected is shared within the specialty?    1. If it is shared, how is it shared?    2. Via what mechanism? Mass email? Newsletter?    3. How often is it shared? Weekly, monthly, etc.    4. Is there any **demand within your specialty** for information/data on antibiotic prescribing? 6. Is there a **reporting structure** for infection prevention and control within your specialty?    1. What about within the hospital? 7. What are the **quality indicators**, if any, infection prevention and control at specialty level? 8. **Who** measures these? 9. How are indicators **reported**? How often? 10. How much of the data collected is shared within the specialty?     1. If it is shared, how is it shared?     2. Via what mechanism? Mass email? Newsletter?     3. How often is it shared? Weekly, monthly, etc.     4. Is there any **demand within your specialty** for information/data on antibiotic prescribing?     5. What about for infection prevention and control? 11. In relation to antibiotics **what kind of data** would you like to have available at organisational or local level?     1. Why this particular data?     2. What about for infection prevention and control?     3. Why this particular data?   *If not picked up in above then ask:*   1. Are you aware of any specific antibiotic prescribing or infection control related **committees/meetings/units**?    1. Who is represented here?    2. How often do they meet?    3. Is there cross-representation at other units/teams? i.e. how is information shared across teams/committees? |
| **Final questions** | 1. Is there anything you’d like to add to what we have discussed? |

**Thank you for taking the time to participate in this research.**

**Appendix 3: Patient Interview Guide**

**Research study:** Antibiotic use across Surgical Pathways - Investigating, Redesigningand Evaluating Systems (ASPIRES Study)

Work Package two: Roles and Context, an ethnographic research of the surgical patient pathways in Cape Town: Part of an ESRC funded project optimising antibiotic use along the surgical pathway

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| **Category of enquiry** | **Sample questions** |
| **Opening questions:** | 1. Can you tell me about the operation you had recently at X hospital – what operation did you have? Was this planned ahead or was it an emergency/urgent operation? 2. Were you alone or did you have a relative/friend/carer accompany you and provide help? |
| **Infection prevention pre-op** | 1. Were you seen by a healthcare professional prior to the operation in order to prepare you? What did they do? 2. Before the operation, were you worried at all about the risk of getting an infection from the surgery? Why? 3. Did the doctor tell you about anything they would do to help you avoid getting an infection? (e.g. give you antibiotics before surgery) |
| **In hospital post op care** | 1. Who in your opinion was in charge of your care whilst you were in hospital? 2. To what extent did you feel involved in the decisions made about your care whilst you were in hospital? 3. While you were still in hospital after the operation, how well do you feel the staff worked to keep the wound clean and avoid you getting an infection? To what extent do you feel they were careful about hygiene when they cared for you? Why? 4. Do you think there are any problems in this hospital that mean patients who have surgery are more likely to get an infection? What are they, for example, cleanliness in the operating theatre, having to share a bed? 5. While you were still in hospital, did your wound become infected at all? 6. Why do you think this happened? 7. How did you feel when you thought it was infected? 8. What happened to treat the infection?    * 1. Were you prescribed antibiotics? Who by?      2. How did you feel about taking antibiotics?      3. How long did you take them for, and who decided when you could stop taking them?      4. What else did the hospital do to care for the infected wound?      5. Were you still taking antibiotics when you got home? What happened then?      6. Is it better now? 9. Were you given antibiotics in hospital for any other reason? Why? 10. Are you aware of any problems that come from taking antibiotics? |
| **Discharge and post op care** | Before discharge, were you given any advice about how to look after your surgical wound?  How easy did you find it to look after your wound and keep it clean at home? Why?  Were you contacted after discharge by a member of the staff at the hospital or your local doctor to ask about how the wound was healing?  When you were back at home, did your wound become infected at all?   * How did you know it was infected? * Why do you think this happened? * How did you feel when you thought it was infected?   What did you do about the infection?   * Did you seek advice from anyone? * Did you take antibiotics? Where did you get them from? Could you get them easily? * How did you feel about taking antibiotics? * How long did you take them for, and why? * Is it better now?   If your wound didn’t get infected at all, what do you think was important in helping to prevent this?   1. Have you ever bought antibiotics to treat a suspected infection without a doctor’s prescription?  * If yes, why did you think you needed the antibiotics? What made you think you had an infection? |
| **Closing questions** | Is there anything that would have made things better for you during your hospital stay or recovery at home?  Is there anything else you wish to add to what we have discussed? |