Appendix 1: QSAP INTERVENTION

Queensland Surgical Antibiotic Prophylaxis (QSAP) Intervention (see figure 1)

The study comprised a mixed-methods design (25, 26) quantitatively assessing an intervention to embed SAP prescribing improvement within a surgical team by way of an interrupted time series design (27) combined with qualitative in-depth individual interviews exploring the experience of the intervention by surgeons and pharmacists at each site. For the quantitative arm the pre-intervention and post-intervention periods were 12 months in length. This study was designed around the following dimensions, based on evidence the current authors and other researchers internationally have identified as shaping SAP:

Barriers: addressing evidence-based barriers (guideline mistrust, lack of visibility/knowledge of guidelines, lack of prioritisation of antibiotic decision-making in the operating theatre) (20) (12, 22)

Enablers: targeting social dynamics within surgical teams which would be expected to increase compliance with guidelines (hierarchical structures, clarity in role delineation (12, 19)) and provide audit/feedback of compliance with guidelines (13)

Ownership: fostering surgical ownership/leadership of quality improvement in SAP (18, 28)

Audit feedback

To promote senior engagement in the study, the facilitator (an Infectious Diseases Physician) met with surgical directors at each site prior to the study and explicitly outlined the need for senior leadership of the study by them within their unit, and also for auditing to be performed by surgical team members. The director of general surgery at each site agreed to lead the quality improvement cycle within their team and nominated surgical team members to perform auditing. The requirement for auditing within the surgical team was a priority to increase guideline knowledge within the team and to facilitate ownership of the study and the study outcomes. Prior to the start of the 12-month intervention period, surgical team members at each site audited SAP compliance against local guidelines. This provided baseline data on departmental performance. The auditing was performed by junior team members at each site, and usually more than one surgical team member was auditing at any one time. At site 2, at times at periods when there were few junior surgical team members engaged, medical rotation junior doctors at that site also performed auditing. The facilitator attended each site multiple times and explained data entry to the juniors and was available for data collection questions via email or phone between visits.

Guideline-based auditing

Each site within the study had established clinical guideline procedures for SAP which covered the majority of general surgical procedures and were based on the Australian electronic therapeutic guidelines (eTG)(29). Where there was no specified local guideline for a particular operation, the prescribing decision was evaluated against eTG. In circumstances where eTG did not have specific guidance for a particular operation, the prescribing decision was referred to an expert committee consisting of a pharmacist and an Infectious Diseases physician (independent of the study) who evaluated whether the prescribing decision was appropriate. Each clinical guideline recommended appropriate choice, dose, timing (prior to knife to skin) and duration of SAP for specific operations. In addition, each guideline had recommendations for SAP for patients who were already on treatment antibiotics (for example, adjusting the timing of the treatment of antibiotics, or if this was not possible, adding SAP). Allergies of each patient were assessed, and where allergies were present, assessment against the guideline recommended antibiotics for allergy was utilised. Where 'knife-to-skin' time was not documented, time from the start of the operation was used as a surrogate for assessment of SAP timing appropriateness. For the large majority of general surgical operations, a single dose of prophylaxis was recommended by clinical guidelines. Post-operative prescribing was

assessed by auditing the medication chart in the post-operative period to see whether SAP was continued after the operation. Overall compliance was assessed by appropriateness of all decisions (see Table 1 for error definitions and potential consequences of each error type).

Collaborative introductory meeting: The Barriers-Enablers-Ownership Nexus

A collaborative meeting started the 12-month intervention period at each site. The facilitator (JB) attended a surgical team meeting and a junior surgical team member at each site presented audit data. A facilitated 45-60-minute discussion around the results, areas of discordance with the guidelines, key evidence-based social influences on prescribing decisions (**barriers**), and the potential for team leadership in fostering change (**enablers**). Teams were also asked to collaboratively identify goals for change to occur at each site and team members to be responsible for the ongoing data collection (**ownership**).

Follow-up meetings

Follow-up meetings, facilitated (by JB), structured around the *Barriers-Enablers-Ownership* model occurred every 3-4 months at each site (at least 3 meetings at each site) for 12 months following the collaborative meeting. This was accompanied by real-time, department specific data on local compliance with guidelines presented by a local team member. Feedback was delivered via a formal audiovisual presentation by the local surgical team member who was completing the audit at each site, with the facilitator present to lead discussion around areas of guideline discordance. Any areas where evidence was unclear and for which surgical teams requested more information were discussed with a literature review (prepared by the facilitator and emailed around to surgical team members) presented at the next meeting. Discussion around guideline discordance was facilitated with a focus on consensus building and leadership from senior surgeons. This allowed a combination of discussion about social and behavioural influences on guideline concordance, as well as reflection on actual, local audit data and why (or why not) change was occurring. Consensus building and goal setting around areas for prescribing improvement were part of these discussions. Meetings were scheduled as part of the usual departmental teaching meeting time, which were attended by all levels of seniority in the department. Attendance was expected as part of the departmental structures. While not mandatory, meetings were scheduled on dates that allowed senior members that were leading the project locally to be in attendance.

Data Collection

To augment the collaborative and follow-up meetings, an online auditing tool was provided to all sites using the REDCap database system. Patient data were obtained by retrospective review of the operating lists, medical record, anaesthetic notes and prescribing chart (either electronic medical record or paper chart depending on the site), and included demographic data, operative details, risk factors for surgical site infection, and the accuracy of SAP prescribing audited against local SAP guidelines. The first 50 elective and acute patients of each month were selected from general surgery operating lists every second month for the 24-month study period and charts were reviewed retrospectively. All data entries were checked for accuracy by the lead investigator (JB). Emails to follow-up data collection and to support juniors in learning and interpreting guidelines against which they were auditing were undertaken by the study facilitator.

Variable components

During the study, sites were able to request additional input that they considered would be helpful (responsiveness to the local context). SAP guideline posters on theatre walls were requested by all sites and the facilitator liaised with the local AMS teams to bring this about. The posters were based on local guidelines and were A3 size or larger. In addition, at site 2 requested that the facilitator present the background to the study to the local anaesthetists, which resulted in a group discussion with the anaesthetists about SAP prescribing influences.