Appendix 1: Activity-theoretical concepts, with definitions and prescribing-relevant examples

Key Concept	Definition	Definition
Activity System	Historically evolving systems within organisations where activities take place.	Hospitals and other health care settings where health care professionals collectively prescribe medications.
Activity	Always collective, includes ambiguity, surprise and sense-making, which include the potential for change, i.e. the expansion of the object.	Processes where care professionals prescribe antibiotics to patients. Prescribing activity is a process in which actions and operations are carried out to treat a patient with an infection. The activity includes the discussed stages in the process model (see Fig. 1).
Object	The sense and meaning of the actions are attached to the object of an activity. The object includes a collective motive and connects actions of individuals to larger systems.	Safe patient care leading to optimal recovery from the acute infection where appropriate. This is a collective object which enables a wider understanding of patient care and "patient-centredness" than the various specific objects held by the many actors involved in the process.
Mediation	The use of artefacts (tools and instruments) ideally driven by collective object-related motives to mediate actions between subjects and objects in the context of work.	Using care pathway protocols to standardize care procedures.
Disturbance	Deviations from the normal scripted course of events in the work process doctor may be a constant that is defined by plans, explicit rules and instructions, or tacitly assumed traditions.	The specific object for a trainee attempt to try to please more senior doctors in the medical hierarchy. This may divert the trainee doctor's attention away from the object of the activity, i.e. the patient.

Appendix 2 A detailed description of each process stage, and the types of healthcare professional typically involved in them

This document explains the stages from the process model in the manuscript in more detail. This level of detail is not needed to understand the article or the analysis process but may be of interest to those working within other healthcare systems.

It also includes information about the types of healthcare professional typically involved. The number of crosses in these boxes signifies whether the group was the main group involved (++) or did it occasionally but were not the main group involved (+).

Stage no.	Title	Description	Profession typically involved			
			Doctors	Nurses	Pharmacists	Microbiologists
1	Assessment	History and examination.	xx			
		Drug allergies and medication history.	xx		xx	
2a	Diagnosis	Working diagnosis and differential diagnoses.	xx			
2b	Infection?	Strength of evidence for bacterial (or microbial) infection is weighed.	xx			
2c	Investigations	Appropriate investigations are ordered, for example, blood test and imaging.	xx			
2d	Specimens	Appropriate specimens are collected (ideally prior to antibiotic administration, although should not delay administration in critically ill patients) and sent to Microbiology for microscopy, culture, and sensitivity (MC&S).	xx	xx		
3a	Considerations	• **Likely pathogen(s):** site of infection, colonisation with resistant organisms, past specimens MC&S, recent hospital admissions, travel abroad, etc. • **Site and severity of infection** • **Antibiotic characteristics:** pharmacokinetics, pharmacodynamics, spectrum of activity, drug interactions, risk of toxicity or allergy. • **Patient factors:** weight, age, gender, pregnancy, breast-feeding, susceptibility to infection, risk factors for *Clostridium difficile* infection, renal and hepatic function, other medications, allergies (including nature of the allergy), other diseases, oral route available, ethnicity, travel history, and colonisation/historic resistance. • **Patient preferences:** desire for out-of-hospital therapy, unacceptable toxicities, etc. • **Antibiotic resistance:** local epidemiology, threat of growing antibiotic resistance (treatment given to one patient can negatively impact on society as a whole).	xx		x	x

3b	Consult guidelines	Evidence-based antibiotic guidelines should be easily available to offer prescribing support and facilitate the initiation of appropriate treatment/best use of antibiotics.	xx			x
3c	Consult experts	Medical Microbiologists and/or Infectious Diseases doctors and Antimicrobial Pharmacists should be available to provide support, particularly for complex or unusual cases.	xx		x	xx
3d	Consult seniors	Senior members of any team should be available to provide prescribing support and/or signposting to facilitate appropriate prescribing.	xx			
4	Select initial antibiotic treatment	• Usually intravenous for severe infection (but may not be). • Correct drug, dose, route and frequency adjusted according to the individual patient's parameters (see 3a patient factors above). This may mean deviating from guidelines. • Check for drug interactions prior to making final choice – monitor and/or adjust treatment plan accordingly.	xx			x
5a	Prescribe initial therapy	Antibiotic therapy is prescribed on the drug chart and any supplementary paperwork (e.g. restricted form) is completed. Good stewardship documentation should be completed.	xx			x
5b	Clinically checked	The initial antibiotic prescription is reviewed by a Pharmacist to assess its clinical appropriateness.			xx	
6a	Communicate initiation to nurse	The prescriber should convey the initiation of the antibiotic prescription to the administrator (and the urgency with which the treatment is required).	xx			
6b	Communicate initiation to patient	The prescriber should discuss the therapy with the patient (as appropriate with reference to the patient's condition).	xx	x	x	x
7a	Locate medication	The antibiotic (and any necessary consumables and/or liquids used to dilute) must be identified and prepared for administration.		xx	x	
7b	Check and administer	The prescription is checked and the prepared therapy is administered to the patient.		xx		
8	Monitor response	The response to treatment is reviewed in light of all new information. This will include: the patient's clinical condition; biochemical tests; adverse effects/toxicity; patient preference; microbiology (MC&S, urinary antigens, etc.) and may include imaging and therapeutic drug monitoring.	xx	x	x	X
9a	Review	Review empirical therapy in light of all new information. Adjust treatment as appropriate (at any time). By 24–72 hours, every patient should be reviewed by a senior doctor and a clinical decision made regarding the on-going need for antibiotics. At least one of the following decisions should be made: • Stop antibiotics (if no evidence of infection); • Switch from intravenous to oral therapy; • Change therapy e.g. de-escalation, substitution or addition of agents; • Continue current therapy; or • Outpatient Parenteral Antibiotic Therapy (OPAT). Good stewardship documentation should be completed.	xx	x	x	X
9b	Consult guidelines	As above (3b). However, with reference to revised therapy, for example intravenous to oral switching guidelines.	xx		x	

9c	Consult experts	As above (3c) but taking new information into account.	xx		x	
9d	Consult seniors	As above (3d) but taking new information into account.	xx		x	
10a	Prescribe revised therapy	Revised antibiotic therapy is prescribed on the drug chart (and initial therapy is stopped unless specifically adding agents). Any supplementary paperwork (e.g. restricted form) is completed. Good stewardship documentation should be completed.	xx			x
10b	Clinically checked	The revised antibiotic prescription is reviewed by a pharmacist to assess its clinical appropriateness.			xx	
10c	Communicate change to nurse	As above (6a). *The nurse will then perform stages 7a and 7b ± 8 until the prescription finishes or is further amended.*	xx			
10d	Communicate change to patient	As above (6b).	xx	x	x	x
11a	Prescribe for discharge	Antibiotic therapy is transcribed onto a discharge prescription (treatment plan/antibiotic therapy may require review and modification for out of hospital administration). Information on infection/treatment should be provided for the GP, along with any instructions for on-going monitoring. Good stewardship documentation should be completed.	xx			
11b	Clinically checked	The antibiotic discharge prescription is reviewed by a pharmacist to assess its clinical appropriateness and an antibiotic supply may be made.			xx	
12a	Discharge	An antibiotic supply is identified from pharmacy or ward stock and checked against the discharge prescription. The patient is then discharged with the antibiotic supply and appropriate advice/counselling on the treatment, potential toxicities, monitoring and safety-netting.	x	xx	xx	
12b	Copy to GP and patient	Copy of discharge prescription to GP and patient				
13	Self-administration	The patient will usually be responsible for self-administration at home (although healthcare professionals, carers or family members may be involved depending on the patient's circumstances and the location to which they are discharged).				
14	Monitor toxicity	The patient will usually monitor for toxicity although with prolonged/complex infections medical oversight may be required.				
All stages	Significant results	Significant results from sterile sites prompts rapid microbiology review and/or consultation (at any stage).				xx
	Safety concerns	Patient safety concerns would immediately be acted upon (in a manner befitting the risk to the patient). For example, serious prescribing errors, identified by any professional, would result in an immediate verbal request for review with the prescribing team (or on-call team out-of-hours). Interventions to optimise therapy, for example, the need to consider oral switching in a patient demonstrating clinical improvement, may be transmitted to the prescribing team via the medical notes.	x	x	xx	x
	Good stewardship	Healthcare professionals should always document indication, severity, agent, route, dose, frequency and duration (or review date) for all antibiotic therapy in the medical notes and on the drug chart.	xx	x	xx	xx