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# The future – are we interpreting stewardship correctly and what could we do differently?

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**Or...**

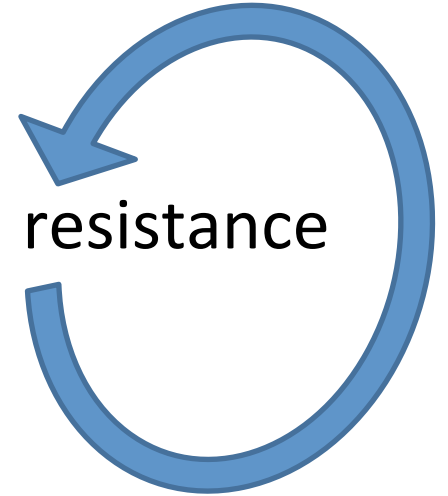
**from microbiology to microeconomics  
and back again**

# Some preliminary assumptions

Only antimicrobials



Antimicrobial resistance



Antimicrobial development is stalled

Resistance is  
effectively  
irreversible



Antimicrobials are a scarce resource

# Another assumption

- The cost of antimicrobials to individual patients is negligible

# IDSA definition of antimicrobial stewardship

- Coordinated interventions designed to improve and measure the appropriate use of antimicrobials by promoting the selection of the optimal antimicrobial drug regimen, dose, duration of therapy, and route of administration. Antimicrobial stewards seek to achieve optimal clinical outcomes related to antimicrobial use, minimize toxicity and other adverse events, reduce the costs of health care for infections, and limit the selection for antimicrobial resistant strains.

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# **IDSA definition of antimicrobial stewardship - objectives**

- appropriate use of antimicrobials**
- optimal clinical outcomes**
- minimize toxicity and other adverse events**
- reduce the costs of health care for infections**
- limit the selection for antimicrobial resistant strains.**

# Stewardship intervention types

- **Persuasive**
  - Education
  - Consensus
  - Opinion leaders
  - Reminders
  - Audit
  - Feedback
- **Restrictive**
  - Restricted susceptibility reporting
  - Formulary restriction
  - Prior authorisation
  - Automatic stop orders
- **Structural**
  - Computerised records
  - Rapid lab tests
  - Expert systems
  - Quality monitoring



# Conceptual difficulties with antimicrobial stewardship

- Vague, potentially contradictory objectives
  - What is meant by:
    - “appropriate use”?
    - “optimal clinical outcomes”?
  - Is this compatible with “limit the selection for antimicrobial resistant strains”?
- Lack of an underlying model that
  - Explains established findings
  - Predicts improvements

# Economics – the study of scarcity

- Can economics help to:
  - Frame the questions raised by antimicrobial stewardship?
  - Understand the barriers to achieving stewardship?
  - Explain successful approaches to stewardship?
  - Predict solutions?

# Game theory<sup>1</sup>

- The study of multi-person decision problems

		Prisoner 2	
		Stay silent	Confess
Prisoner 1	Stay silent	-1, -1	-9, 0
	Confess	0, -9	-6, -6

- Game theory explains and predicts outcome of games

1. See, for example, R Gibbons, *A primer in game theory*

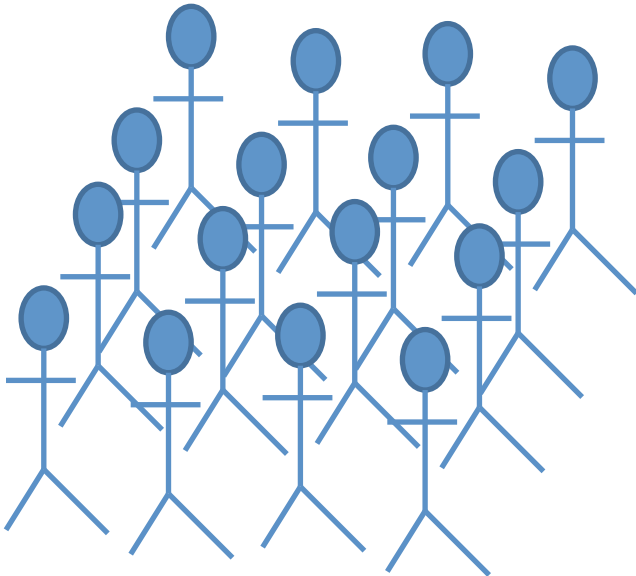


## Prescribe or not?

DON'T PRESCRIBE

PRESCRIBE

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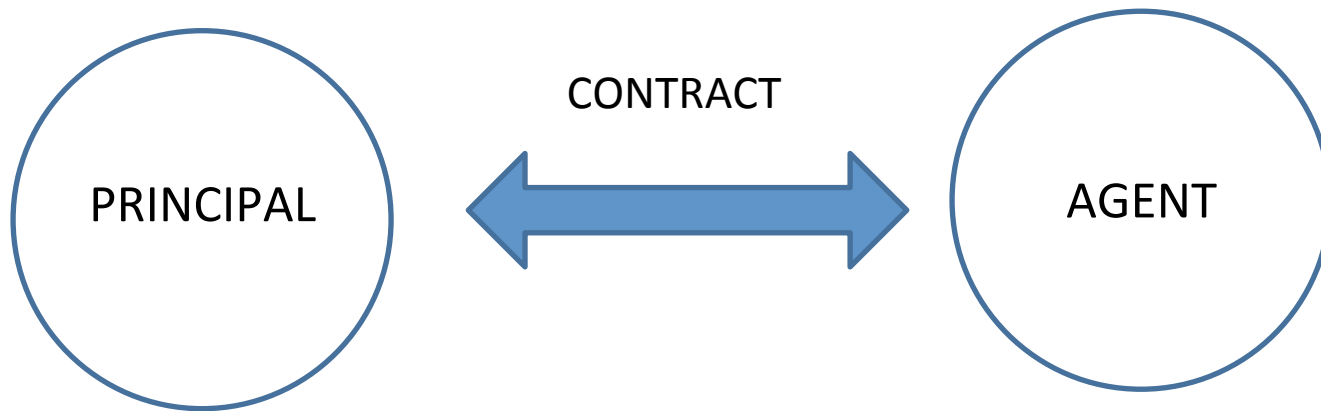


# Antimicrobial stewardship as a final-offer arbitration game

- When the prescriber has freedom to arbitrate, population does not have primacy in determining outcome
- Highlights the central role of the prescriber's personal preference, influenced by the two (opposing) strategy choices of the two players
- Population is most likely to win if the antimicrobial guidelines are a closer match to the prescriber's personal preference than the patient's preferred strategy (assuming incongruence) (and vice versa)

**Another perspective – agency theory**

# Agency theory and the principal-agent problem<sup>1</sup>



The problem: Is the agent fulfilling the principal's objectives?

Becomes a problem when it is difficult or expensive for the principal to verify what the agent is doing

1. See, for example, KM Eisenhardt Acad Management Rev 1989;14:57-74

# Why wouldn't the agent do what the principal wants?

- Adverse selection
  - Agent not competent
- Moral hazard
  - Agent's objectives are not aligned with those of the principal



# Explicit assumptions about the agent

- Self-interest
- Bounded rationality and type I thinking
- Risk aversion

# Solving the agency problem

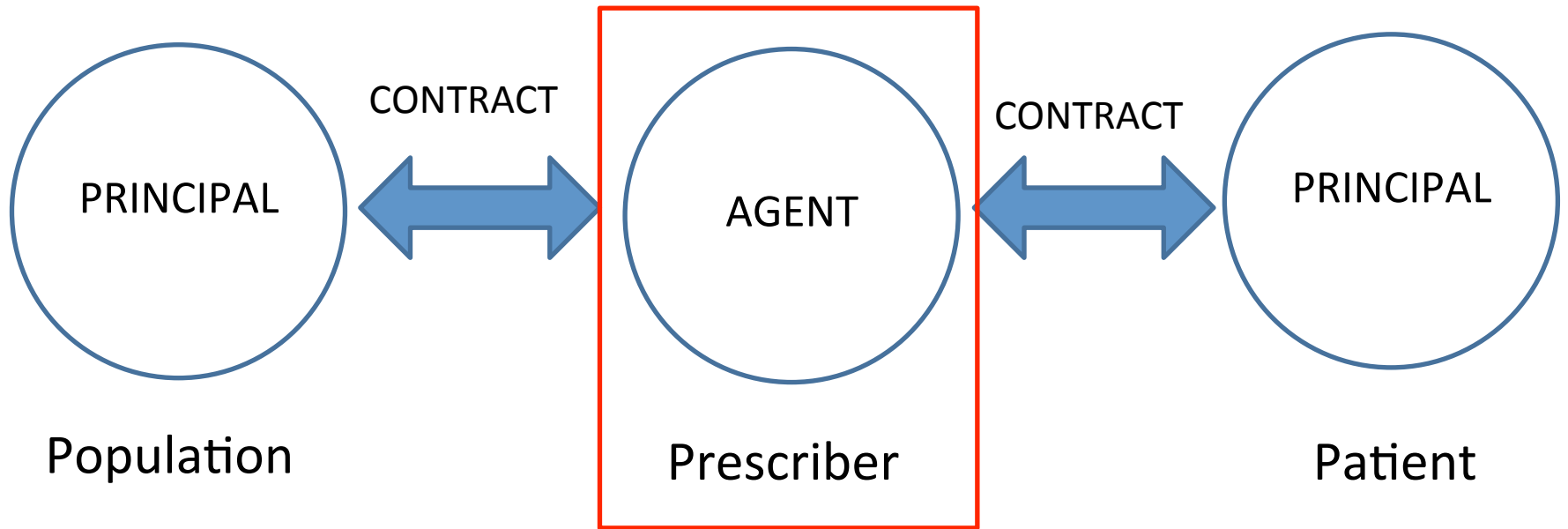
The contract is the answer

- Behaviour-based contract
  - Depends on programmability of contract – degree to which agent's behaviour can be specified in advance
- Outcome-based contract
  - Depends on measurability of contract

Preference influenced by costs of measuring behaviour or outcomes

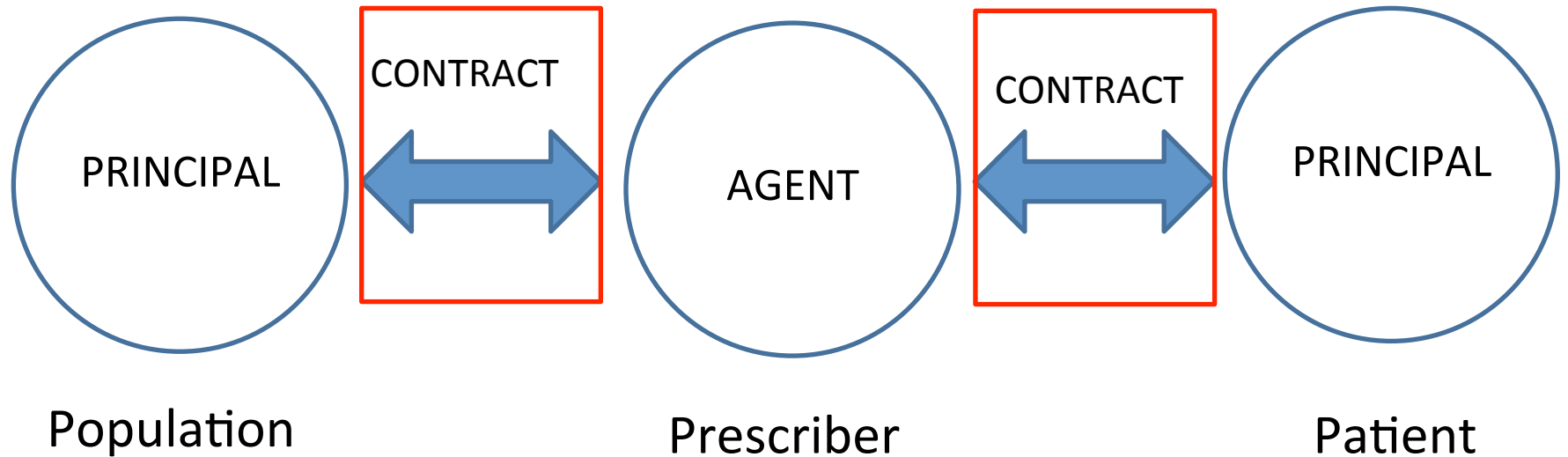
# **An agency theoretical approach to antimicrobial stewardship**





#### Agent issues

- Adverse selection:
  - Medical degree doesn't guarantee adequate knowledge of antimicrobials and prescribing
  - Poor prescriber decision-making under uncertainty
    - Bounded rationality
    - Type I thinking
- Moral hazard
  - Risk averse prescriber
  - Hidden principal
  - Path of least resistance



Using the contract to solve the agency problem

- Contract specification
- Behaviour-based contract
- Outcome-based contract

“The folly of rewarding A while hoping for B”<sup>1</sup>  
 Examine programmability of prescribing process  
 “Right Drug, Right Dose, Right Time, Right Duration”<sup>2</sup>  
 Structural, restrictive, persuasive interventions  
 Substitution of agent  
 Identify measurable outcomes of prescribing process

Ensure contract is with individual agents

1. Kerr S. Acad Management J 1975;18:769-783
2. ARHAI *Start smart - then focus*

# Value of a game/agency theory-based view

- Provides a coherent model for antimicrobial stewardship
- Identifies stewardship as a member of a class of problems, sharing challenges and solutions
- Makes explicit the opposing objectives of the two principals – population and patient
- Highlights the dual agent role of the prescriber
- Acknowledges adverse selection and moral hazard as the two ways in which stewardship may be compromised
- Emphasises the importance of the contract and behaviour/outcome based approaches as potential solutions
- Places current approaches to improving stewardship into a strategic framework