# Lifesaving Exchange

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Introduction

- Patients waiting for a kidney.

- Many patients found already a relative, partner or friend to donate a kidney to them

- However kidneys don't always match (bloodtype, many factors)

- Author tries to apply game theory to help!

First Match

- Usually waiting list

- Find a donor!

- Manual matching of two pairs
  - Finding two patient-donor pairs which match!
  - inefficient

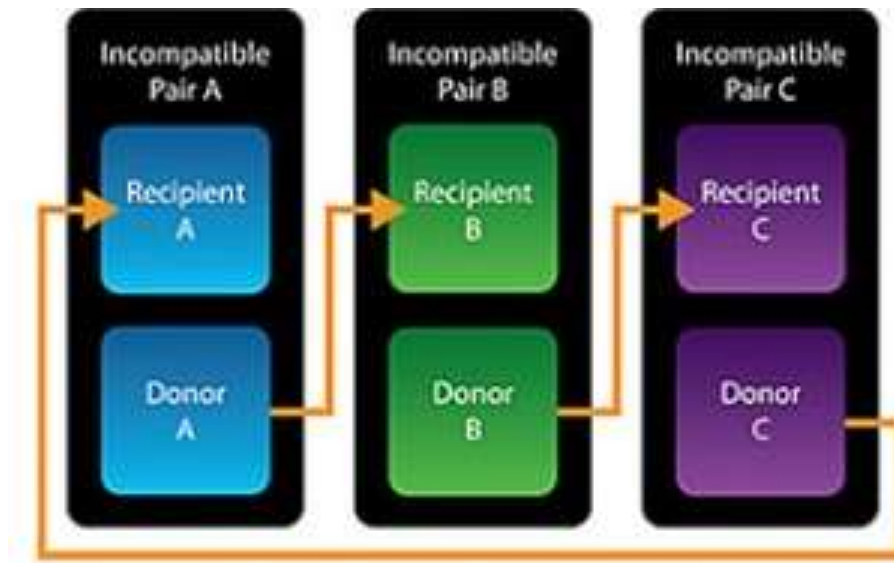- Solution: more data and software to solve matching

Creating a market with no money

- 1st welfare theorem violation: kidneys are not allowed to be traded for money
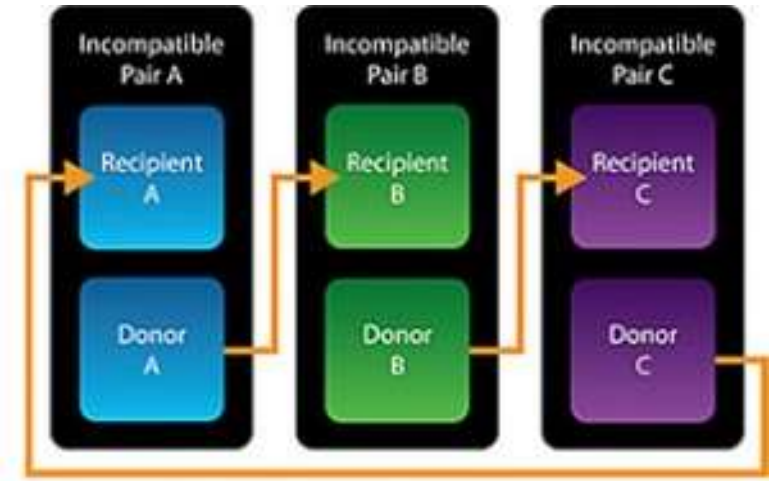- Barter transaction: "double coincidence" of patient-donor pairs
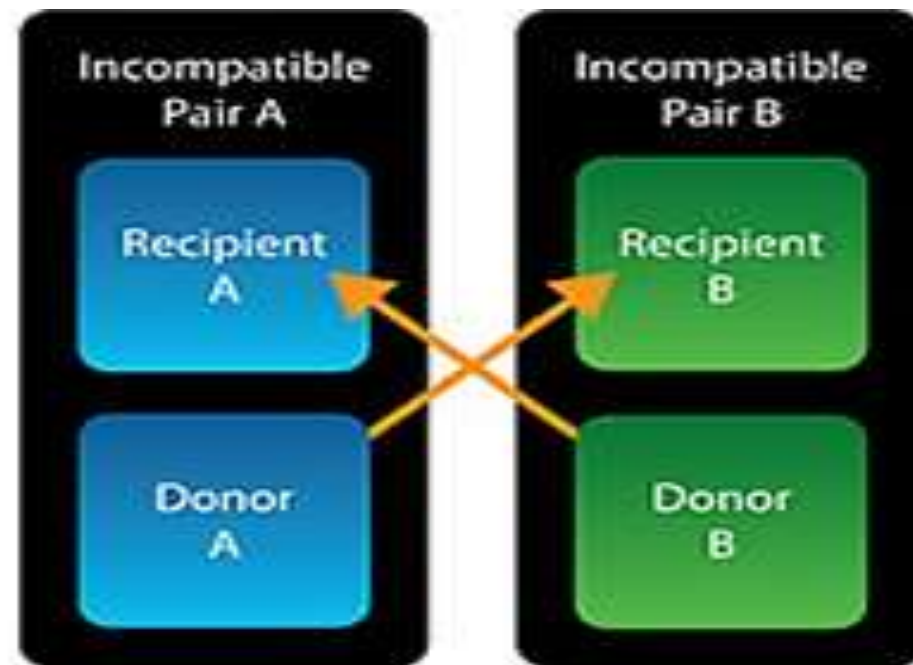
One solution: Cycle of PD-pairs

- Cycles are more efficient than two-PD-pair matching
 - Some cases can not be solved by two-PD-pair matching

- Cycles can be very large in theory
- Operations must be done <u>simultaneously</u>

One solution: Cycle of PD-pairs

- Cycles create opportunities for patients to deviate to a different cycle to get an even better kidney

- Revealing less information might be better strategy (to get better kidney)

- Creating "Top Trading Cycles" (Shapley & Scarf, 1974) provides solution for "perfect" cycle with no incentives to deviate and full information disclosure
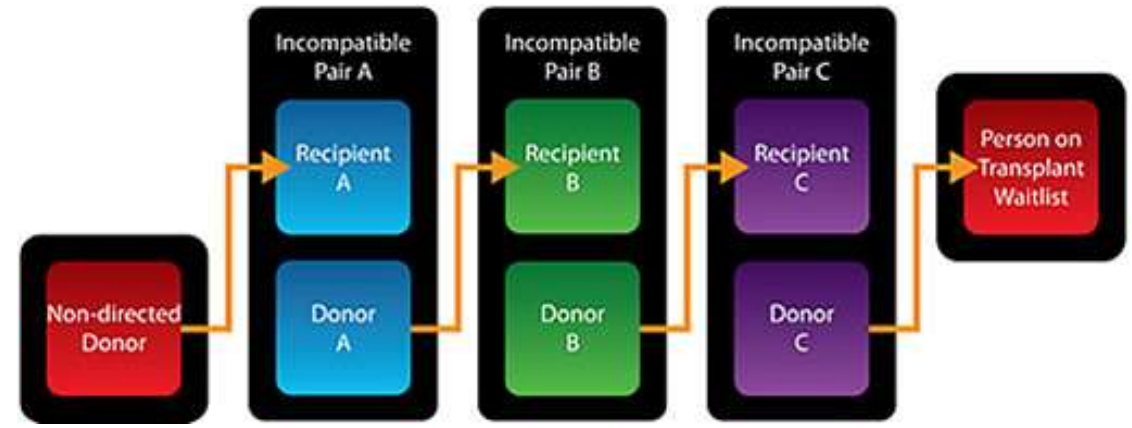
Another solution: Chain of PD-pairs
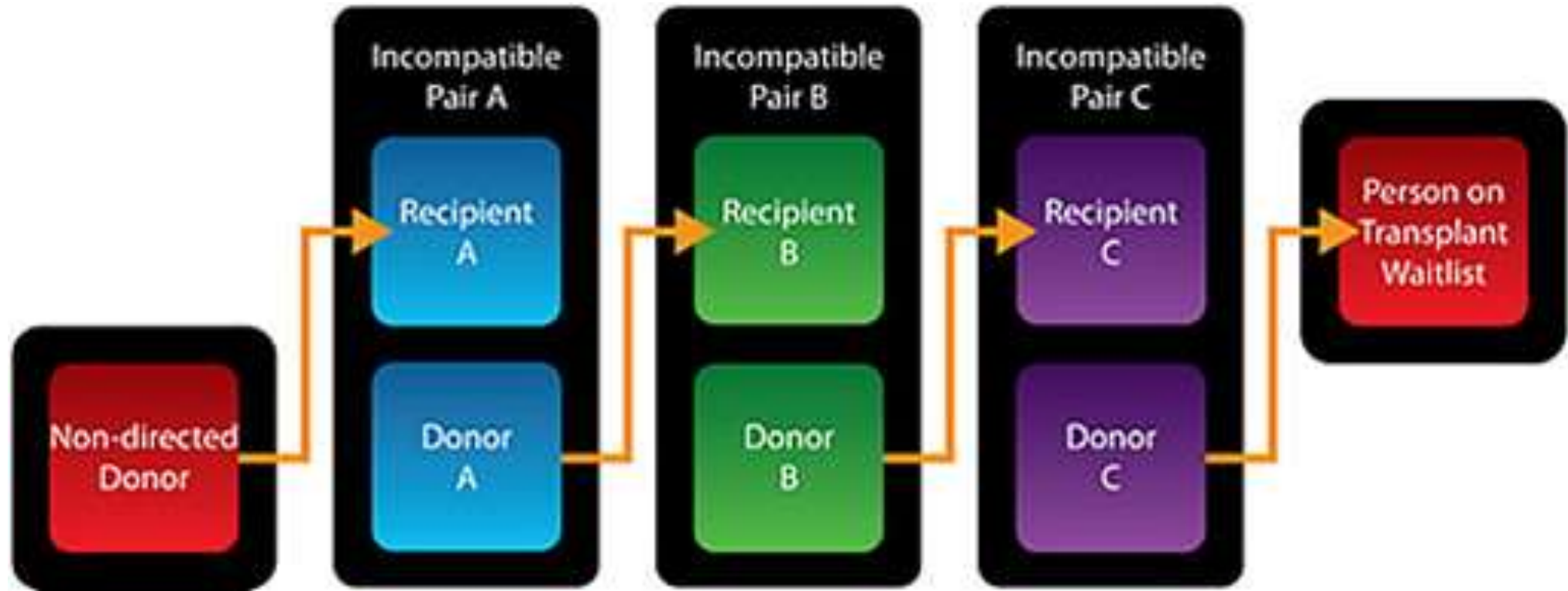
Another solution: Chain of PD-pairs

- Simultaneous
- Starts with volunteer donor
- Last kidney goes to patient with no donor (classic waiting list)
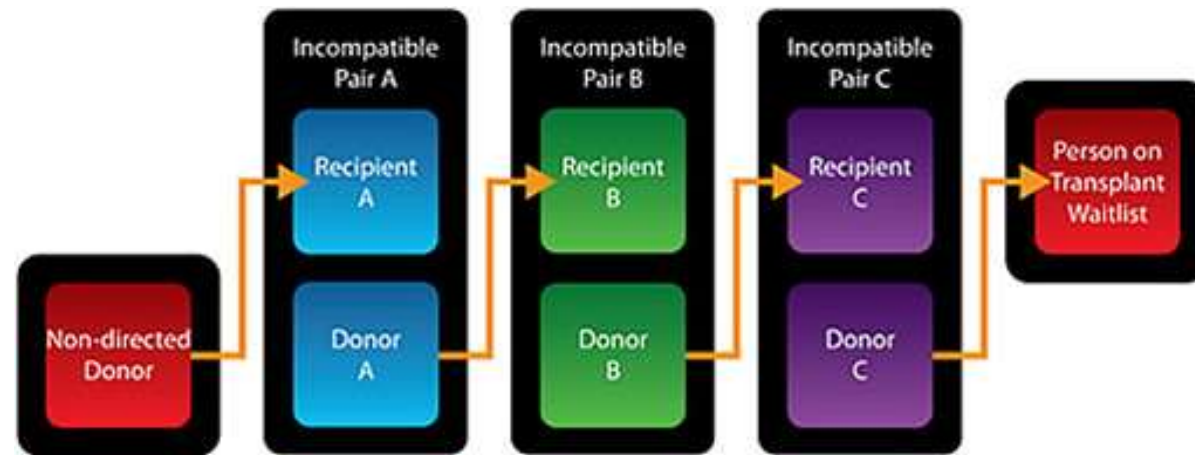
Non-simultaneous Chain

- No simultaneous surgery
  - Logistically easier, avoids hospital limitations
  - Big simultaneous chains and cycles are infeasible (hospitals prefer simultaneous solution, because they consider it less risky)
  - Help future patients
  - Can be done locally for each patient
- Problems:
  - Chain stops when donor bails out, but no actual harm is done, unlike in a simultaneous cycle

Market design/Economic engineering

- Challenges:
  - Difficult to create big cycles and chains
  - Bureaucracy
  - Hospitals compete for patients
  - Business
  - Hospitals enroll only hard to match donors

Market design/Economic engineering

- Creating an efficient market place
  - Thickness – collecting more data (more patient-donor pairs)
  - Congestion – more surgery rooms (logistics)
  - Safe & Easy – incentives for hospitals to enroll its patients, not only the hard-to-match ones

- Taking advantage of behavioral economics
  - Volunteer-donors exist!
  - Non-simultaneous chain works! (very few bail out)

references

- https://professionaleducation.blood.ca/en/organs-and-tissues/programs-and-services/kidney-paired-donation-kpd-program