Fair Allocation of Vaccines, Ventilators and Antiviral Treatments: Leaving No Ethical Value Behind in Health Care Rationing

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Synopsis

- COVID-19 pandemic has spurred renewed interest in guidelines for allocating scarce medical resources.
  - Guidelines cover a wide range of public health emergencies.
  - Scarce items: ventilators, ICU beds, anti-virals, vaccines, etc.
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- By and large, these guidelines in the field and scholarly literatures in bioethics and emergency healthcare restrict their attention to variants of a priority system as their allocation mechanism of consideration.
- In this presentation:
  1) We argue that a priority system is too restrictive, presenting evidence on how decision makers who are restricted to existing guidelines often struggle to integrate or balance the desired ethical values.
  2) To increase the flexibility of the system, we propose a reserve system.
  3) We develop a general theory of reserve system design.
  4) We relate our analysis to current societal debates, and report preliminary policy impact.

Background

- COVID-19 pandemic has motivated policymakers to revisit existing or issue new guidelines on allocating medical resources (Emanuel et al. *NEJM* 2020, Truog et al. *NEJM* 2020).
- These guidelines appeal to various ethical principles including:
  - Saving the most lives
  - Saving the most life-years
  - The life-cycle principle
  - Instrumental value
  - Reciprocity
  - Equal access

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  - Saving the most lives
  - Saving the most life-years
  - The life-cycle principle
  - Instrumental value
  - Reciprocity
  - Equal access
- These principles can compete with each other:
  - E.g., equal access ignores patient age while the life-cycle principle explicitly considers it.
- An allocation mechanism must implement the desired balance of ethical values.

Ethical Values with Cardinal Measures

- For some of these ethical principles,
  - only individual attributes are relevant, and
  - they may have a natural or a well-established cardinal measure.
- Metric for life-cycle principle: Age
- Metric for saving the most lives (ventilator/ICU allocation): Sequential Organ Failure Assessment (SOFA) score

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- Metric for life-cycle principle: Age
- Metric for saving the most lives (ventilator/ICU allocation): Sequential Organ Failure Assessment (SOFA) score
  - The SOFA score numerically quantifies the number and severity of failed organs.
  - Each of six organ groups lungs, liver, brain, kidneys, blood clotting and blood pressure is assigned a score of 1 to 4, with higher scores for more severely failed organs.

Priority System

- By and large, most pandemic allocation guidelines worldwide rely on versions of a priority system to implement the desired balance of ethical values.
- Vaccine Allocation: Priority systems based on priority tiers.
- Ventilator/ICU Allocation: Priority point systems.

Priority Point System for Ventilator/ICU Allocation

- The SOFA score is considered a good proxy for mortality risk.
- So if the sole ethical value under consideration is the utilitarian goal of saving the most lives, a single-principle point system based on SOFA scores may be a good choice for ventilator/ICU allocation.
- But if there are multiple ethical values as urged by the majority of the experts, then a priority point system is too restrictive to reach an ethically-compelling balance between the desired values.
- It maps individual attributes to a numeric scale, and therefore it cannot even incorporate principles which lack a cardinal and monotonic representation, let alone aggregate them.

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  Example: It cannot accommodate distributional objectives such as proportional representation of disadvantaged groups.

Priority Point System for Ventilator/ICU Allocation

- During the initial phases of the Covid-19 pandemic, while recognizing the need to consider multiple ethical values, many states adopted a priority point system based on SOFA scores only.
- Others have adopted multi-principle priority point systems to accommodate multiple ethical values.
- For ventilator allocation, the priority point system emerged as the mechanism of choice in the US, adopted in the following states:
  - Single-Principle Point System: (SOFA or mSOFA based) NY, MN, NM, AZ, NV, UT, CO, OR, IN, KY, TN, KS, VT
  - Multi-Principle Point System: CA, CO, MA, NJ, OK, PA, SC, MD
- Vast majority were adopted in haste after the COVID-19 pandemic.

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- Aggregation across ethical values also raises the question of incommensurability – "apples vs. oranges"
- We next illustrate some of the consequences of these shortcomings, focusing on recent debates on Essential Personnel priority for ventilator allocation.

Illustrative Debate on Prioritizing Essential Personnel

- Many argue that essential personnel should receive priority under pandemic resource allocation systems.
- This view is also strongly endorsed by medical ethicists based on:
  - the backward-looking principle of reciprocity,
  - the forward-looking principle of instrumental value, and
  - due to the incentives it creates:

"... but giving them priority for ventilators [...] may also discourage absenteeism." (Emanuel et al. NEJM 2020)

Illustrative Debate on Prioritizing Essential Personnel

- In order to issue their guidelines in a timely manner at the outset of the COVID-19 crisis, some states remained vague about essential personnel priority, despite being precise on other details.
- Initially MA recommended a priority point system that relies on rigorous clinical criteria, but it casually suggested "heightened priority" for essential personnel.
- The Pittsburgh guideline initially specified two tie-breakers, one based on age and the other based on essential personnel status. However, it was silent on how to use these tie-breakers.
- The vagueness in these cases sharply contrasts with widely-accepted calls for clarity in pandemic resource allocation guidelines.

Confusion & Frustration due to Vague Descriptions

Who gets a ventilator? New gut-wrenching state guidelines issued on rationing equipment

Preference given to medical personnel, people who are healthy, younger

By Liz Kowalczyk Globe Staff, Updated April 7, 2020, 2:49 p.m.

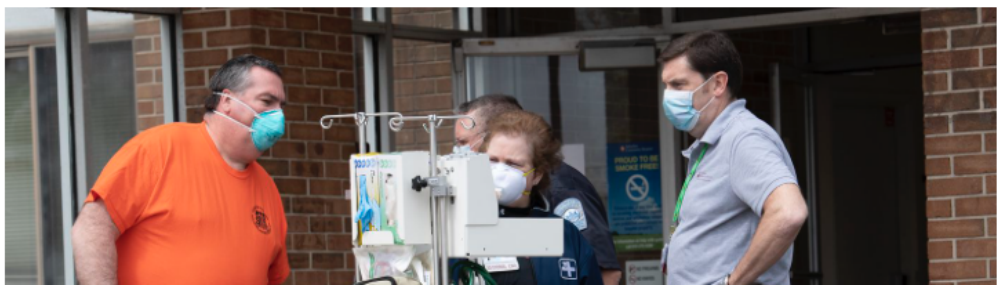
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OPINION

I helped write Maryland's ventilator guidelines in 2017. Pa.'s rules are too vague. | Expert Opinion

Updated: April 27, 2020 - 11:33 AM

Darren P. Mareiniss, For The Inquirer



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Illustrative Debate on Prioritizing Essential Personnel

- Yet worse, states such as NY and MN had to give up on essential personnel priority, largely due to concerns about extreme scenarios where no resources may remain for the rest of the society.
  - "[. . .] *it is possible that they [essential personnel] would use most, if not all, of the short supply of ventilators; other groups systematically would be deprived access.*"

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- Bottomline: A limitation of an allocation mechanism designed to implement ethical values resulted in giving up some of these values!

Increasing Flexibility with a Reserve System

- It is clear that many challenges of the priority system stem from its restriction of relying on a single priority ranking of patients to allocate each and every unit.
  - Therefore, a remedy has to break this limiting feature.

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  - Therefore, a remedy has to break this limiting feature.
- A reserve system divides resources into multiple categories and allows for distinct criteria for allocation of units in different categories.
- These category-specific criteria reflect the balance of ethical values guiding allocation of units in the given category.

Real-Life Applications of Reserve Systems

- Deceased Donor kidney Allocation in the U.S.
  Categories: Higher quality kidneys (20%), other kidneys (80%)
- Assignment of Slots for Boston and NYC Marathons
- H-1B Visa Allocation in the U.S.
- School Choice
  - Boston
  - Chicago
  - New York
  - Chile
- Affirmative Action in India
- College Admissions in Brazil

Reserve System: A Categorized Priority System

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  2. The size of each category
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  - Since units are identical, an individual does not care about the category through which she receives a unit.
  - However, this choice influences the outcome for other individuals.
- This last point is often misunderstood in real-life applications, resulting in unintended (distibutional) consequences:
  - Boston schools 50-50 neighborhood reserve (Dur et al. 2018)
  - H-1B visa allocation (Pathak, Rees-Jones & Sönmez 2020)

Theoretical Agenda

- We therefore present a general theory of reserve systems.
- Today's Plan for Theory:
  - Formulate three intuitive axioms and examine their implications.
  - Formulate a cutoff equilibrium solution concept, linking our axioms to real-life applications.
  - Extend the prior analysis of sequential reserve matching policies which dominate real-life applications.
  - Formulate potential shortcomings of sequential reserve matching policies, and introduce/analyze smart reserve matching policies as a remedy.

A General Model of Reserve Systems

- I: set of patients each in need of one unit
- q: # of identical medical units in short supply
- $\mathcal{C}$: set of reserve categories
- r_c: # of units subject to category-c allocation criteria s.t.

$$\sum_{c \in \mathcal{C}} r_c = q$$

- π_c: strict priority order of patients for units in category c
  - $i \ \pi_c \ j$ Patient i has higher priority for category-c units than patient j
  - $i \ \pi_c \ \emptyset$ Patient i is eligible for category c
  - $\emptyset \ \pi_c \ c$ Patient i is ineligible for category c

$\underline{\pi}_c$: weak order induced by π_c

Outcome: A Matching of Patients to Categories

- A matching $\mu : I \to \mathcal{C} \cup \{\emptyset\}$ is an assignment of each patient either a category or $\emptyset$, such that no category is assigned to more patients than the number of its units.

$\mu(i) = c$	Patient i receives a unit reserved for category c
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- Important Modeling Choice: Why do we need to specify how a patient receives her assignment?
  - Because, even though patients are indifferent between all units, their "claims" over units in different categories are potentially different.

Primary Axioms

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- A matching is non-wasteful if no unit from any category remains idle despite the presence of an eligible patient who remains unserved.
- A matching respects priorities if no patient remains unserved while a unit from some category $c \in \mathcal{C}$ is awarded to a lower category-c priority patient.

Cutoff Equilibria

- We next formulate a natural counterpart of the standard competitive equilibrium for our model.
- For any category $c \in \mathcal{C}$, a cutoff f_c is an element of $I \cup \{\emptyset\}$ s.t.

$$f_c \ \underline{\pi}_c \ \emptyset$$

  - Expressed in terms of a "cutoff" individual.
  - Plays the same role as a non-negative price.

- For a given a cutoff vector $f = (f_c)_{c \in \mathcal{C}}$, the budget set of patient i is

$$\mathcal{B}_i(f) = \{c \in \mathcal{C} \ : \ i \ \underline{\pi}_c \ f_c\}$$

Cutoff Equilibria

- A cutoff equilibrium is a cutoff vector-matching pair (f, μ) s.t.
  1. For any patient $i \in I$,
     (a) $\mu(i) \in \mathcal{B}_i(f) \cup \{\emptyset\}$, and
     (b) $\mathcal{B}_i(f) \neq \emptyset \implies \mu(i) \in \mathcal{B}_i(f)$.
  2. For any category $c \in \mathcal{C}$,

$$|\mu^{-1}(c)| < r_c \implies f_c = \emptyset.$$

Here,

- the first condition corresponds to utility maximization within the budget set, whereas
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  Here,
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  - the second one corresponds to the market-clearing condition.
- A matching μ is a cutoff matching if it is supported by some cutoff vector f at a cutoff equilibrium (f, μ).

Cutoff Equilibria in Real-Life Applications

- It is widespread practice to describe the outcome of a reserve system through its cutoff equilibrium, often utilizing a metric that is used to construct the priority order at each category.
- India-Allocation of Public Jobs and Seats at Public Schools:
  - Outcome defined by cutoff exam scores for each category.
- Chicago-Admission to Selective Enrollment High Schools:
  - Outcome defined by cutoff composite scores for the merit-only seats and for each of the four socioeconomic tiers.
- US-Assignment of H-1B visas:
  - 2005-2008: Outcome defined by cutoff application arrival dates for the general category and the advanced degree category (with ties broken with an even lottery within each category).

Cutoff Equilibria in Real-Life Applications

RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

DATE: 23-11-2012

THE CANDIDATES BEARING THE FOLLOWING ROLL NO. FOR THE RAJASTHAN STATE & SUBORDINATE SERVICES COMBINED COMPETITIVE (PRELIMINARY) EXAMINATION, 2012 HELD ON 14-06-2012 ARE DECLARED **PROVISIONALITY QUALIFIED FOR ADMISSION TO THE MAIN EXAMINATION** IF ANY CANDIDATE IS FOUND THAT HE/SHE DOES NOT FULFILL THE CONDITIONS OF ELIGIBILITY PRESCRIBED AS PER ADVERTISEMENT/RULES, **THE COMMISSION SHALL REJECT HIS/HER CANDIDATURE AT ANY STAGE.**

CUT OFF MARKS

CATEGORY		CUT OFF MARKS
GEN	GEN	218.89
	FEM	185.22
	WD	141.80
	DV	162.31
SC	GEN	210.79
	FEM	151.73
	WD	123.68
	DV	141.94
TSP SC	GEN	184.02
	FEM	
ST	GEN	218.91
	FEM	168.86
	WD	138.16
	DV	191.59
TSP ST	GEN	162.10
	FEM	140.59
OBC	GEN	218.91
	FEM	185.22
	WD	142.16
	DV	164.76
SBC	GEN	207.74
	FEM	171.36
BL/LV		140.68
LD		Already pass in respective category
HI		140.91
NG		Already pass in respective category
DC		140.27
EX		143.09

Quest Education



CUTOFF SCORES

SELECTIVE ENROLLMENT HIGH SCHOOLS

2020-2021

School	Selection Method	Min	Mean	Max
Brooks	Rank	806	837.39	894
Brooks	Tier 1	694	729.42	804
Brooks	Tier 2	731	773.39	806
Brooks	Tier 3	759	782.61	806
Brooks	Tier 4	704	758.78	806

School	Selection Method	Min	Mean	Max
Hancock	Rank	826	848.51	890
Hancock	Tier 1	722	754.2	814
Hancock	Tier 2	776	802.4	825
Hancock	Tier 3	784	804	826
Hancock	Tier 4	700	762.95	825

School	Selection Method	Min	Mean	Max
Jones	Rank	891	895.02	900
Jones	Tier 1	799	838.11	889
Jones	Tier 2	845	868.11	890
Jones	Tier 3	855	872.53	890
Jones	Tier 4	883	886.96	890

School	Selection Method	Min	Mean	Max
King	Rank	684	724.34	846
King	Tier 1	600	639.03	684
King	Tier 2	600	642.51	684
King	Tier 3	601	635.24	683
King	Tier 4	624	647.63	677

School	Selection Method	Min	Mean	Max
Lane	Rank	875	885.58	900
Lane	Tier 1	747	788.16	874
Lane	Tier 2	810	836.36	875
Lane	Tier 3	838	855.8	875
Lane	Tier 4	862	869.39	875

School	Selection Method	Min	Mean	Max
Lindblom	Rank	771	813.38	895
Lindblom	Tier 1	687	717.85	769
Lindblom	Tier 2	712	734.78	769
Lindblom	Tier 3	707	733.63	769
Lindblom	Tier 4	603	669.78	771

School	Selection Method	Min	Mean	Max
Northside	Rank	894	897.61	900
Northside	Tier 1	745	817.39	894
Northside	Tier 2	843	871.14	894
Northside	Tier 3	875	884.06	894
Northside	Tier 4	888	891.63	894

School	Selection Method	Min	Mean	Max
Payton	Rank	898	899.44	900
Payton	Tier 1	803	849.11	894
Payton	Tier 2	855	882.74	898
Payton	Tier 3	882	891.13	898
Payton	Tier 4	895	896.61	898

School	Selection Method	Min	Mean	Max
South Shore	Rank	684	734.64	862
South Shore	Tier 1	602	634.69	682
South Shore	Tier 2	602	636.91	684
South Shore	Tier 3	600	633.74	682
South Shore	Tier 4	613	645	677

School	Selection Method	Min	Mean	Max
Westinghouse	Rank	796	821.27	883
Westinghouse	Tier 1	711	744.43	793
Westinghouse	Tier 2	734	765.08	795
Westinghouse	Tier 3	726	759.82	795
Westinghouse	Tier 4	601	693.78	794

School	Selection Method	Min	Mean	Max
Young	Rank	883	891.28	900
Young	Tier 1	808	841.33	883
Young	Tier 2	831	852.64	883
Young	Tier 3	854	870.1	883
Young	Tier 4	872	878.63	883

Note: The 'Rank' score denotes students selected by their point score only, outside of their tiers. The 'Min' score is the cutoff score.

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Characterization through Cutoff Equilibria

- Our first analytical result shows a strong link between our three axioms and the cutoff equilibrium solution concept.

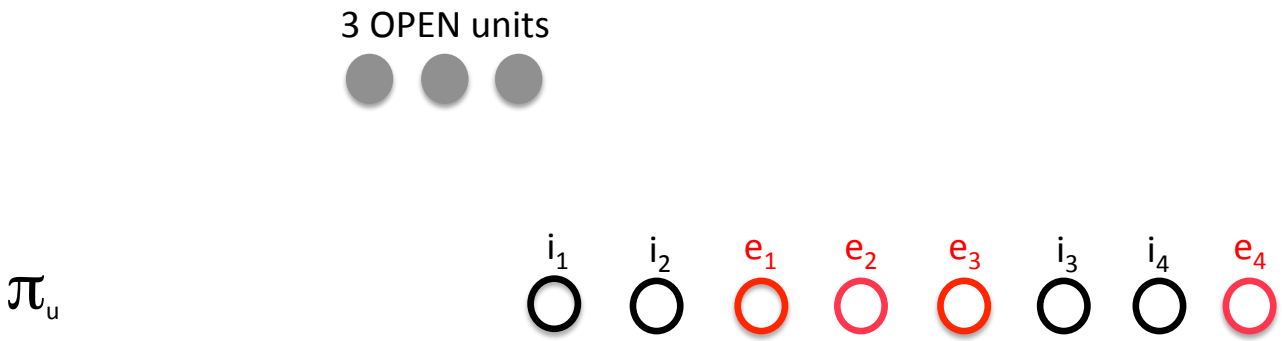
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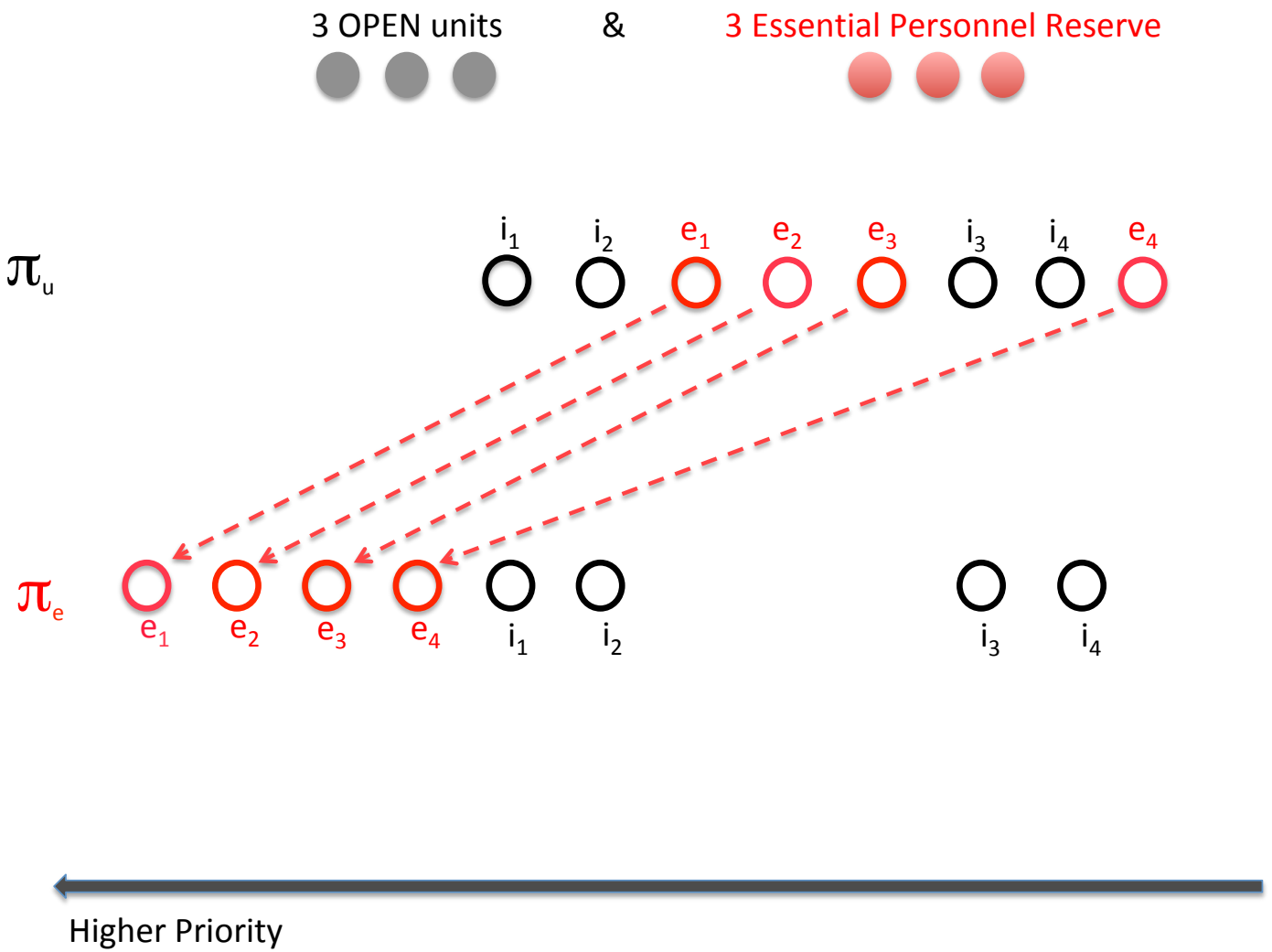
- Theorem: A matching
  1. *complies with eligibility requirements*,
  2. is *non-wasteful*, and
  3. *respects priorities*

  if, and only if, it is a cutoff matching.

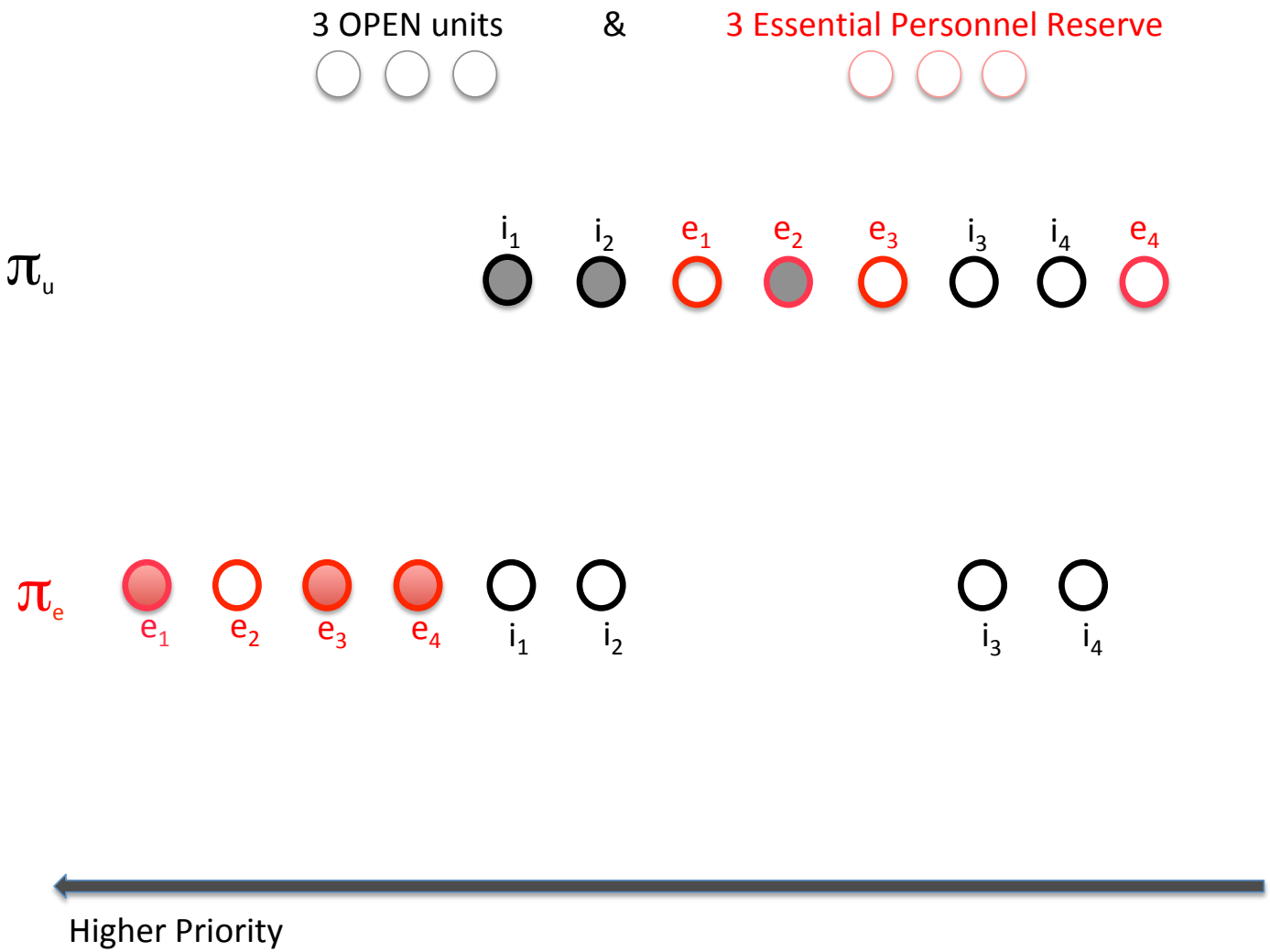
Cutoff Vector Construction



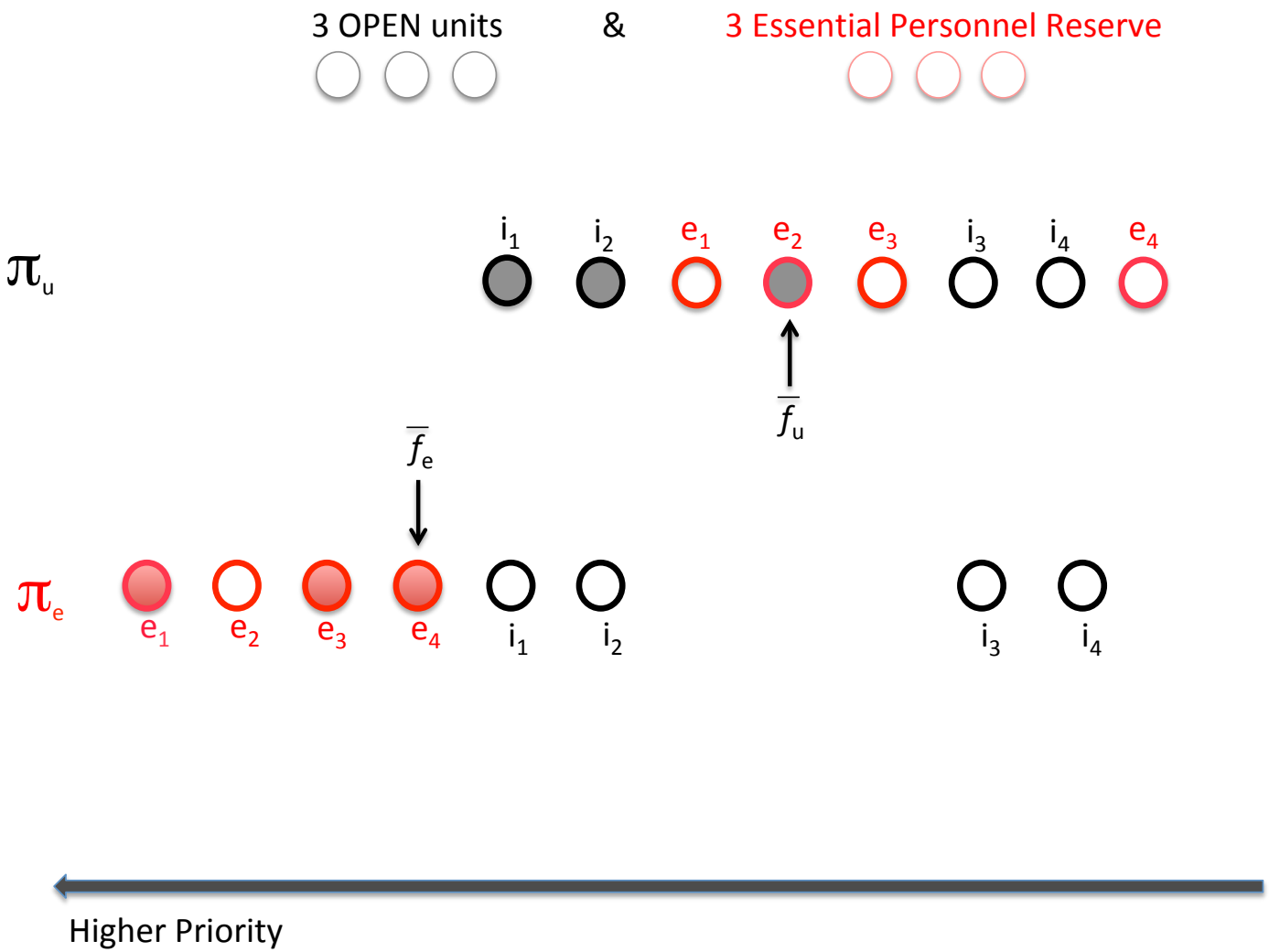
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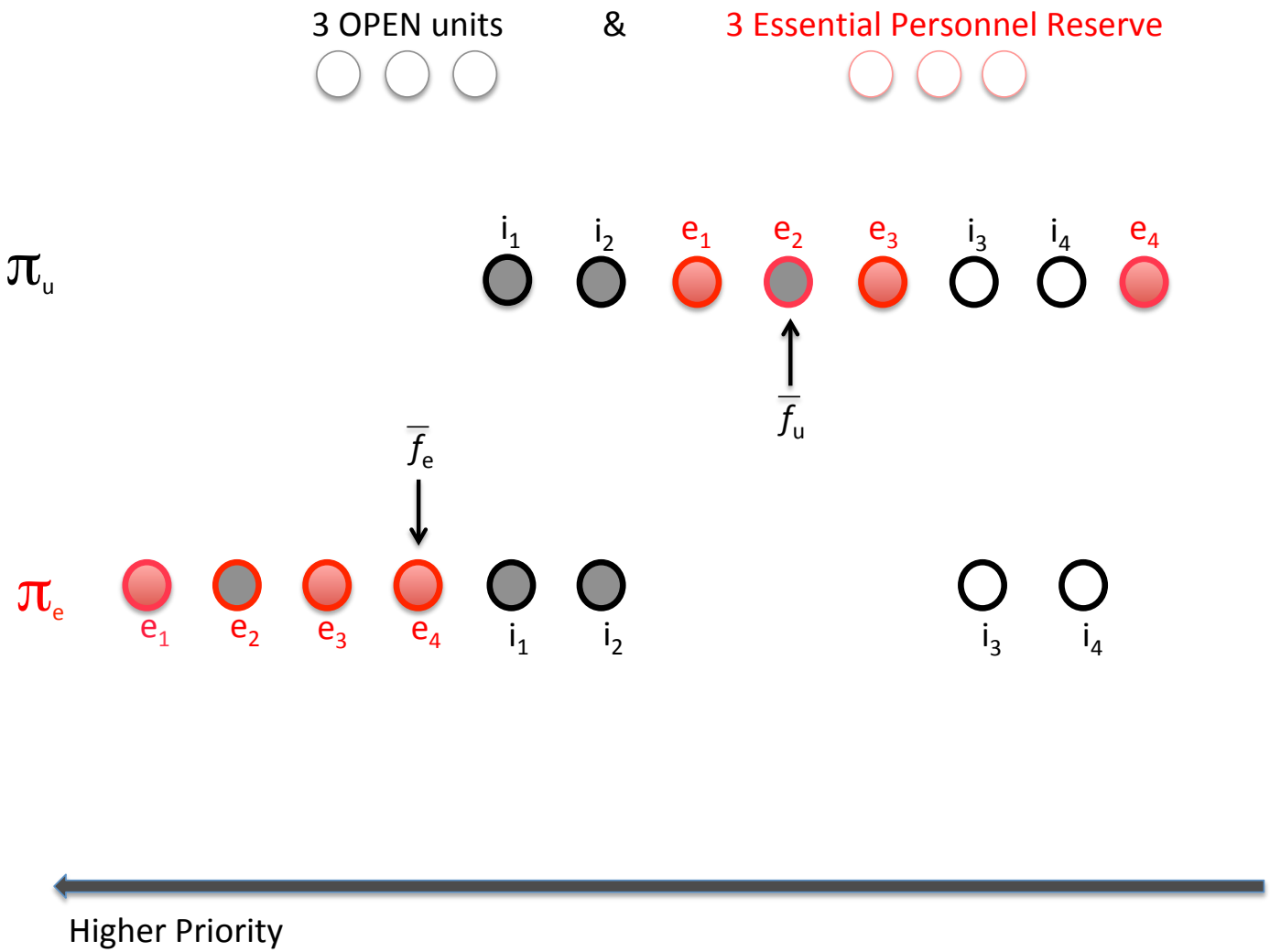
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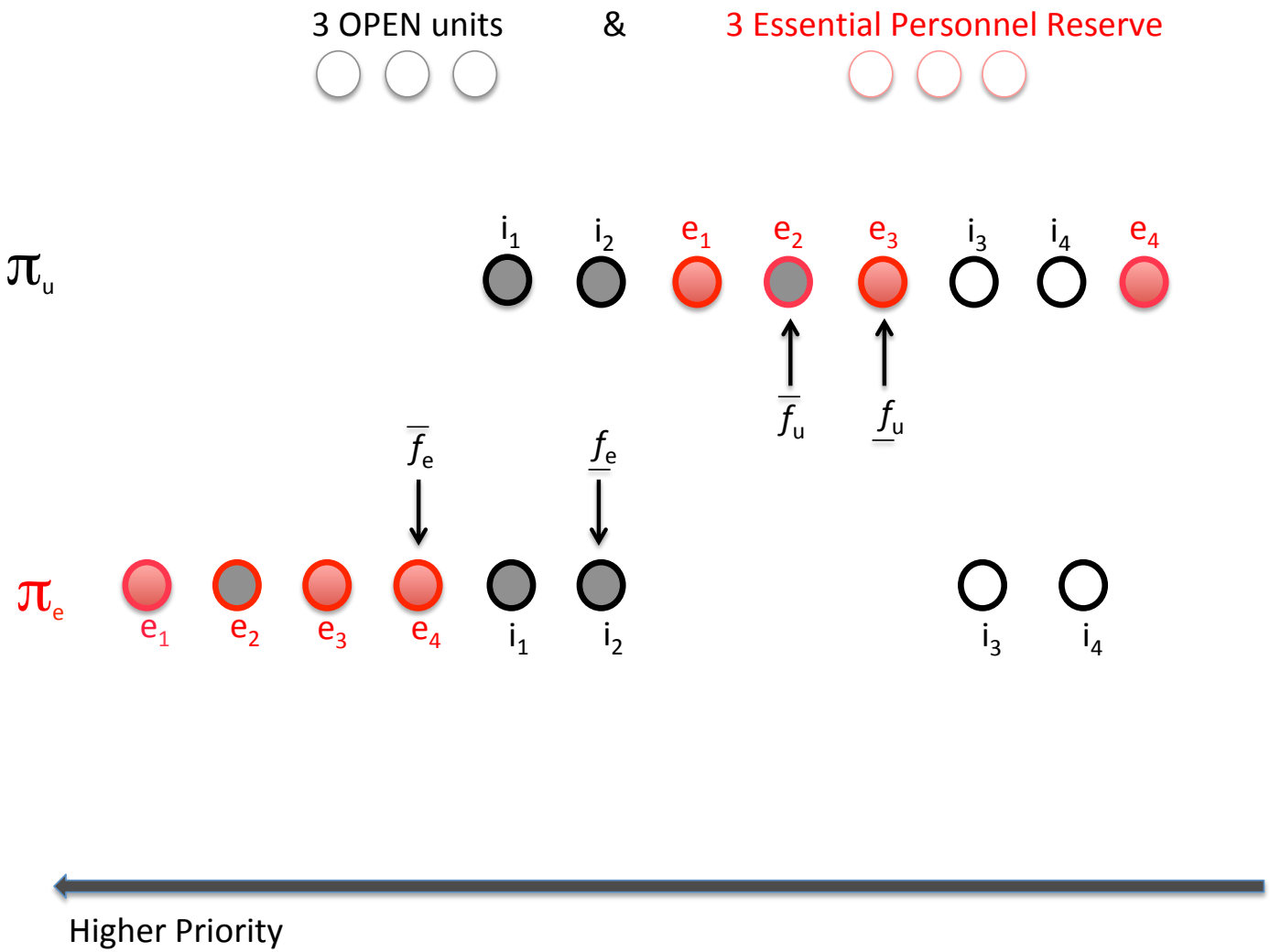
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Cutoff Vector Construction



Cutoff Equilibria Interpretation

- We focus on the maximum cutoff vector $\bar{f} = (\bar{f}_c)_{c \in \mathcal{C}}$
  - For any category $c \in \mathcal{C}$, it is given by the lowest π_c-priority patient matched to category c if units in category exhausted, and $\emptyset$ otherwise.
  - Other cutoffs are artificially lower and without any clear interpretation.
- The maximum cutoff indicates the selectivity of a category.
  - The higher priority the cutoff individual is, the more competitive the category is.

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- The maximum cutoff indicates the selectivity of a category.
  - The higher priority the cutoff individual is, the more competitive the category is.
- How to find cutoff equilibrium matchings?
  - We start with reserve systems where categories are processed sequentially for a given sequence of categories.

Reserve Systems through Sequential Reserve Matching

- Not all reserve systems have to process categories sequentially, but in most real-life practices they do.
- An order of precedence $\triangleright$ specifies the processing sequence of categories.

  $c \triangleright c'$: Category-c units are to be allocated before category-c' units.

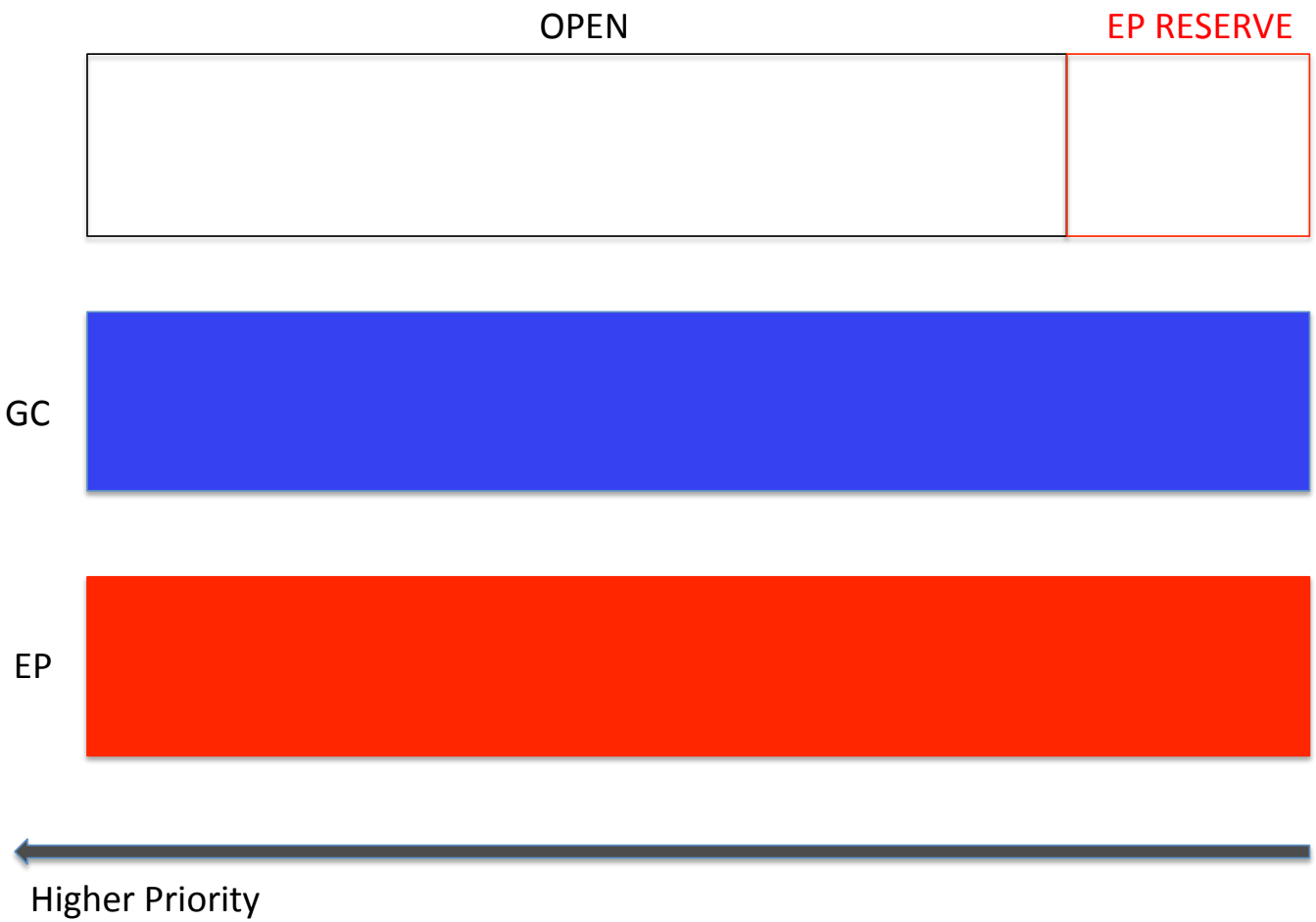
Reserve Systems through Sequential Reserve Matching

- Not all reserve systems have to process categories sequentially, but in most real-life practices they do.
- An order of precedence $\triangleright$ specifies the processing sequence of categories.

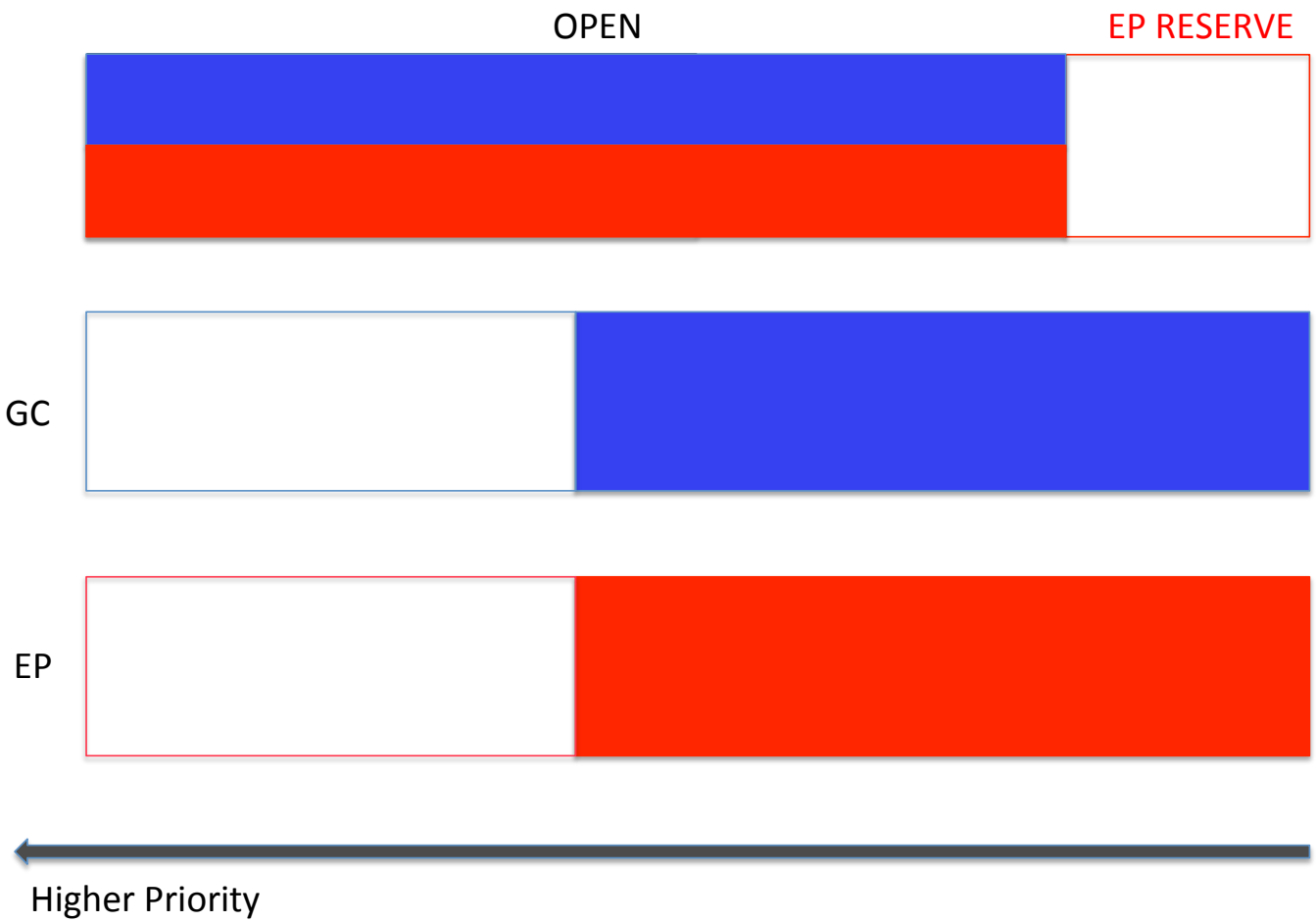
  $c \triangleright c'$: Category-c units are to be allocated before category-c' units.

- Sequential Reserve Matching: Fix a processing sequence $\triangleright$ of the categories. Following this sequence, allocate units in each category c to the highest category-c priority patients up to capacity.

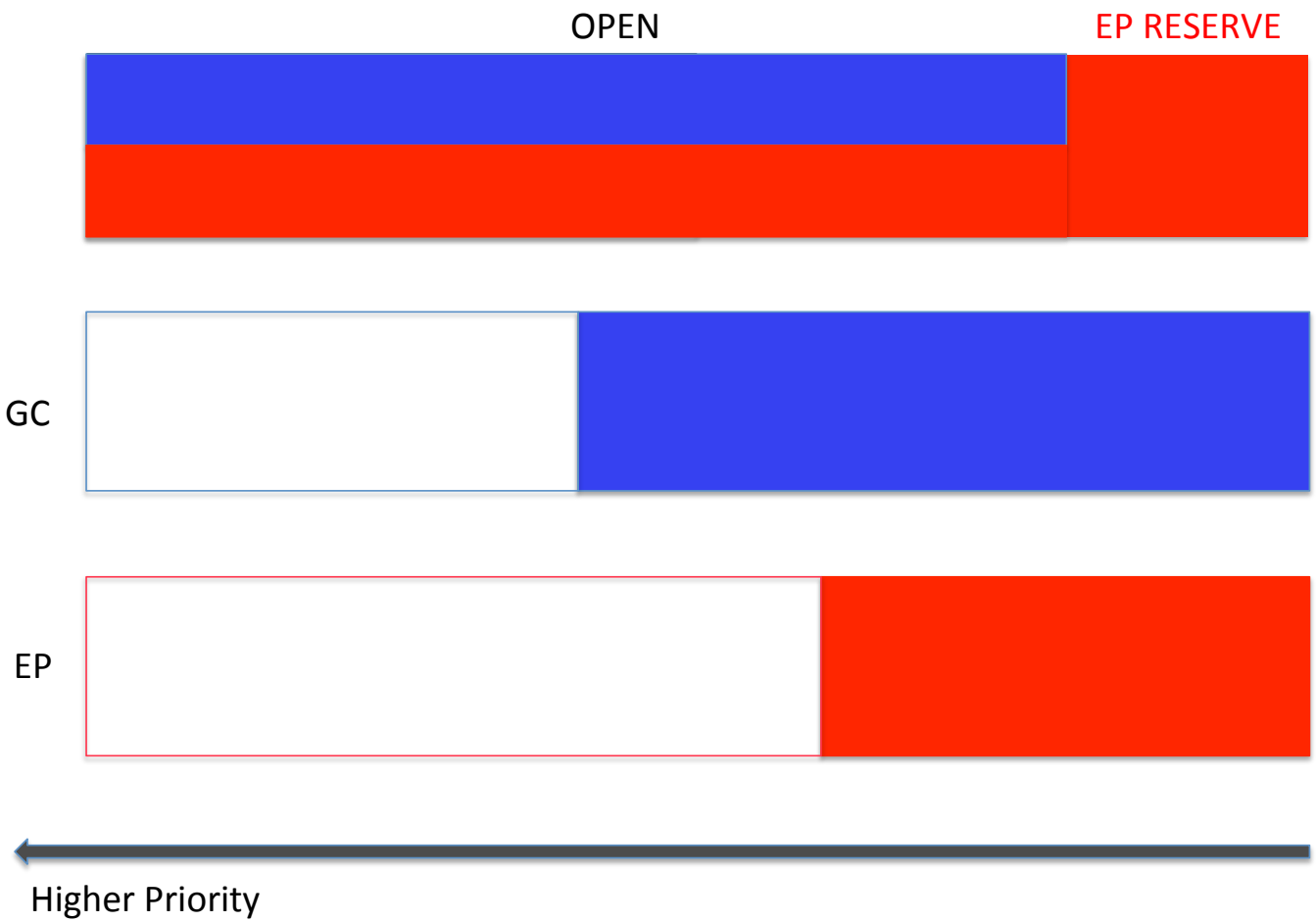
Sequential Category Processing: Open-Reserved



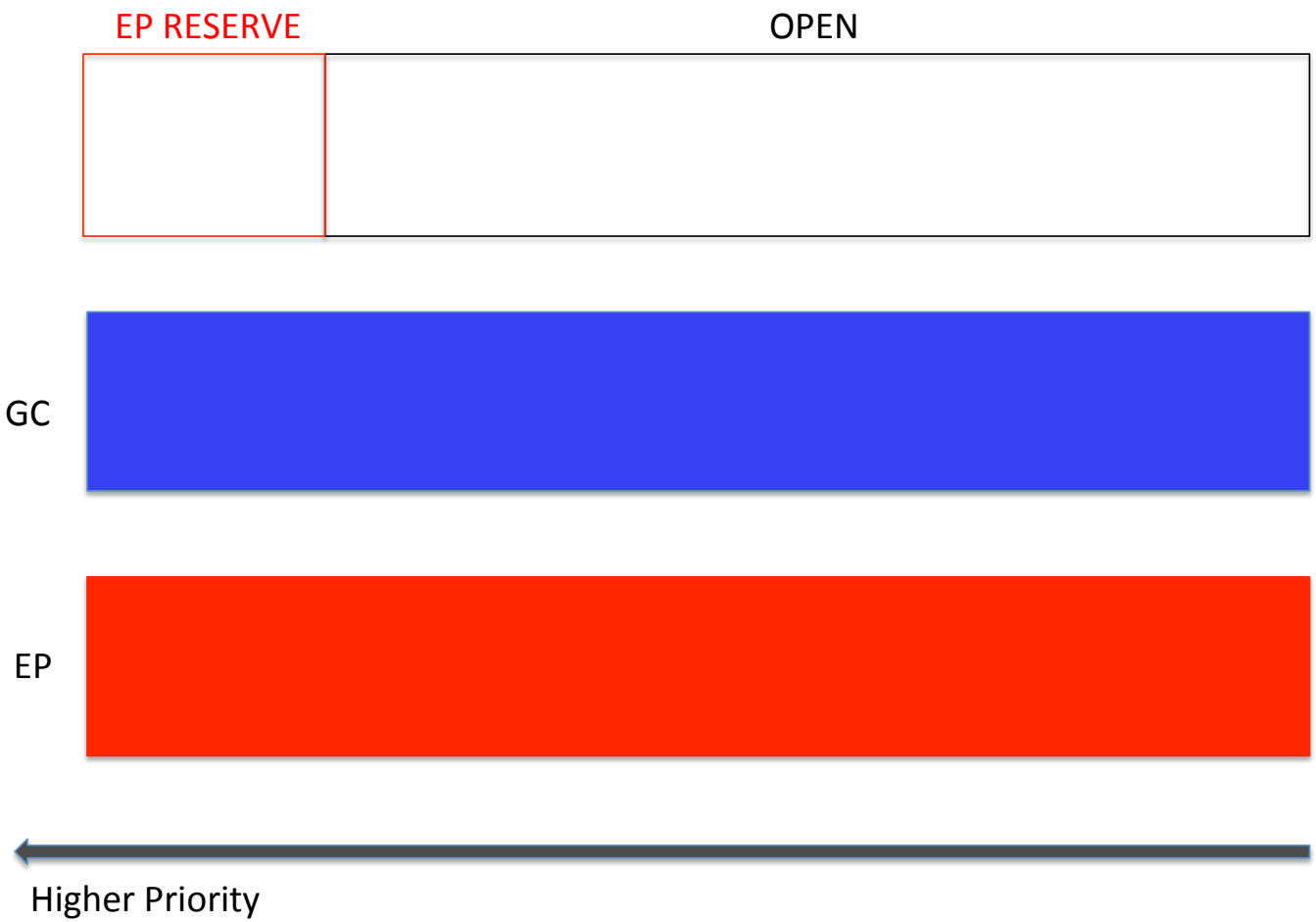
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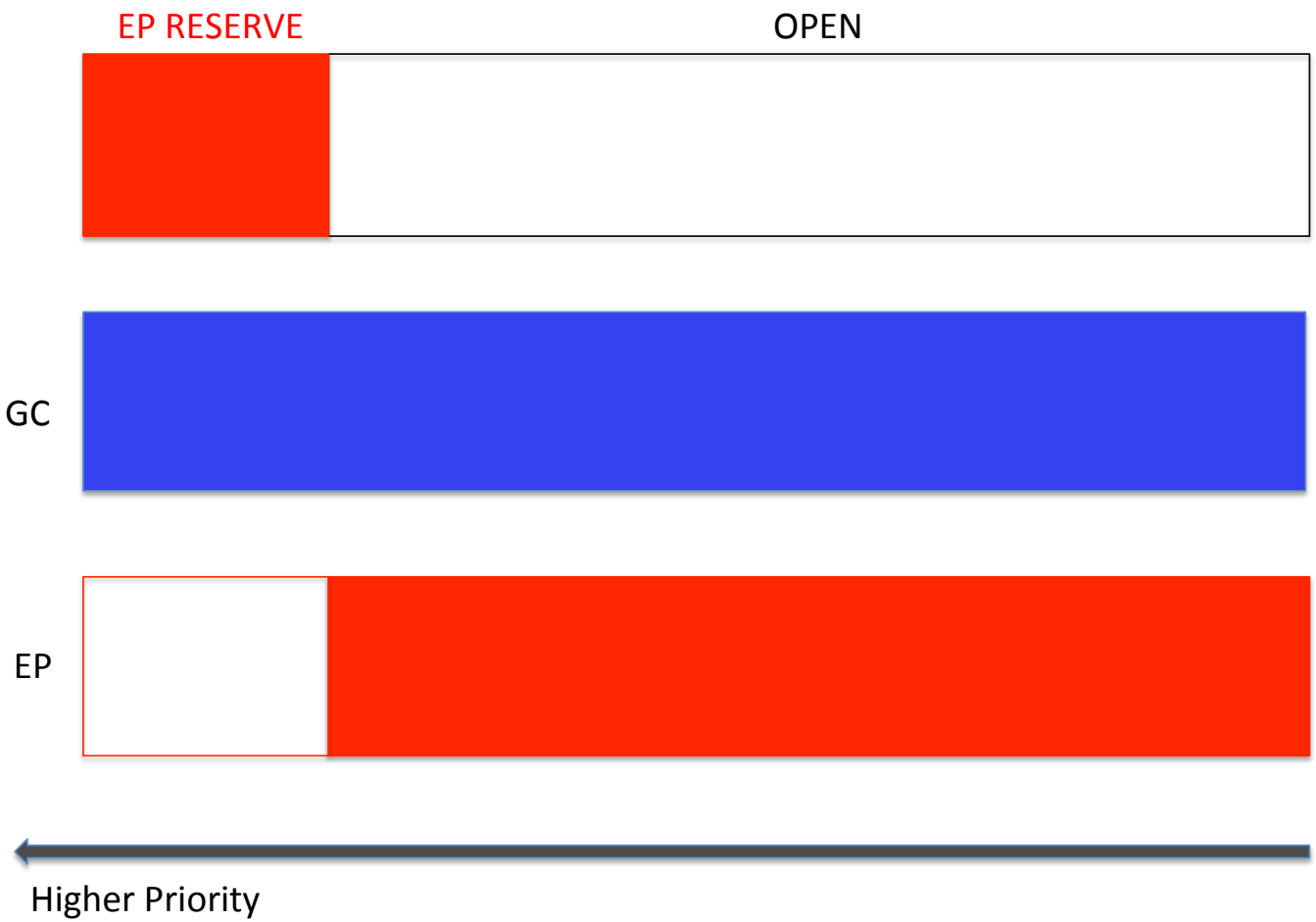
Open First - Reserved Next = Over & Above Policy



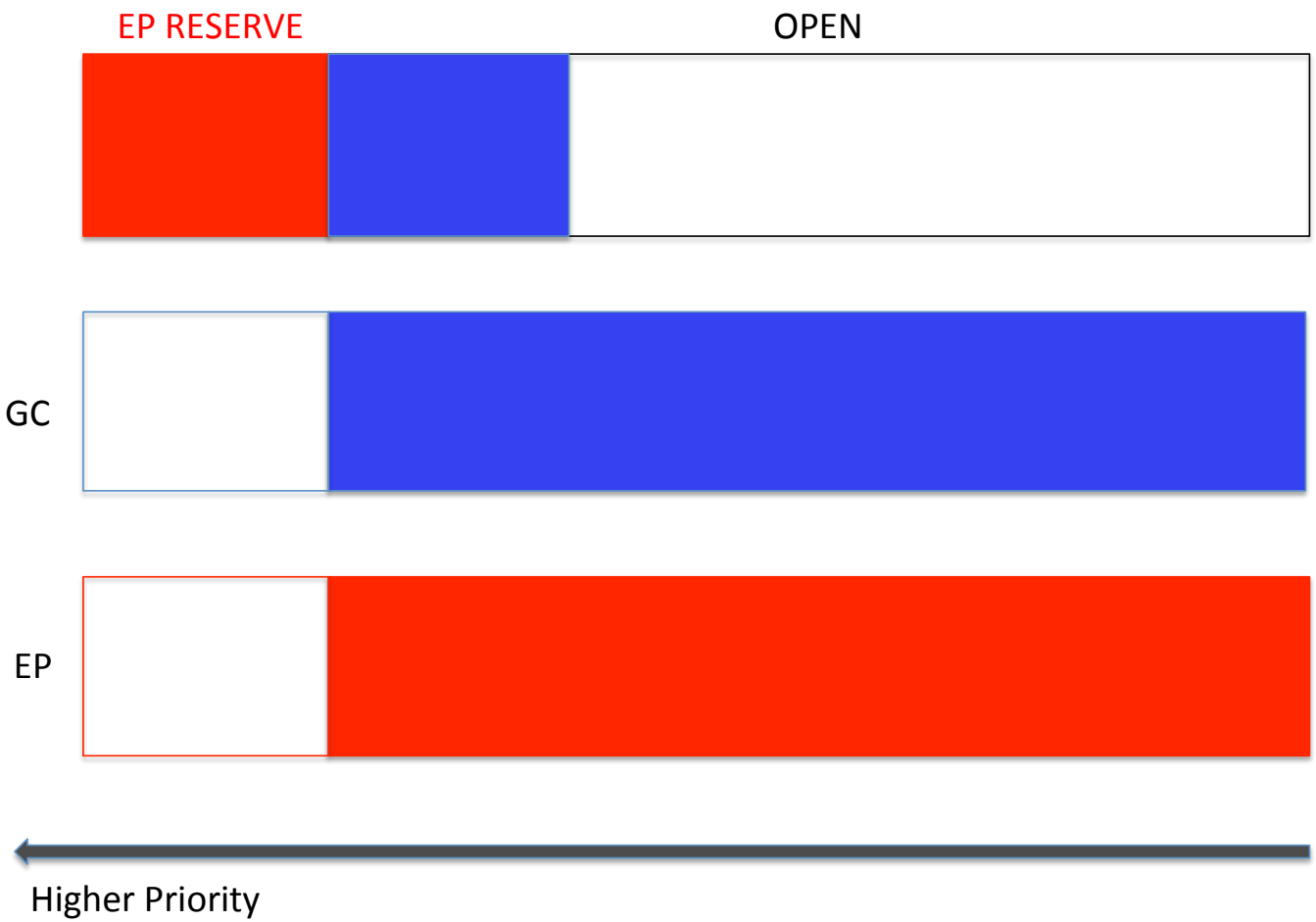
Sequential Category Processing: Reserved-Open



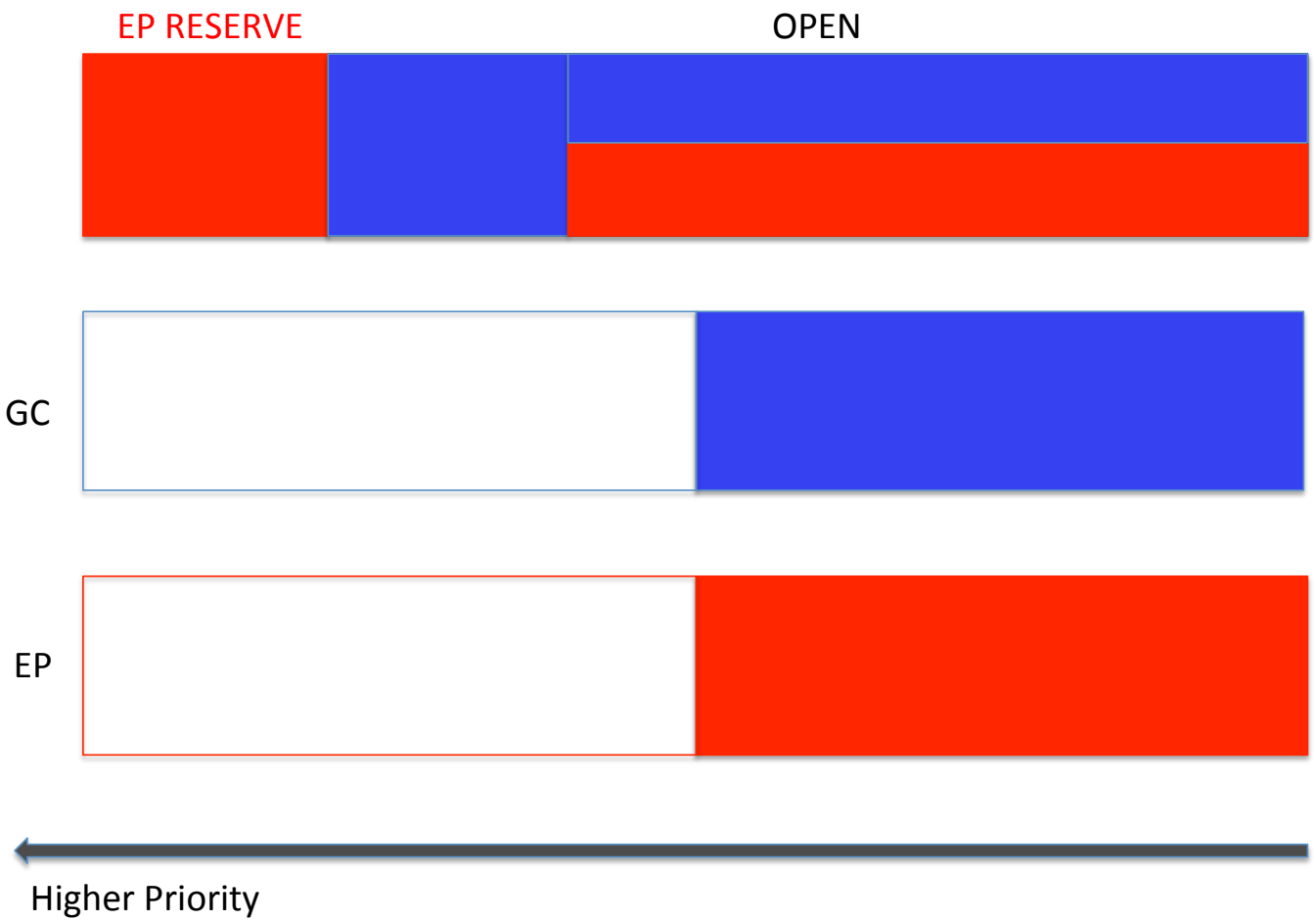
Sequential Category Processing: Reserved-Open



Sequential Category Processing: Reserved-Open



Reserved First - Open Next = Minimum Guarantee Policy



The Importance of Processing Sequence of Categories

- Example shows that
  - there may be several cutoff matchings,
  - the processing sequence of categories is important, and
  - reserves may sometimes be redundant (minimum guarantee).

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- Proposition: Let an order of precedence $\triangleright'$ be obtained from another order of precedence $\triangleright$ by
  - processing a category c earlier in the sequence,
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- Interpretation: The earlier a category is processed, the more selective it becomes.

Reserve Systems with a Baseline Priority Order

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  - Soft Reserves: Everyone is still eligible

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- The set of general-community patients I_g are those who are beneficiaries of the unreserved category only.

$$I_g = I \setminus \cup_{c \in \mathcal{C} \setminus \{u\}} I_c$$

Comparative Statics Under a Baseline Priority Order

- Proposition: Consider a reserve system with hard reserves, and let an order of precedence $\triangleright'$ be obtained from another order of precedence $\triangleright$ by
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- Remark: Result holds for soft reserves as well, provided that there are at most five categories and each patient is a beneficiary of at most one preferential-treatment category.

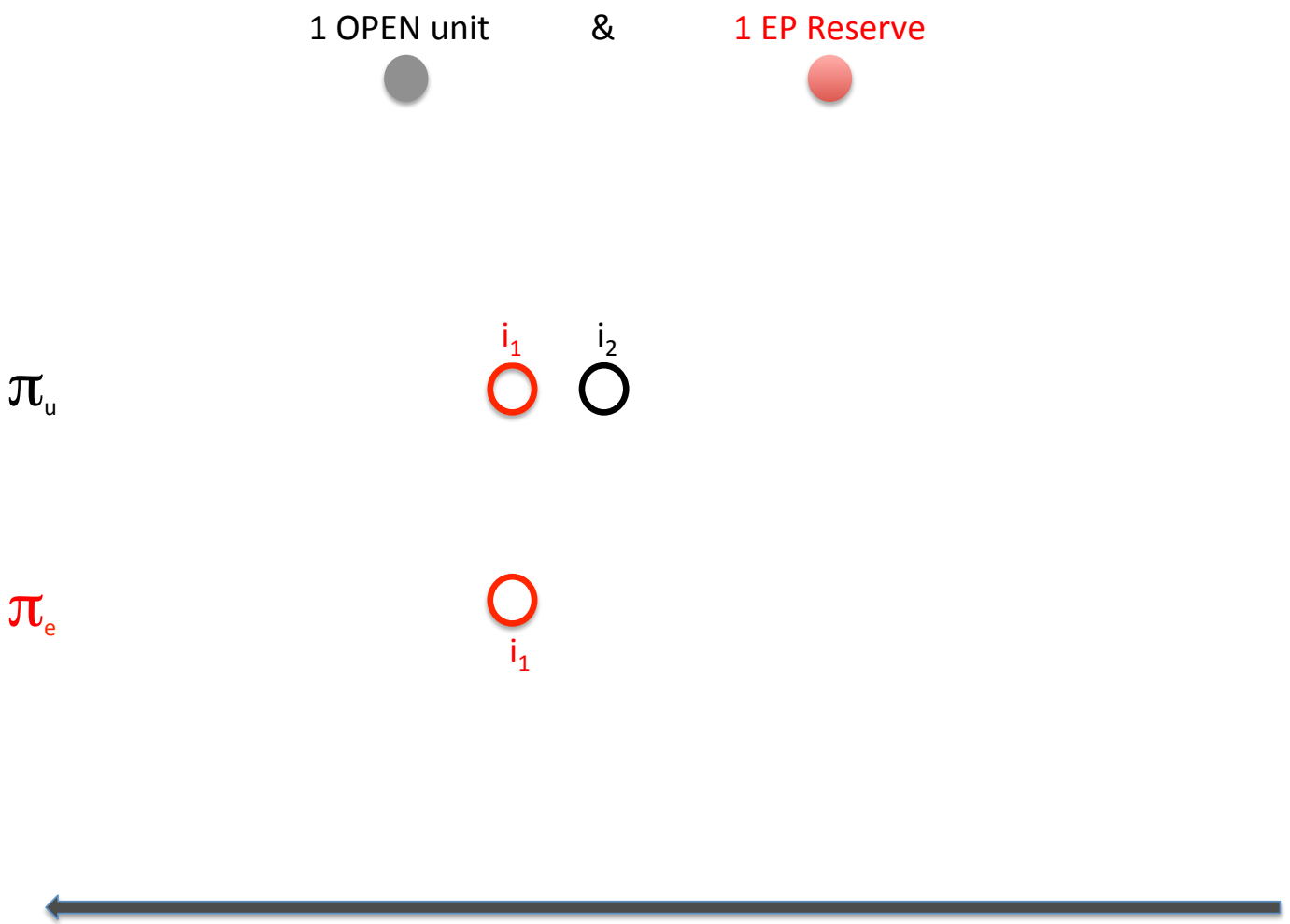
Over & Above Reserve Processing

- Over & Above implementation:
  - Reserve category processed after the open category
  - Provides stronger benefit
  - Best suited for situations that warrant an extra boost
- Real-Life Examples of Over & Above Implementation:
  - Public Positions in India: Scheduled Castes, Scheduled Tribes, OBC
  - School Choice in Chicago: 4 Distinct Socioeconomic tiers (17.5% each)
  - Post-2020 H1-B Visa Allocation in the US: Advanced Degree Cap

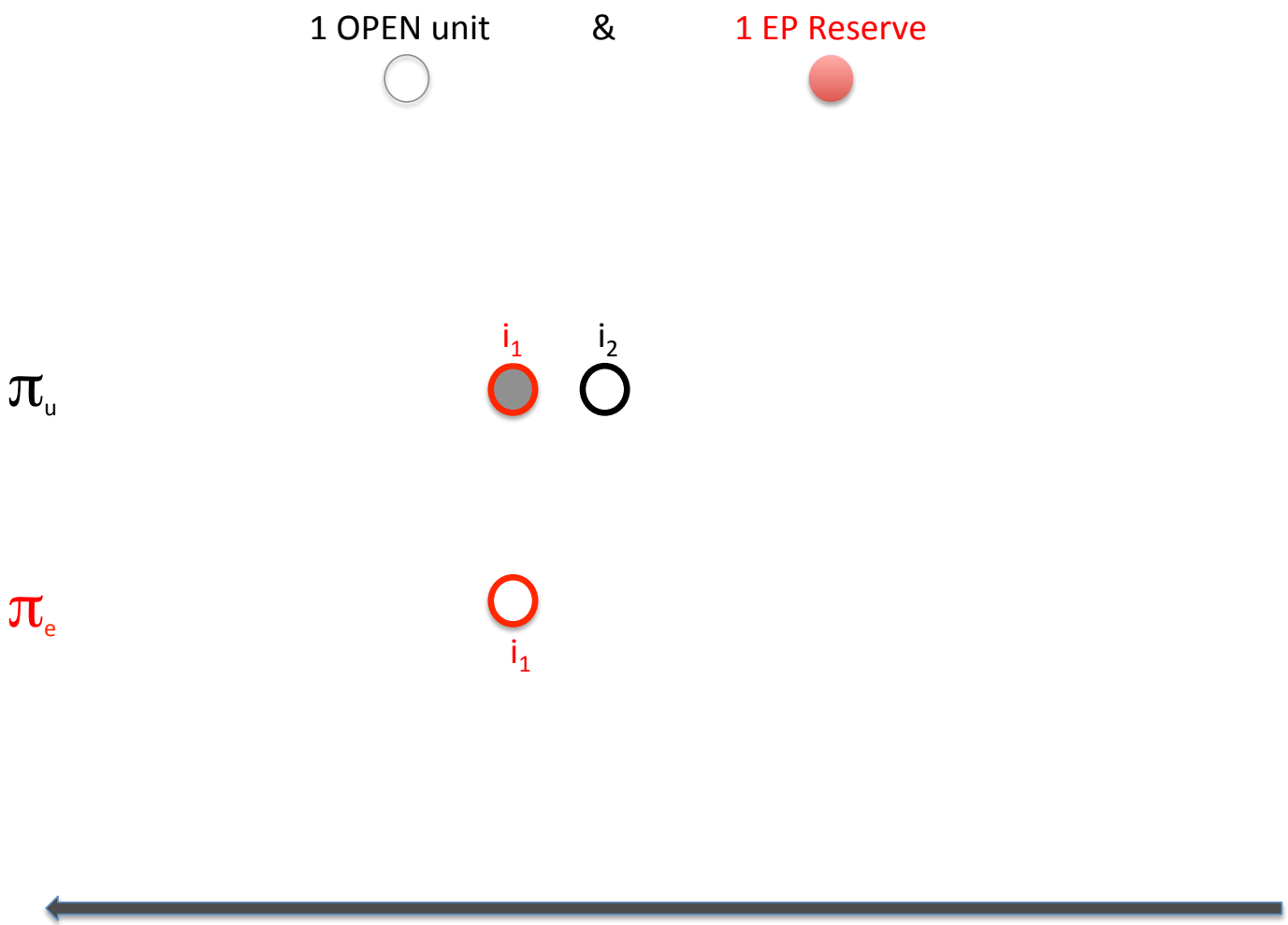
Minimum Guarantee Reserve Processing

- Minimum Guarantee implementation:
  - Reserve category processed prior to open category
  - Provides weaker benefit compared to O&A implementation
  - May provide no benefit at all if target minimum already reached in the absence of reserve
  - Best suited for situations that warrant a protective measure
- Real-Life Examples of Minimum Guarantee Implementation:
  - Public Positions in India: Persons with Disabilities
  - School Choice in Boston: Neighborhood (Accidental: O&A Intended!)
  - School Choice in Chile: Low Income, Special Needs, High-Achieving

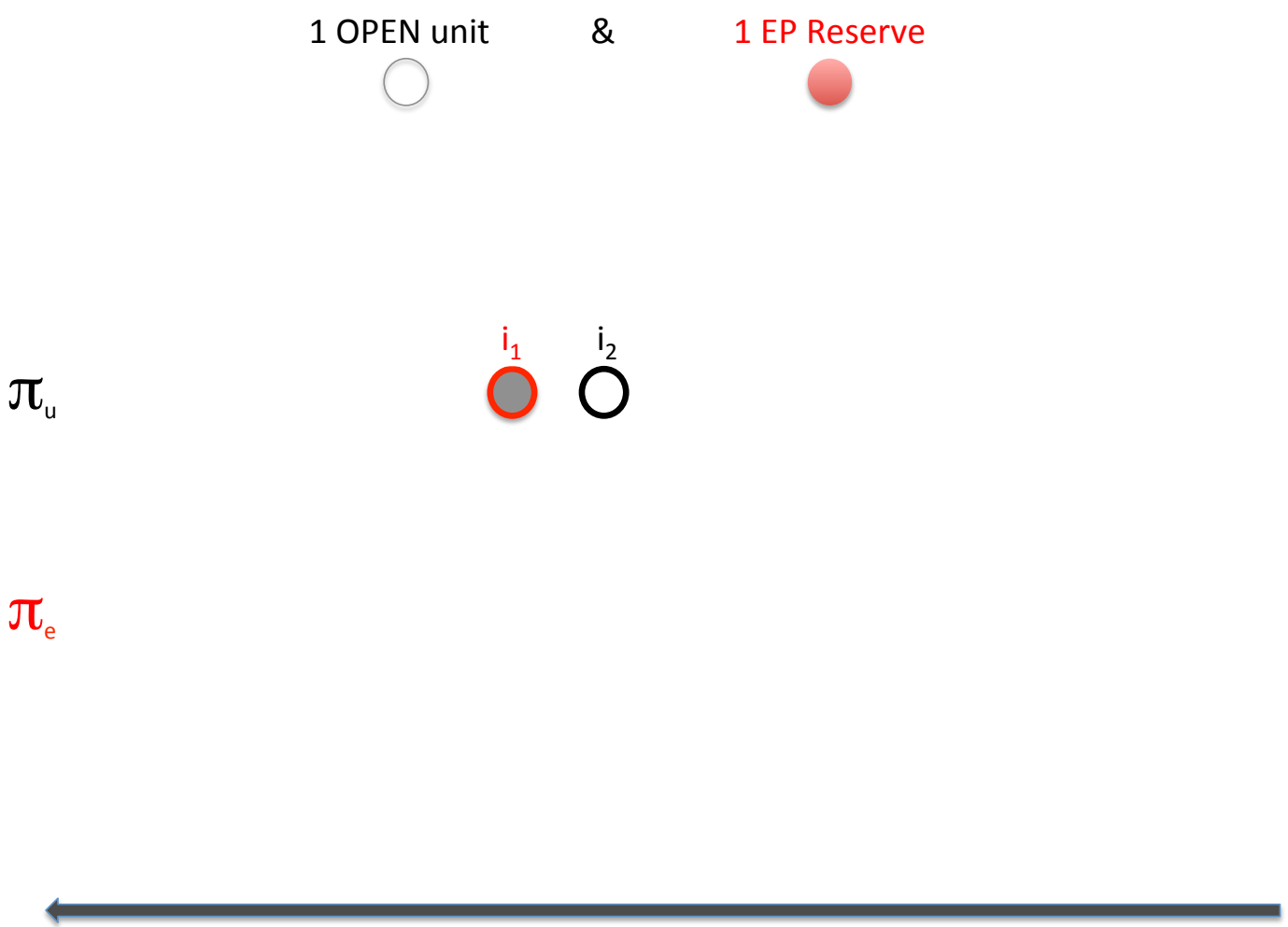
Example: Possible Efficiency Loss under Hard Reserves



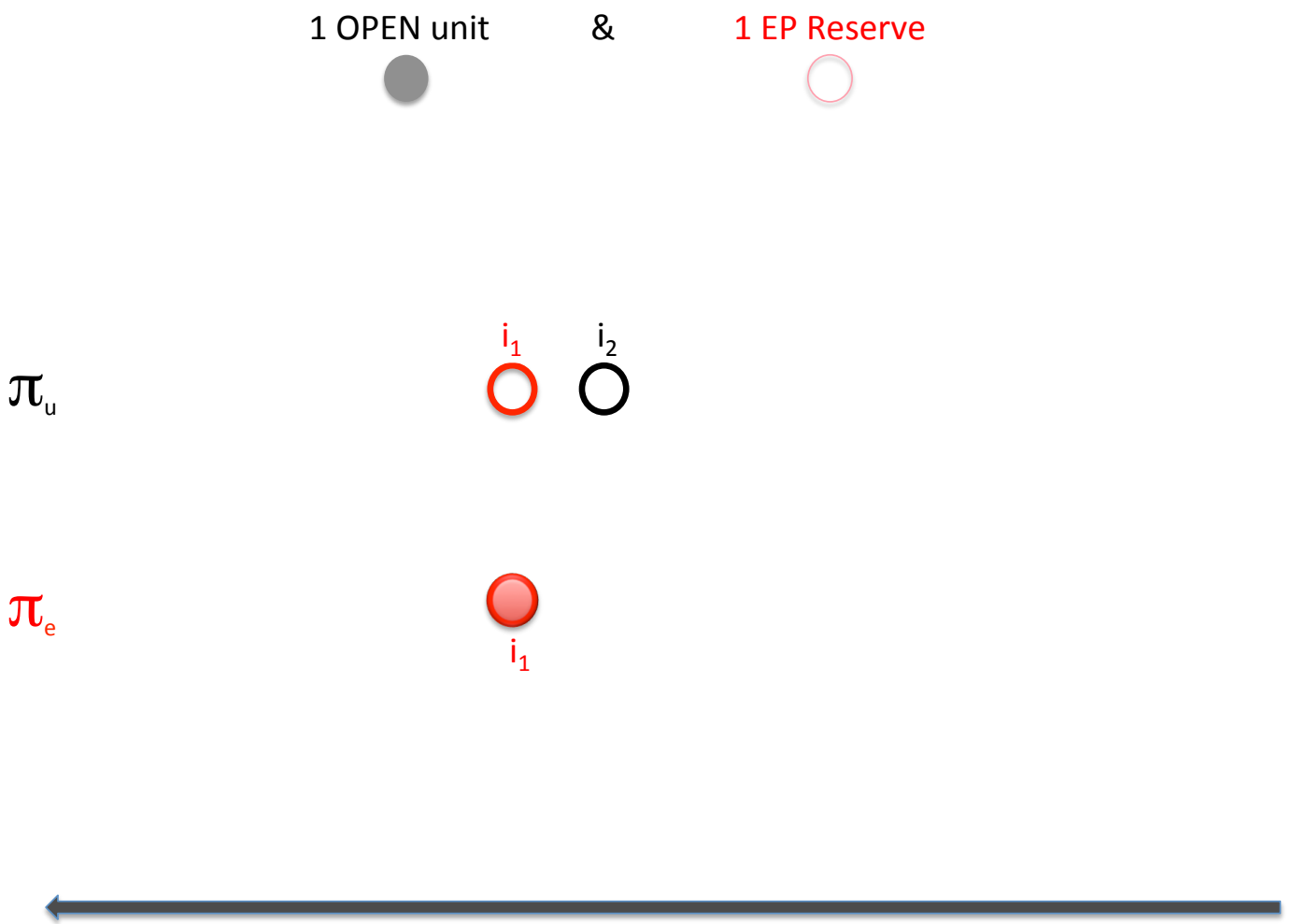
Order of Precedence: Open ▷ Reserved



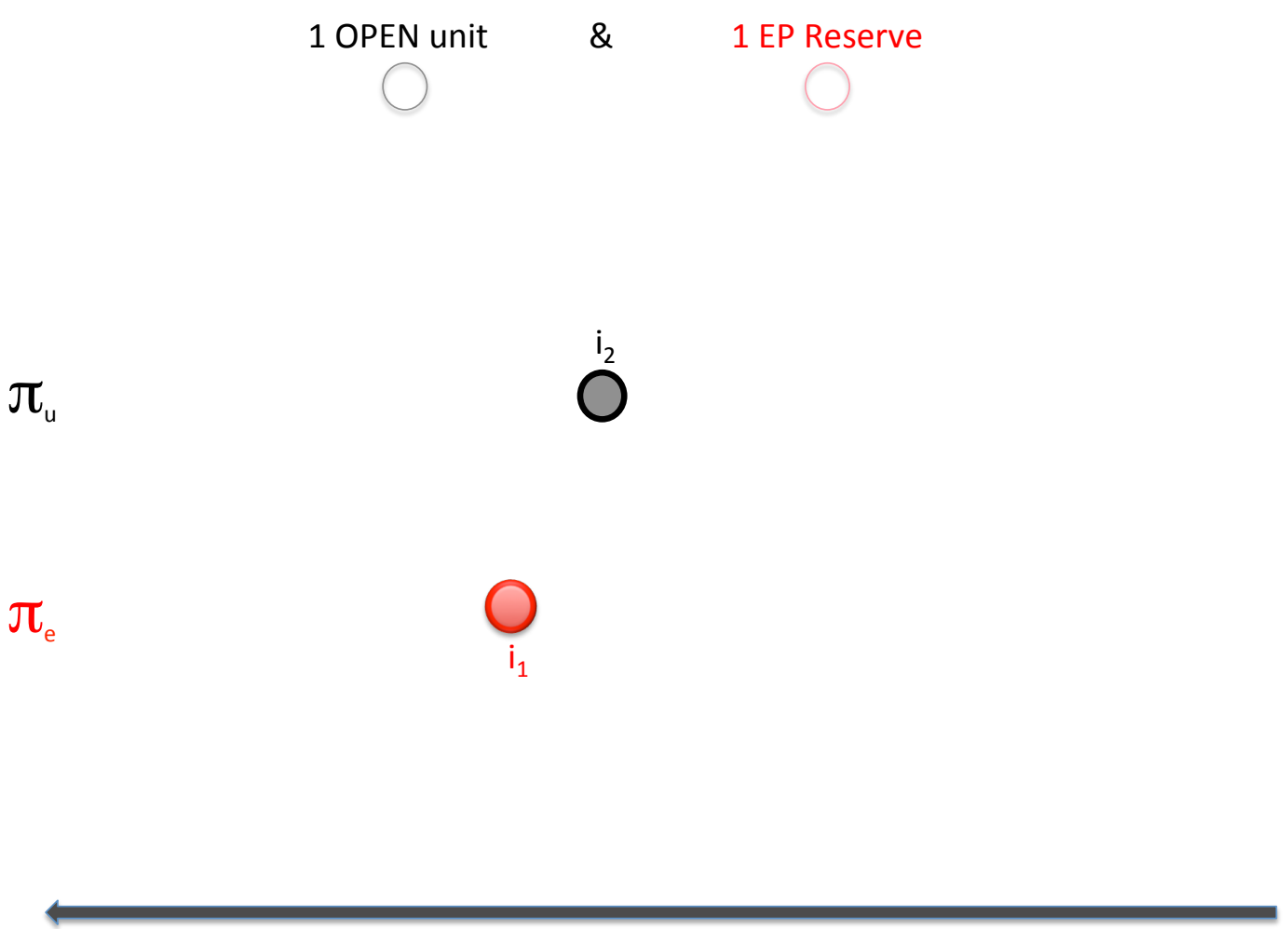
Open ▷ Reserved $\Longrightarrow$ Idle Unit



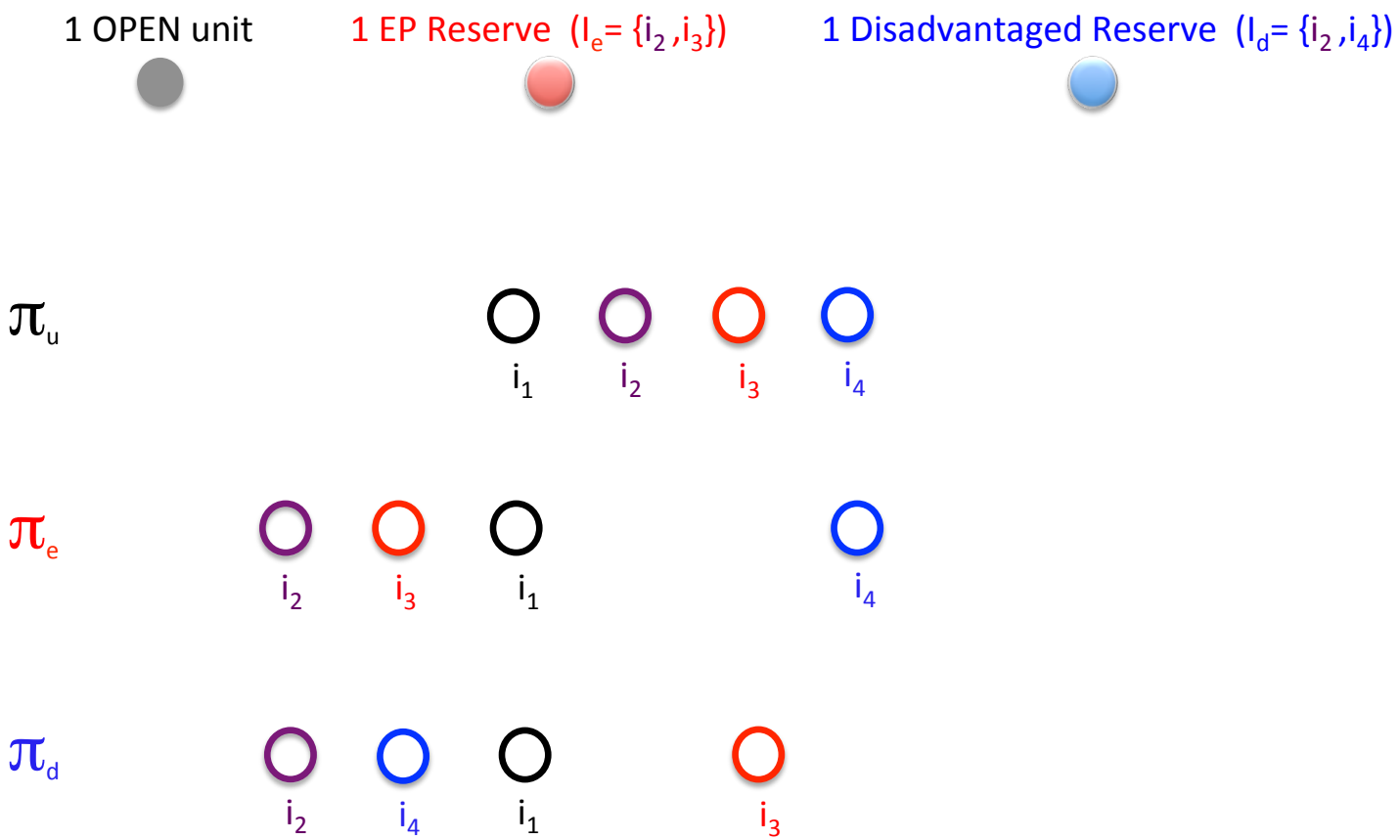
Order of Precedence: Reserved $\triangleright'$ Open



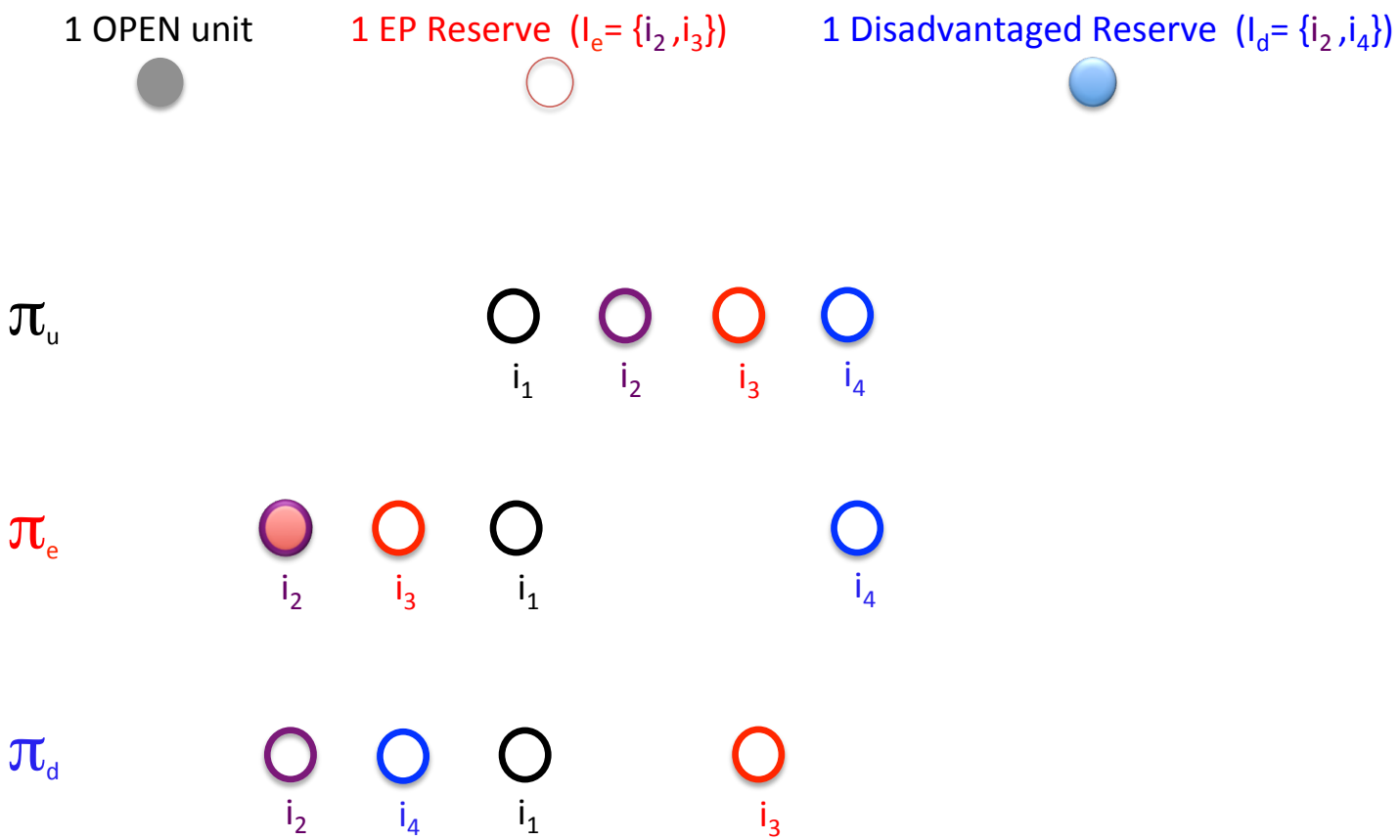
Reserved $\triangleright'$ Open $\Longrightarrow$ Maximal Match



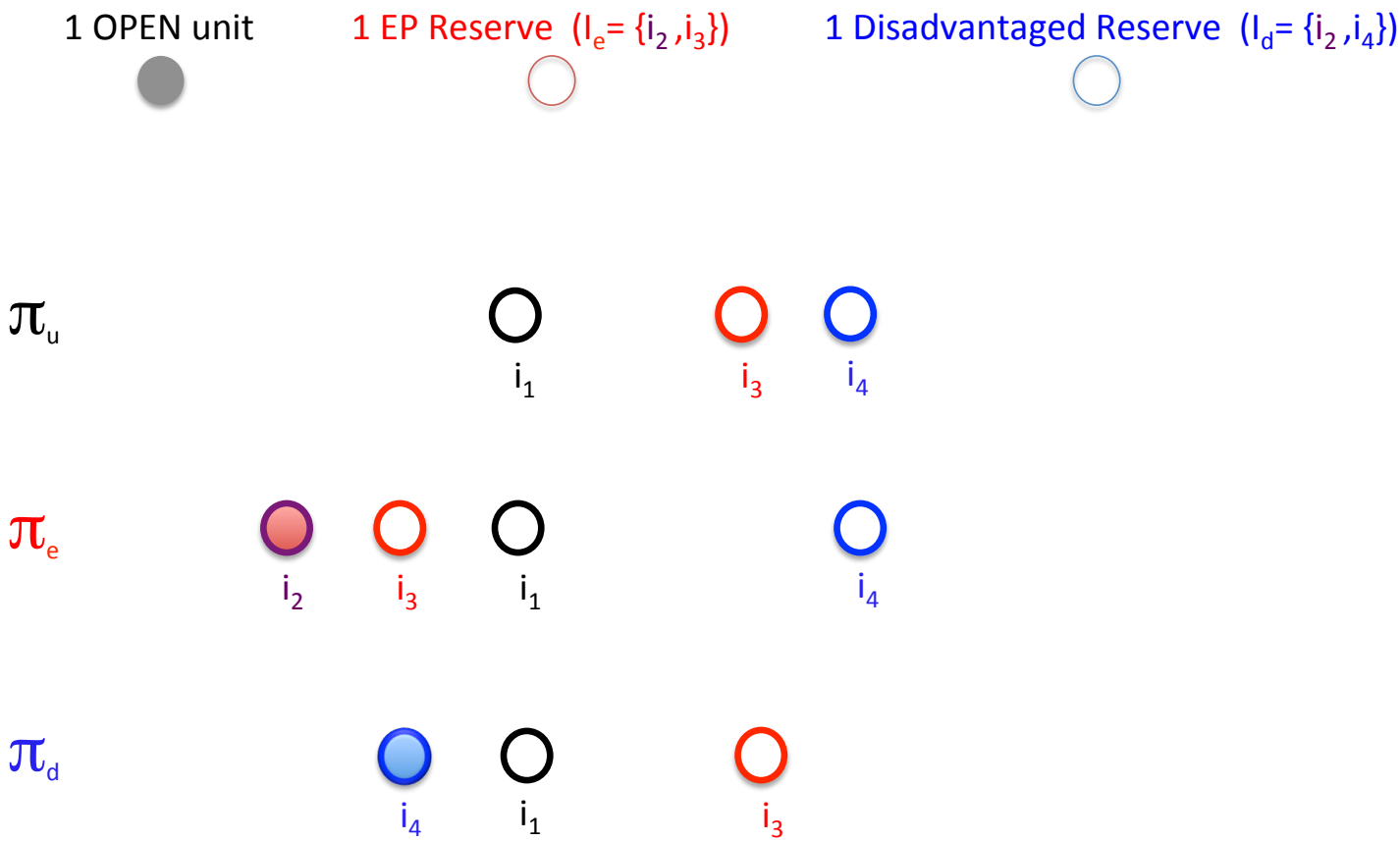
Example: Needless Rejection of High-Priority Individuals



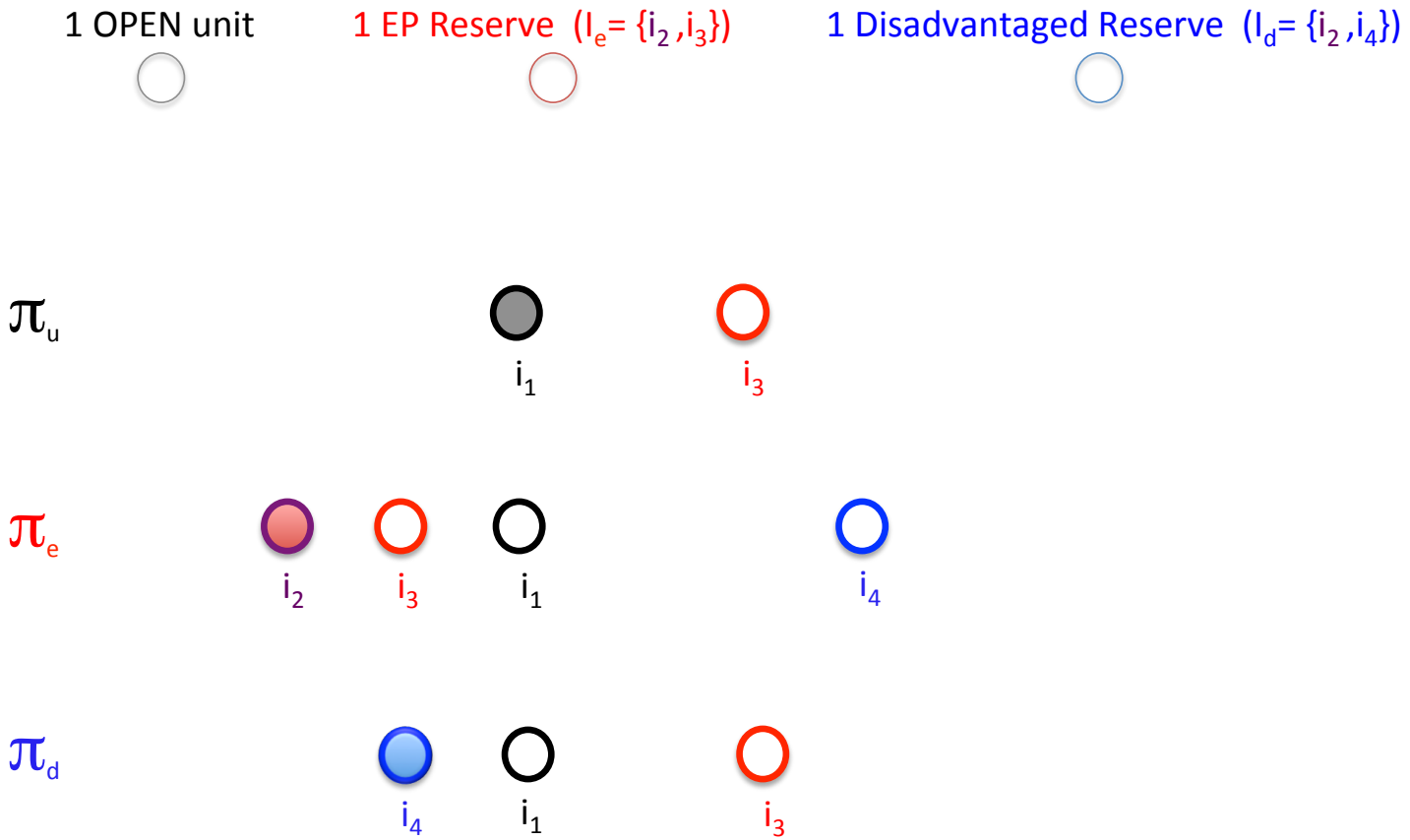
Order of Precedence: E ▷ D ▷ O



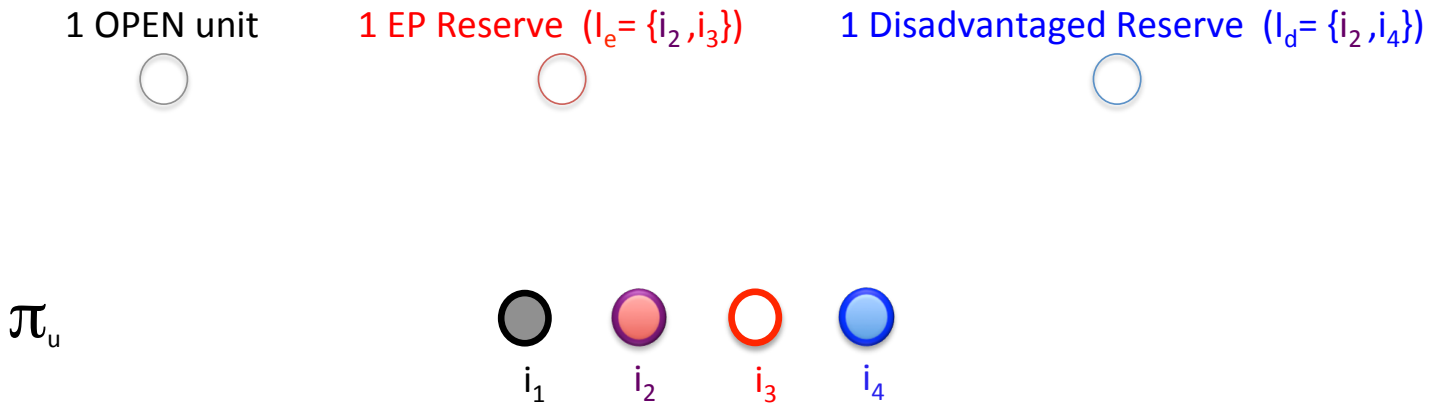
Order of Precedence: E ▷ D ▷ O



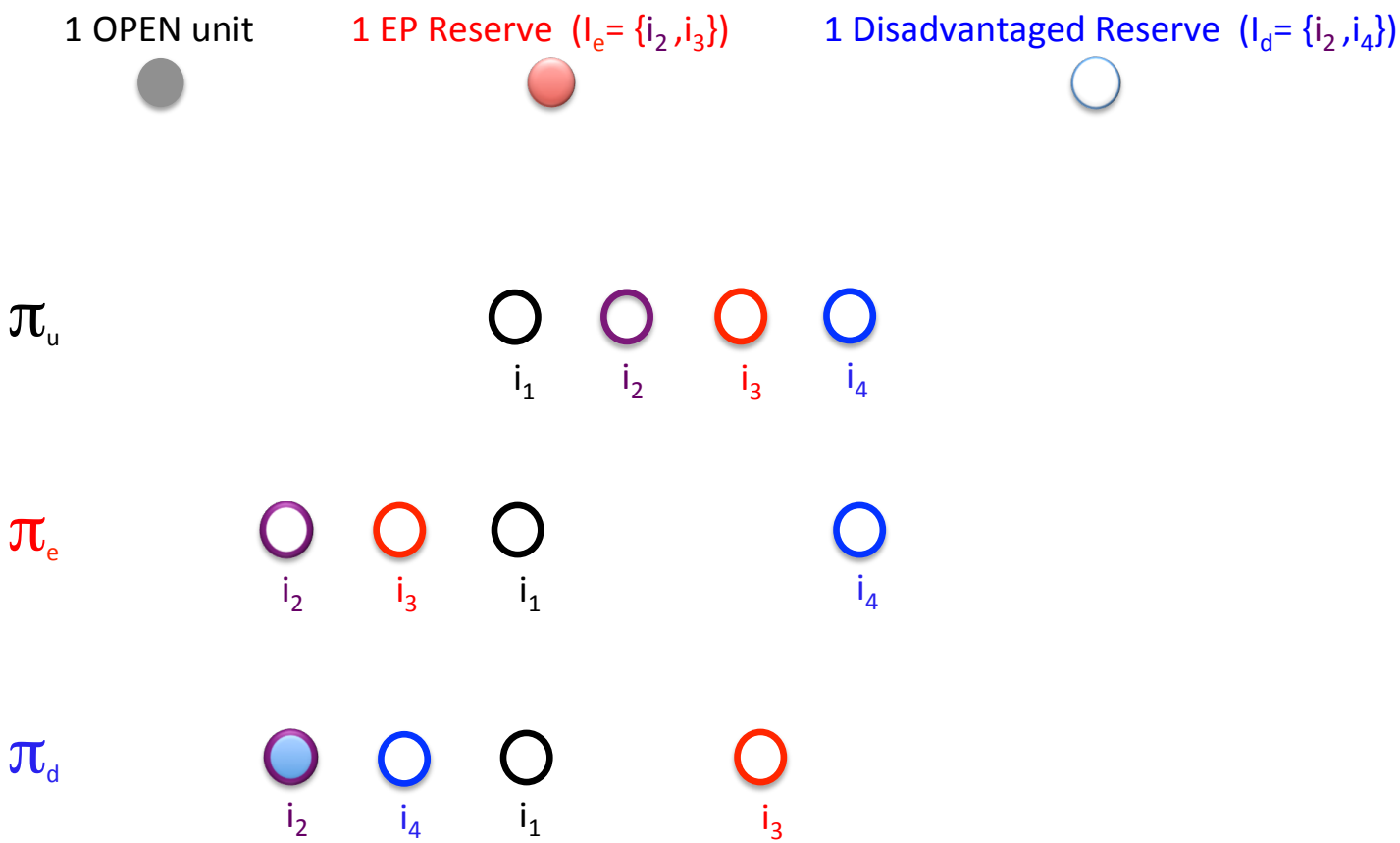
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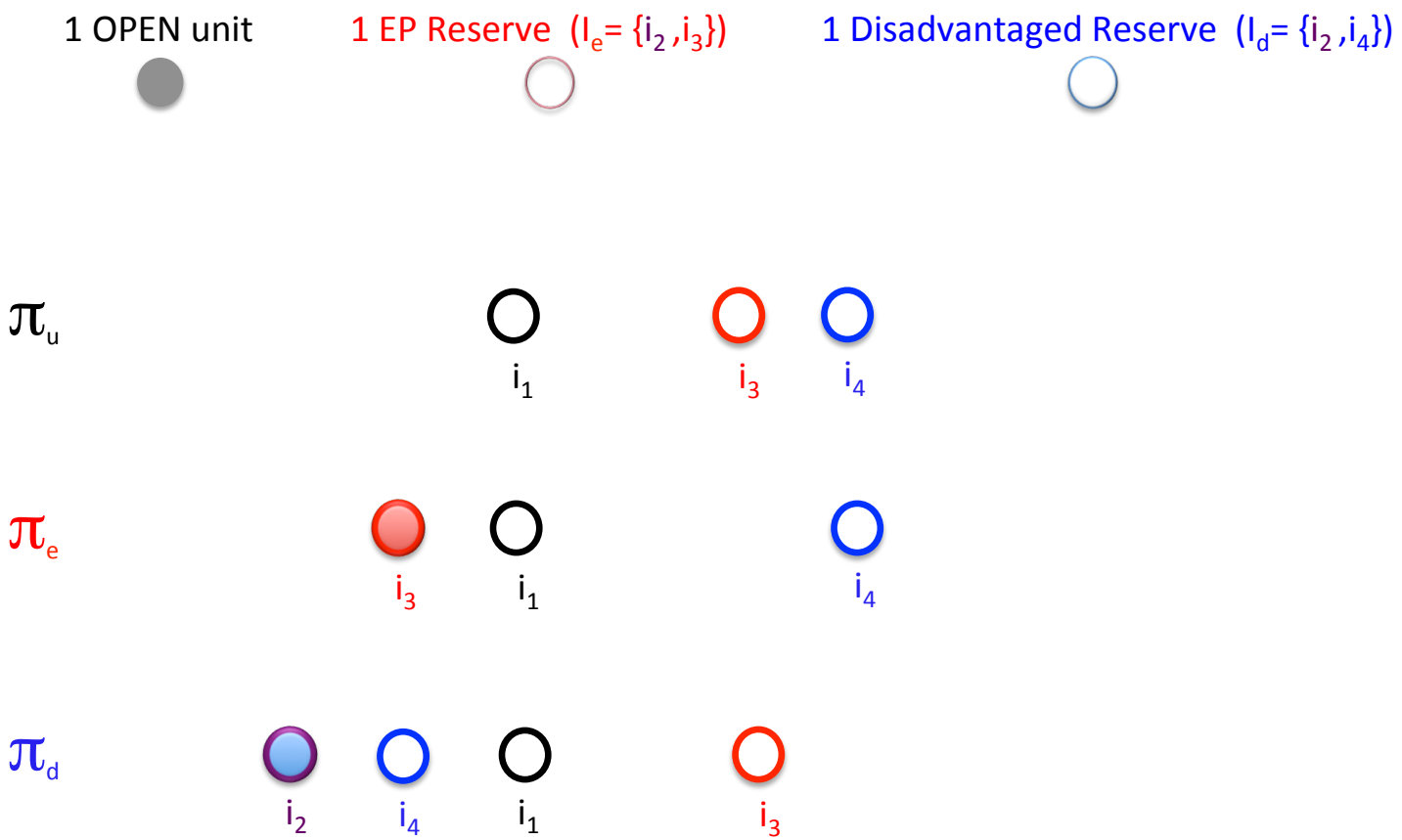
E ▷ D ▷ O: i_4 Receives a Unit at the Expense of i_3



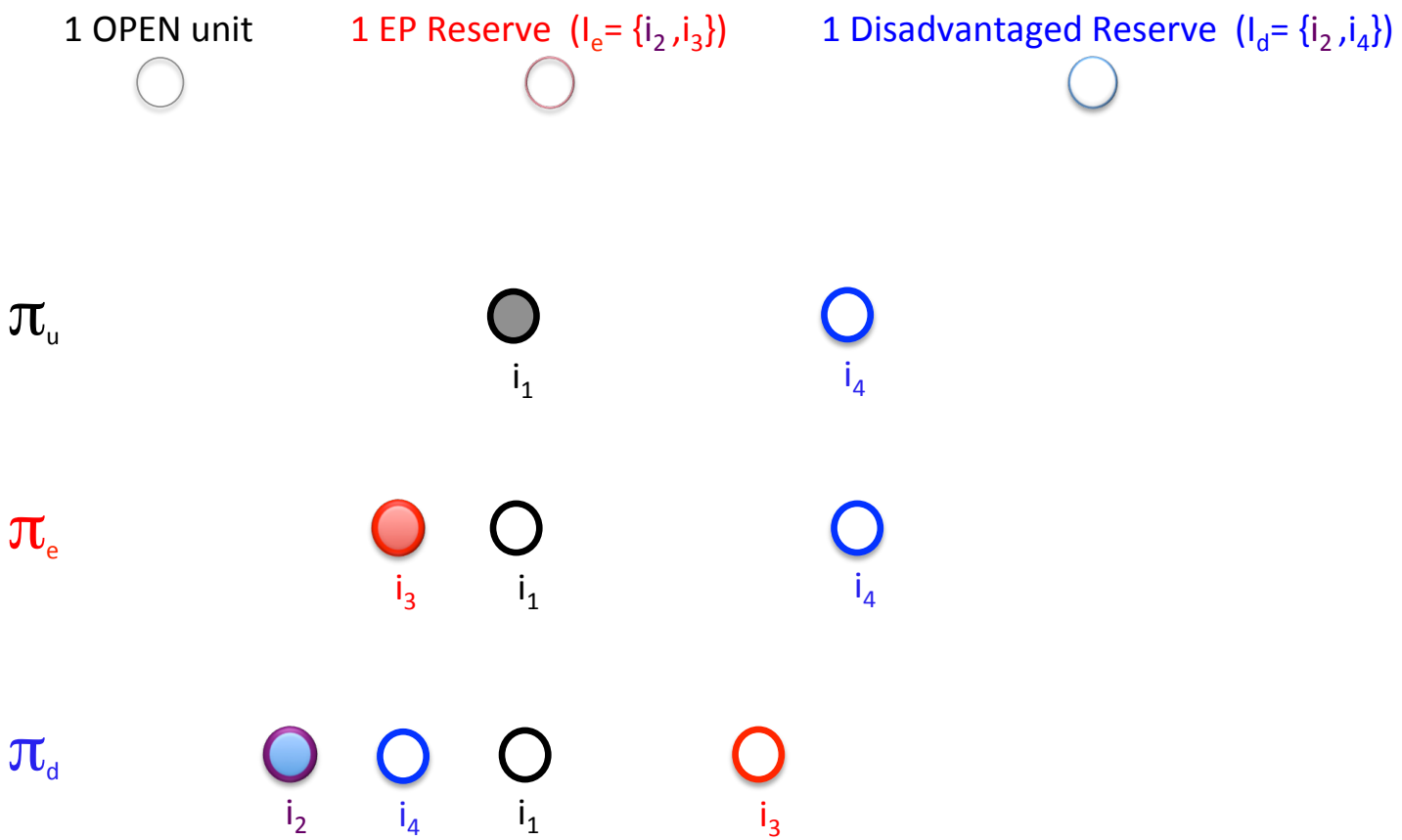
Order of Precedence: D $\triangleright'$ E $\triangleright'$ O



Order of Precedence: D $\rhd'$ E $\rhd'$ O



Order of Precedence: D $\rhd'$ E $\rhd'$ O

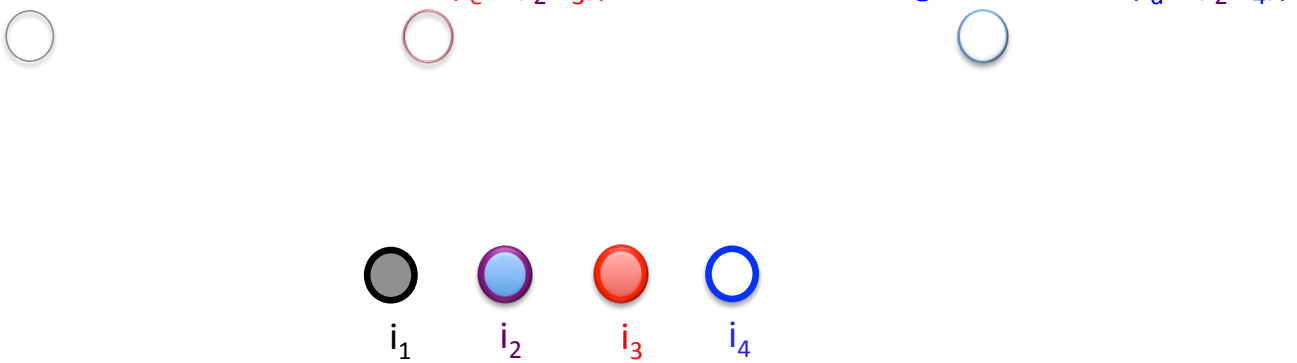


D $\triangleright'$ E $\triangleright'$ O: A More Just Allocation of Units

1 OPEN unit

1 EP Reserve ($I_e = \{i_2, i_3\}$)

1 Disadvantaged Reserve ($I_d = \{i_2, i_4\}$)



Additional Axiom: Maximality in Beneficiary Assignment

- The following requirement helps us to avoid any efficiency loss by precluding the myopic assignment of patients to categories.
- A matching is maximal in beneficiary assignment if it maximizes the total number of units awarded to "target" beneficiaries of categories.
- Observation:Together with non-wastefulness, maximality in beneficiary assignment implies Pareto efficiency.

Smart Reserve Matching

- Intuition: The main idea is, determining which agents are to be matched (with some category) in a greedy manner following their baseline priorities while assuring maximality in beneficiary assignment.
- This can be done in multiple ways, depending on when unreserved units are processed.
- If all unreserved units are processed at the end, this extreme case of our algorithm generates a minimum guarantee version of the smart reserve matchings.
  - This case simplifies to the meritorious horizontal choice rule in Sönmez & Yenmez (*ECMA* forthcoming), where it is proposed for implementation of overlapping horizontal reservations in India.
- If all unreserved units are processed at the beginning, this other extreme of our algorithm generates an over & above version of the smart reserve matchings.

Smart Reserve Matching

- Proposition: Any smart reserve matching *complies with eligibility requirements*, is *non-wasteful*, *respects priorities* and *maximal in beneficiary assignment*.

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- Theorem: Let
  - ω be any over & above smart reserve matching,
  - μ be any minimum guarantee smart reserve matching, and
  - ν be any matching that *complies with eligibility requirements*, is *non-wasteful*, *respects priorities* and *maximal in beneficiary assignment*.

  Then

$$\overline{f}_u^{\omega} \underline{\pi}_u \overline{f}_u^{\nu} \underline{\pi}_u \overline{f}_u^{\mu}$$

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  Then
  $$\overline{f}_u^{\omega} \underline{\pi}_u \overline{f}_u^{\nu} \underline{\pi}_u \overline{f}_u^{\mu}$$
- Interpretation: Of all matchings that satisfy our four axioms,
  - over & above smart matchings are the most selective, and
  - minimum guarantee smart matchings are the least selective

  ones for the unreserved category.

Most Related Literature

- Reserve Systems: Hafalir, Yenmez & Yildirim (*TE* 2013), Echenique & Yenmez (*AER* 2015)
- Sequential Reserve Matching: Kominers & Sönmez (*TE* 2016)
- Smart Reserves: Sönmez & Yenmez (*ECMA* forthcoming)
- Impact of Reserve Processing Sequence: Dur et al. (*JPE* 2018), Dur, Pathak & Sönmez (*JET* 2020), Pathak, Rees-Jones & Sönmez (2020), Sönmez & Yenmez (*ECMA* forthcoming)
- Additional Applications: Aygün & Bó (*AEJ: Micro* 2021), Aygün & Turhan (*JET* 2020, 2021), Correa et al. (*EC* 2019)

The Path Between Theory and Practice

The NEW ENGLAND JOURNAL of MEDICINE

Editor's Note: This article was published on March 23, 2020, at NEJM.org.

SOUNDING BOARD

Fair Allocation of Scarce Medical Resources in the Time of Covid-19

Ezekiel J. Emanuel, M.D., Ph.D., Govind Persad, J.D., Ph.D., Ross Upshur, M.D., Beatriz Thome, M.D., M.P.H., Ph.D., Michael Parker, Ph.D., Aaron Glickman, B.A., Cathy Zhang, B.A., Connor Boyle, B.A., Maxwell Smith, Ph.D., and James P. Phillips, M.D.

Implementing Rationing Policies

The need to balance multiple ethical values for various interventions and in different circumstances is likely to lead to differing judgments about how much weight to give each value in particular cases. This highlights the need for fair and consistent allocation procedures that include the affected parties: clinicians, patients, public officials, and others. These procedures must be transparent to ensure public trust in their fairness.

The outcome of these fair allocation procedures, informed by the ethical values and recommendations delineated here, should be the development of prioritization guidelines that ensure that individual physicians are not faced with the terrible task of improvising decisions about whom to treat or making these decisions in isolation. Placing such burdens on individual physicians could exact an acute and life-long emotional toll. However, even well-designed guidelines can present challenging problems in real-time decision making and implementation. To help clinicians navigate these challenges, institutions may employ triage officers, physicians in roles outside direct patient care, or committees of experienced physicians and ethicists, to help apply guidelines, to assist with rationing decisions, or to make and implement choices outright — relieving the individual front-line clinicians of that burden.[26] Institutions may also include appeals processes, but appeals should be limited to concerns about procedural mistakes, given time and resource constraints.[29]

- Shortly after Covid-19 is declared a pandemic, *NEJM* published a (what became to be) a highly influential paper outlining the desired ethical principles for allocation of pandemic medical resources.
- Our first response was, "shouldn't experts from analytical fields, such as economists, operations researchers, and computer scientists also be part of these designs?"

The Path Between Theory and Practice

- Together with Parag Pathak and Utku Ünver, we were already working on a book chapter on the general theory of reserve systems.
- Upon observing the limitations of the existing rationing systems, and especially the inability of New York State and Minnesota ventilator allocation committees to accommodate Essential Personnel Priority due to these limitations, we knew the reserve system is the answer.
- We repurposed our book chapter, and circulated the first version of our working paper in April 2020.

The Path Between Theory and Practice

- Two days after we circulated the first draft of our paper, Massachusetts announced its ventilator allocation guidelines, but something was not quite right.
- Even though the announced priority point system did not have any priority points for the medical personnel status, the Boston Globe headline suggested otherwise!



Who gets a ventilator? New gut-wrenching state guidelines issued on rationing equipment

Preference given to medical personnel, people who are healthy, younger

By Liz Kowalczyk Globe Staff, Updated April 7, 2020, 2:49 p.m.

241

- The culprit for this confusion was an informal referral to "heightened priority" for medical personnel.
- This observation made us believe that the committee in Massachusetts may have faced a similar challenge to those faced earlier by the committees in New York State and Minnesota.

The Path Between Theory and Practice

- We reached out to Robert Truog, a member of the committee and a leading bioethicist who has coauthored another influential piece on the ethics of pandemic triage.


The NEW ENGLAND JOURNAL of MEDICINE

Editor's Note: This article was published on March 23, 2020, at NEJM.org.

Perspective

The Toughest Triage — Allocating Ventilators in a Pandemic

Robert D. Truog, M.D., Christine Mitchell, R.N., and George Q. Daley, M.D., Ph.D.

- Robert Truog immediately responded to our inquiry, and proposed a collaboration also including
  - Govind Persad (one of the lead authors of the *NEJM* piece that motivated our initial interest), and
  - Douglas White (a Professor of Clinical Care Medicine well known for his priority point system for ventilator allocation).

Outreach Efforts

- Joining forces with Truog, Persad, and White, over the next several months we engaged in various outreach activities to introduce the reserve system to bioethics and emergency care communities.

- Through these efforts, we introduced the reserve system to several groups, and started collaborating with bioethicist Harald Schmidt who was especially interested in utilizing it to mitigate disparities in healthcare access.


CHEST JOURNAL

Categorized Priority Systems

A New Tool for Fairly Allocating Scarce Medical Resources in the Face of Profound Social Inequities

Tayfun Sönmez, PhD • Parag A. Pathak, PhD • M. Utku Ünver, PhD • Govind Persad, JD, PhD • Robert D. Truog, MD • Douglas B. White, MD

Published: December 25, 2020 • DOI: https://doi.org/10.1016/j.chest.2020.12.019 • Check for updates


JOHNS HOPKINS BERMAN INSTITUTE of BIOETHICS

1995 • 2020 25 YEARS

Rationing Medical Resources in a Pandemic

Thursday, May 7, 3-4 p.m.

Zoom Seminar

- **Presenter,** Tayfun Sonmez, PhD, Professor of Economics, Boston College
- **Discussant**, Allen Kachalia, MD, JD, Senior Vice President for Patient Safety and Quality, Director of the Armstrong Institute for Patient Safety and Quality
- **Moderator**, Daniel Polsky, PhD, Bloomberg Distinguished Professor of Health Policy and Economics

Sponsored by:

- Hopkins Business of Health Initiative
- Berman Institute of Bioethics
- Economics Department, Krieger School of Arts and Sciences


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GLOBAL HEALTH INEQUALITY

Covid-19: how to prioritize worse-off populations in allocating safe and effective vaccines

How should we decide which population groups receive covid-19 vaccines before others? **Harald Schmidt**, **Parag Pathak**, **Tayfun Sönmez**, and **M Utku Ünver** examine the existing frameworks and argue that prioritizing worse-off groups is urgent, justified, and feasible

Harald Schmidt, [1] Parag Pathak, [2] Tayfun Sönmez, [3] M Utku Ünver[4]

Reserve System in Pittsburgh (UPMC)

- The first concrete outcome of our collaboration was a design of the antiviral medicine allocation guideline at University of Pittsburgh Medical Center, which was subsequently endorsed by the Commonwealth of Pennsylvania throughout the state.

A MODEL HOSPITAL POLICY FOR FAIR ALLOCATION OF MEDICATIONS TO TREAT COVID-19

HOME (/) • A MODEL HOSPITAL POLICY FOR FAIR ALLOCATION OF MEDICATIONS TO TREAT COVID-19



Available now online:

To assist hospitals and health systems to implement a transparent and fair approach to allocate scarce medications to treat patients with COVID-19, we have created a model hospital policy and allocation framework. Hospitals and health systems are welcome to adapt the policy for their specific needs. Click here to download a PDF (https://ccm.pitt.edu/sites/default/files/2020-05-

Pittsburgh Model Policy for Anti-viral Medications

- Reserve categories based on the combinations of the following three considerations:
  - Hardest hit (ADI of 8-10)
  - Essential worker (using PA state definition)
  - Is patient expected to die in one-year?
- Priorities are based on lottery
  - In this case reserve system simplifies to stratified lottery (25% boost for each of the first two considerations, 50% reduction for the third)
  - Used in May 2020 for allocation of the antiviral Remdesivir
  - Outcome determined dynamically through cutoff lottery points for each reserve category

Increased Awareness on Equitable Access to Healthcare

- By the late summer of 2020 our focus have shifted from ventilator and antiviral rationing to the upcoming vaccine rollout.
- Since the beginning of the pandemic, there has been a vigorous debate on equitable vaccine allocation.
  - Until NASEM's announcement of its preliminary Framework for Equitable Vaccine Allocation in September 2020, these debates were purely focused on the structure of priority tiers under a presumed priority system.

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- Melinda Gates in June 2020:

"We care about this vaccine getting out equitably. The first people that need this vaccine are the 60 million health care workers around the world. They deserve to get it before anybody else. Then you start tiering. In the U.S. that would be black people next, quite honestly, and many other people of color. They are having disproportionate effects from Covid-19."

Impasse under the Priority System

Vox TWITTER FACEBOOK

Should people of color get access to the Covid-19 vaccine before others?

"It's so important that we get this right. We don't have a history of doing this well."

By Sigal Samuel | Updated Oct 28, 2020, 10:55am EDT

Who should get coronavirus vaccine first? U.S. weighs early access for some

July 9, 2020 at 4:45 am | *Updated July 9, 2020 at 7:51 am*



Dr. Francis Collins, director of the National Institutes of Health (NIH), holds up a model of COVID-19 during a Senate hearing on the plan to research,... (Saul Loeb / The Associated Press) **More**

By Megan Twohey

The New York Times

Federal health officials are already trying to decide who will get the first doses of any effective coronavirus vaccines, which could be on the market this winter but could require many additional months to become widely available to Americans.

The Centers for Disease Control and Prevention and an advisory committee of outside health experts in April began working on a ranking system for what may be an extended rollout in the United States. According to a preliminary plan, any approved vaccines would be offered to vital medical and national security officials first, and then to other essential workers and those considered at high risk — the elderly instead of children, people with underlying conditions instead of the relatively healthy.

Agency officials and the advisers are also considering what has become a contentious option: putting Black and Latino people, who have disproportionately fallen victim to COVID-19, ahead of others in the population.

CATO INSTITUTE

ABOUT EXPERTS EVENTS PUBLICATIONS BLOG

Constitution and Law Economics

Government Must Not Assign a Coronavirus Vaccine by Race

When we get a vaccine, the people who are most at risk should be the ones prioritized.

AUGUST 19, 2020 • COMMENTARY

By **Walter Olson**

This article appeared on ***The Bulwark*** on August 19, 2020.

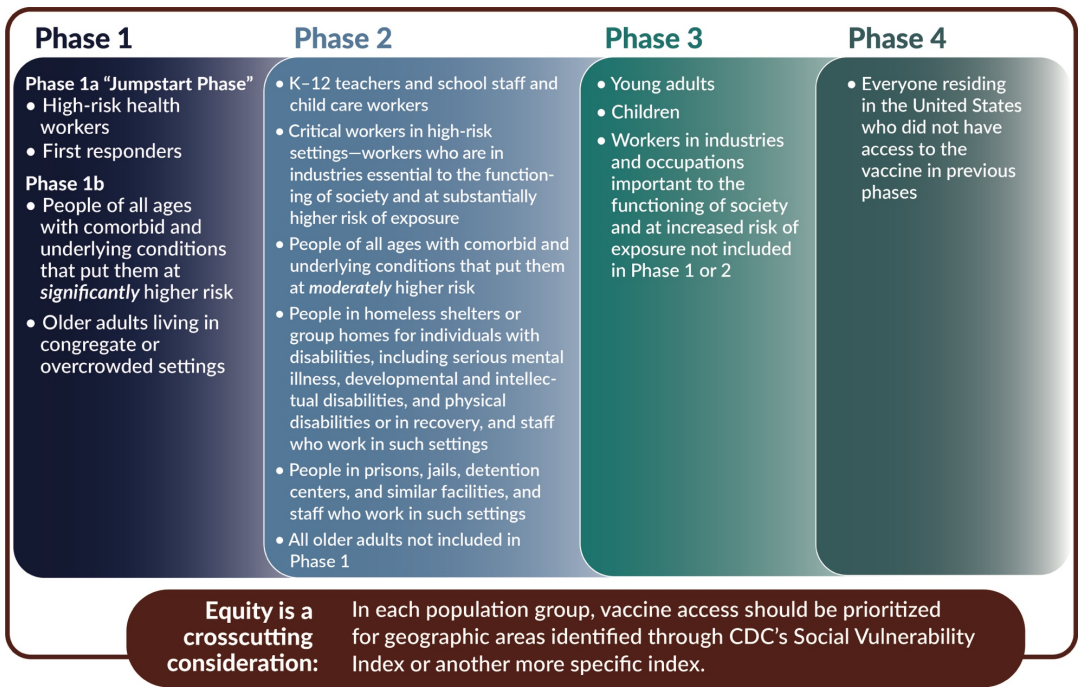
A federal advisory committee recommending priorities for the eventual distribution of a COVID-19 vaccine has floated a very bad idea: according priority to some beneficiaries over others because of their race. If implemented, the regime would very likely be struck down by courts as unconstitutional. But even aside from that, racial preferences on this question would constitute a dangerous betrayal of the neutrality and impartiality citizens have a right to expect from government.

NASEM Framework for Equitable Vaccine Allocation

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  - NASEM appointed a committee of distinguished experts.

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  - NASEM appointed a committee of distinguished experts.
- September 2020: A preliminary discussion draft of the *Framework for Equitable Allocation of COVID-19 Vaccine* is made public.



Million Dollar Question: How to Implement Equity?

- September 2020: Immediately following the NASEM discussion draft, comments from the public were solicited through a formal process.
- In his written and oral comments, University of Pennsylvania bioethicist Harald Schmidt has inquired about the recommended mechanism to prioritize members of hard-hit communities.
- In preparation for this contingency and in collaboration with Harald Schmidt, weeks earlier we circulated the working paper Pathak, Schmidt et al. (2020), illustrating how easily a traditional tiered priority system can be "modified" as a reserve system, by building equity into the system though an index of social vulnerability.
    - This precise formulation was brought to the attention of the committee as a possible mechanism to embed equity in their framework.

Million Dollar Question: How to Implement Equity?

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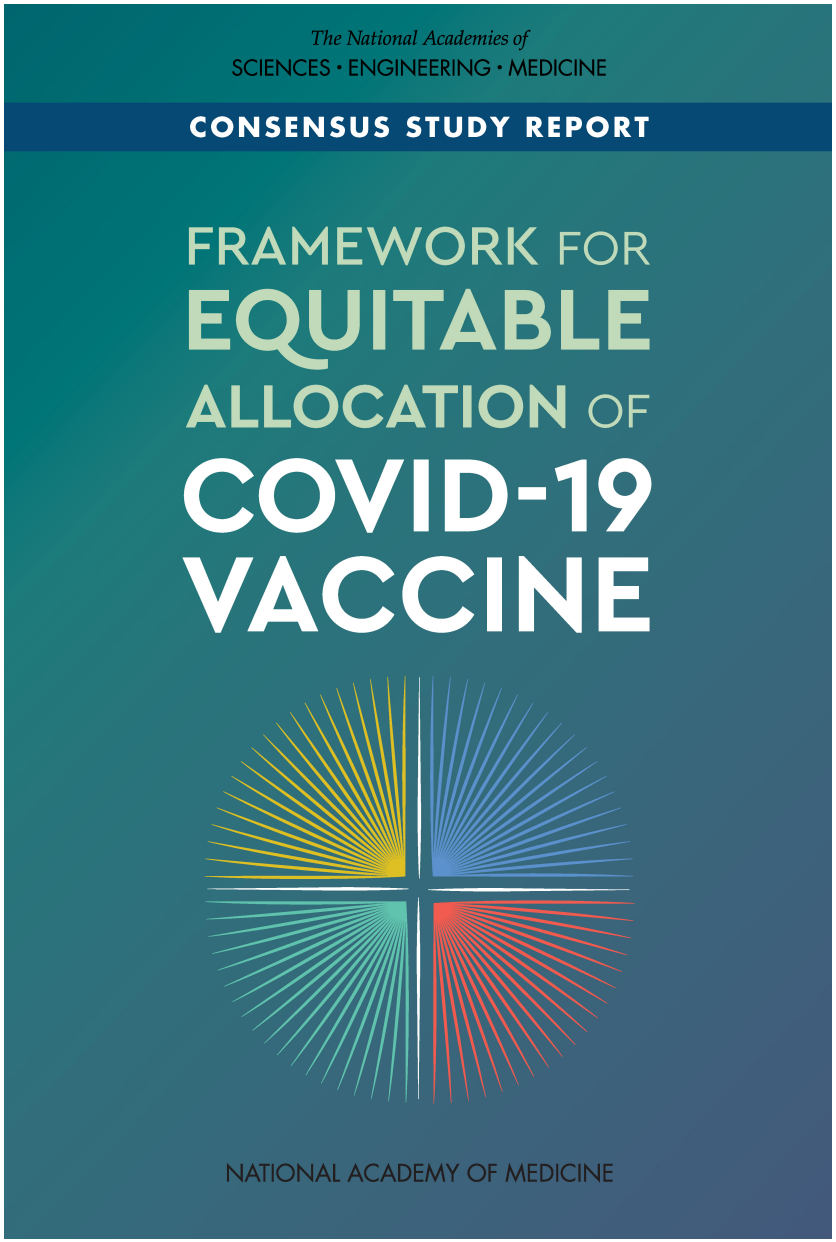
  "Dividing the initial vaccine allotment into priority access categories and using medical criteria to prioritize within each category is a promising approach. For instance, half of the initial allotment might be prioritized for frontline health workers, a quarter for people working or living in high-risk settings, and the remainder for others. Within each category, preference could be given to people with high-risk medical conditions. Such a categorized approach would be preferable to the tiered ordering previously used for influenza vaccines, because it ensures that multiple priority groups will have initial access to vaccines."

NASEM Framework for Equitable Vaccine Allocation

- October 2020: NASEM published their final Framework for Equitable Allocation of COVID-19 Vaccine (2020), based on the ethical values formulated in (Emanuel et al. *NEJM* 2020).

> *"Fair Allocation of Scarce Medical Resources in the Time of COVID-19*
>
> *In May 2020, an article in The New England Journal of Medicine proposed a set of ethical values to underpin recommendations for allocating scarce medical resources during the COVID-19 pandemic (Emanuel et al. NEJM 2020)."*

NASEM Framework for Equitable Vaccine Allocation



- The final NASEM framework formally recommended a 10 percent reserve for people from hard-hit areas.

  "The committee does not propose an approach in which, within each phase, all vaccine is first given to people in high SVI areas. Rather the committee proposes that the SVI be used in two ways. First as previously noted, a reserved 10 percent portion of the total federal allocation of COVID-19 vaccine may be reserved to target areas with a high SVI (defined as the top 25 percent of the SVI distribution within the state)."

TN Adopts a Reserve System for Vaccine Allocation

- October 2020: Shortly after the NASEM recommendation, Tennessee became the first state to adapt a reserve system for its vaccine rollout.

Tennessee Infrastructure Plan for COVID-19 Vaccine Distribution

Wednesday, October 21, 2020 | 01:39pm

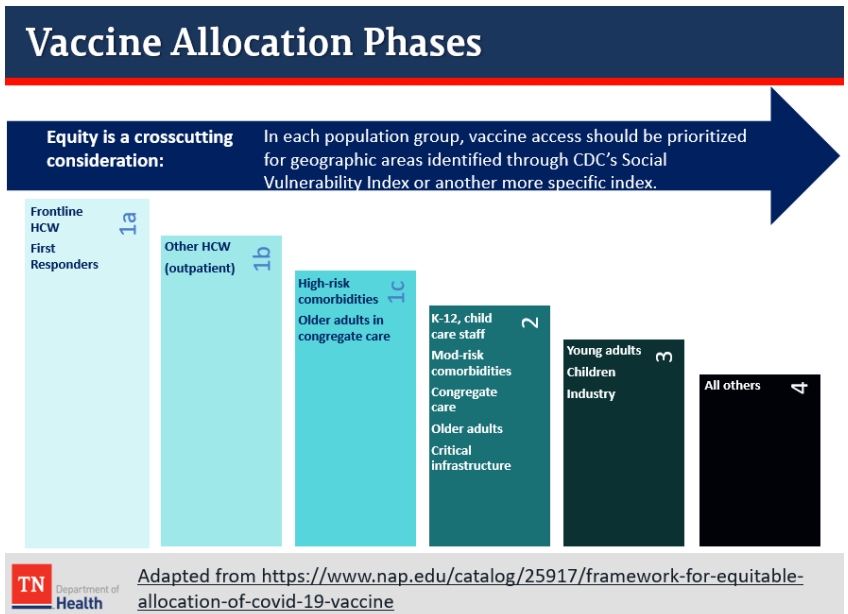
NASHVILLE, Tenn. – The Tennessee Department of Health today announced the state's infrastructure plan for distribution of COVID-19 vaccines once they become available. TDH in coordination with other state and local agencies submitted an initial draft of the COVID-19 Vaccination Plan for Tennessee to the Centers for Disease Control and Prevention on October 16, 2020.

"We assure Tennesseans that safe, effective and approved COVID-19 vaccines will be released in Tennessee when they are available to reduce the spread of the virus," said Tennessee Health Commissioner Lisa Piercey, MD, MBA, FAAP. "Our vaccine distribution plan will be modified as more is understood about the virus and the availability of approved vaccines currently in development."

TDH has developed a preliminary structure for the allocation and distribution of COVID-19 vaccines:

- Five percent of Tennessee's allocation of COVID-19 vaccines will be distributed equitably among all 95 counties
- Ten percent of Tennessee's allocation of COVID-19 vaccines will be reserved by the state for use in targeted areas with high vulnerability to illness and death from the virus
- 85 percent of Tennessee's allocation of COVID-19 vaccines will be distributed among all 95 counties based on their populations

TDH modeled this approach to allocation and distribution of COVID-19 vaccines after review of the CDC's COVID-19 Vaccination Program Interim Playbook for Jurisdictional Operations and the National Academies of Sciences, Engineering and Medicine's Framework for Equitable Allocation of COVID-19 Vaccine, and in consultation with Tennessee's Unified Command Group
and a stakeholder group of more than 28 partner agencies and offices.



The Washington Post
Democracy Dies in Darkness

Health

Covid-19 is devastating communities of color. Can vaccines counter racial inequity?

As states wrestle with whether to prioritize essential workers or the elderly, Tennessee is setting aside shots for especially vulnerable areas

Symposium on Vaccine Allocation and Social Justice

- December 2020: In part to illustrate policymakers how easily equity can be built into vaccine rollout through a reserve system, we co-hosted a symposium in collaboration with Ariadne Labs, Harvard Chan School of Public Health, and UPenn's Department of Medical Ethics and Health Policy.

DEC 4, 2020

SESSION 1
10:30 - 11:55 am EST
Practical, legal, and ethical ways of allocating vaccines equitably using novel approaches: an overview

Welcome

Why allocating in ways that reduces, rather than maintains (or worse, exacerbates), inequities matters now
Saad Omer, Advisor, Strategic Advisory Group of Experts on Immunization (SAGE), World Health Organization
Michelle Williams, Dean, Harvard T.H. Chan School of Public Health

Practical and legal aspects of using different statistical measures of disadvantage
Lawrence Gostin, Director, O'Neill Institute for National and Global Health Law
Read the paper

How different adjustments to allocation frameworks impact vaccine distribution to disadvantaged populations
Parag Pathak, Professor of Economics, MIT
M Utku Ünver, Professor of Economics, Boston College
Tayfun Sönmez, Professor of Economics, Boston College
Read the paper
Read the paper
Read the paper

Normative reference points for pragmatic adjustments
Harald Schmidt, Assistant Professor of Medical Ethics & Health Policy, University of Pennsylvania
Read the paper
Read the paper

SESSION 3
1:05 - 2:30 pm EST
In the Midst of Scarcity: How Leaders are Preparing Systems for Equitable Vaccine Allocation

Opening
Atul Gawande, Founder and Chair, Ariadne Labs

States and other jurisdictions' initial vaccine allocation plans
Rebecca Weintraub, Assistant Professor, Harvard Medical School, Ariadne Labs
Kate Miller, Senior Scientist, Ariadne Labs
Read the paper

The ethical framework of the Advisory Committee on Immunization Practices
Nancy McClung, Epidemiologist, CDC Vaccine Task Force

Equity and vaccine allocation – ASTHO perspective
Mary Ann Cooney, VP, Health Equity, Association of State and Territorial Health Officials

Equity and vaccine allocation – State perspective: Tennessee
Michelle D. Fiscus, Medical Director, Vaccine-Preventable Diseases and Immunization Program, Tennessee Department of Health
Slides

Equity and vaccine allocation – State perspective: California
Erica Pan, Acting State Health Officer, California State

Equity and vaccine allocation – State perspective: Illinois
Heidi Clark, MPH , Chief, Division of Infectious Diseases, Office of Health Protection, Illinois Department of Public Health

Closing
Rebecca Weintraub, Assistant Professor, Harvard Medical School, Ariadne Labs
Slides

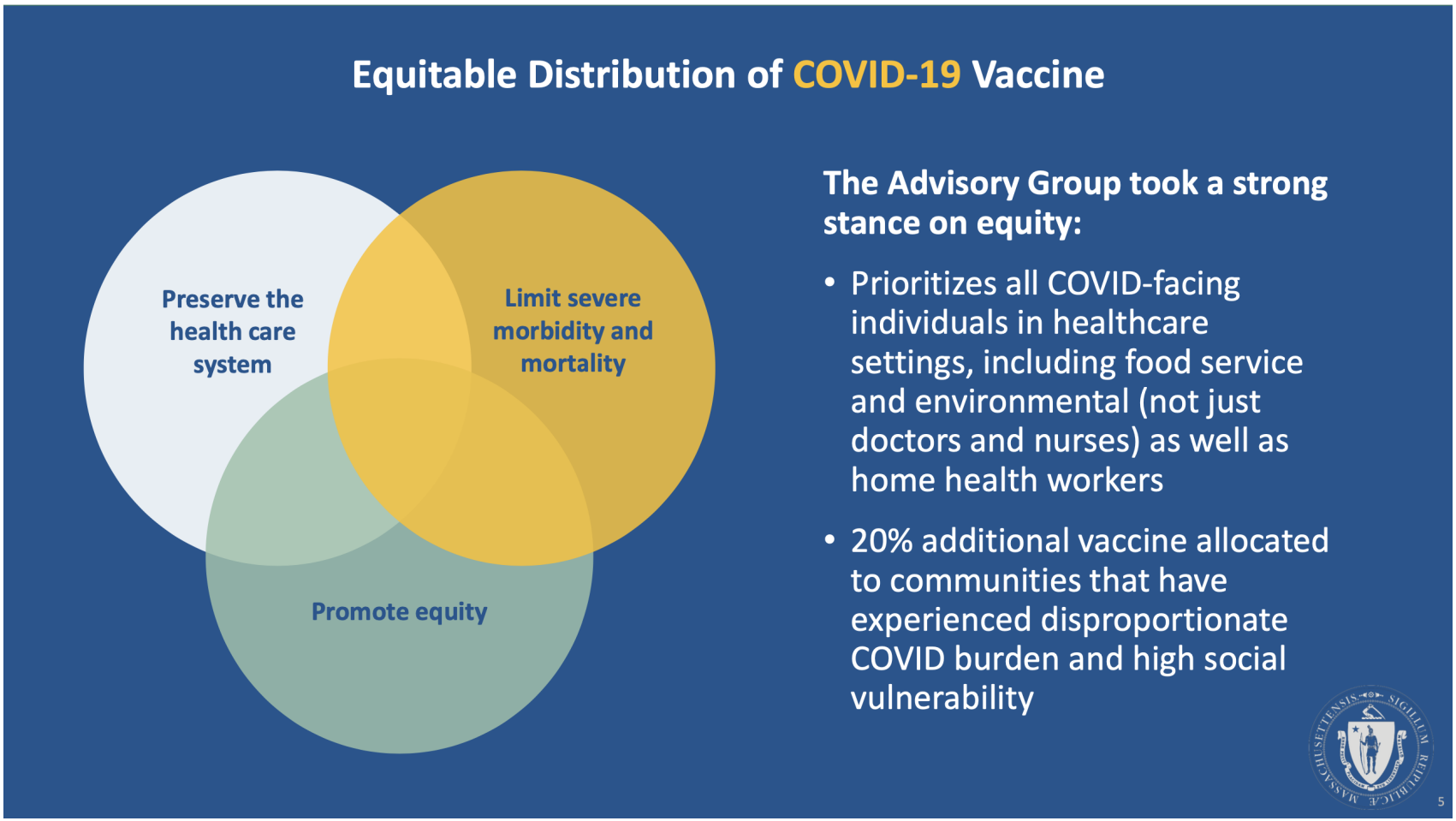
Symposium on Vaccine Allocation and Social Justice

- The symposium not only helped us to better understand the needs, challenges and perspectives of several jurisdictions, but it also directly contributed to two important developments.

1. It provided our co-organizers from Ariadne Labs with a natural opportunity to bring the reserve system to the attention of the committee responsible for vaccine rollout in Massachusetts.
2. Similarly, it provided our group with an opportunity to bring the reserve system to the attention of California's Surgeon General Dr. Nadine Burke Harris.
    - In a number of group meetings, we introduced the reserve system to Dr. Harris and her team, advocated for its adoption in California as an instrument to built in equity in their upcoming vaccine rollout, and coached members of her team on the subtleties of the reserve system.

MA Adopts a Reserve System for Vaccine Allocation

- December 2020: Massachusetts became the second state to adopt a reserve system for its vaccine rollout.



CA Adopts a Reserve System for Vaccine Allocation

- March 2021: California adopted a particularly ambitious reserve system for its vaccine rollout, with reserve categories both for educators and hard-hit populations.

Office of Governor
GAVIN NEWSOM

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California Leads with Public Health and Vaccine Equity to Safely and Sustainably Reopen

Published: Mar 04, 2021

State introduces vaccine equity metric to update Blueprint for a Safer Economy based on vaccinating the state's hardest hit communities against COVID-19

California sets aside 40 percent of vaccine doses for most impacted communities; seeks to reach 2 million vaccine doses in those communities to move counties through tiers and open more activities safely

As vaccination increases and disease spread slows, counties will be able to move through tiers more quickly with modestly higher case rates

Los Angeles Times

CALIFORNIA

California will earmark 10% of weekly COVID-19 vaccine supply for teachers

Los Angeles Times

California will reserve 40% of COVID-19 vaccine for disadvantaged areas to speed reopenings



CORONAVIRUS, VACCINES AND PANDEMIC

As L.A. eyes orange coronavirus tier, is a wave of reopenings around the corner?

New Facebook tool aims to connect peo vaccines — but disinformation is rampa

Pandemic's reach far outstripped officia coronavirus case counts, study suggests

Vaccine Reserve System News from Other States

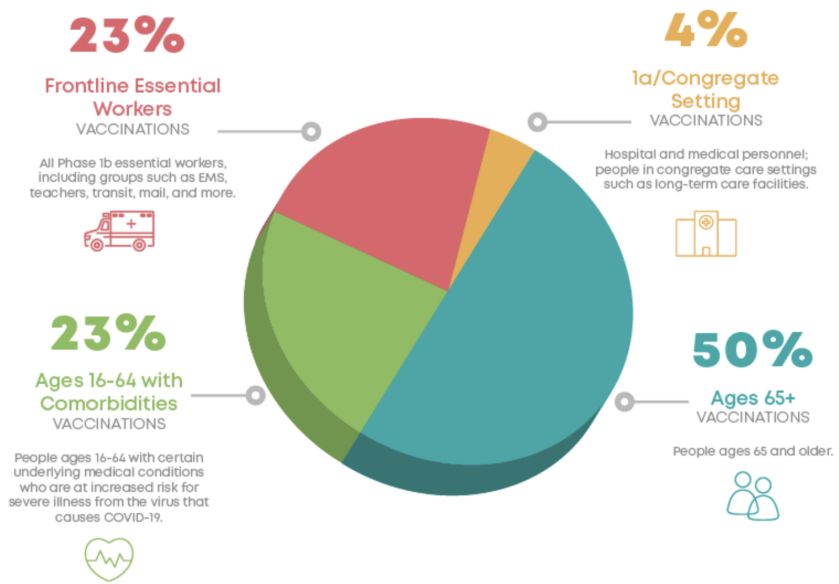
- January 2021
  - New Hampshire (10% O&A for hard-hit communities)
  - North Carolina (unspecified % O&A for historically marginalized communities)
- February 2021
  - Connecticut (10% O&A for hard-hit communities)
  - Florida (1.5k doses O&A for homebound seniors)
  - Minnesota (7k doses for 65+ y/o, 10k for school and child-care workers)
- March 2021
  - Colorado (15% O&A for hard-hit communities)
  - Mississippi (300 doses O&A for Vietnamese community)
  - Maryland (2.1k doses O&A weekly for a hard-hit county)
  - Nebraska (90%-10% reserves for two overlapping categories)
  - New Mexico (1k doses O&A weekly for persons with disabilities and elderly)
  - Georgia (15k doses O&A for Court staff, 3k doses O&A for Chatham educators)
  - Illinois (300-500 doses weekly for each of nine sites for hard-hit communities)
  - Richmond, Virginia (an elaborate reserve system with four overlapping categories)

Richmond, VA - Phase 1b Vaccine Allocation Plan

- While equity and social justice considerations have been the driving force in most jurisdictions for the acceptance of the reserve system, it is not the only reason.

Richmond, VA - Phase 1b Vaccine Allocation Plan

- While equity and social justice considerations have been the driving force in most jurisdictions for the acceptance of the reserve system, it is not the only reason.
- Phase 1b Vaccine Rollout in Richmond, VA is a good example:



- Richmond's reserve system utilizes category-specific priorities, an important feature absent under a priority system.

MA Inquiry on a Reserve System for MAB Therapy

- Our proposed reserve system has been gaining traction for allocation of medical resources other than vaccines as well.
- The Department of Public Health assembled a Working Group to advise on equitable allocation of Covid-19 therapies delivered to Massachusetts in the event of a shortage.
- A member of the Working Group, Dr. Emily Rubin from Mass General Hospital, inquired to our group whether our proposed reserve system can be used for equitable allocation of Covid-19 Monoclonal Antibody Therapies, and if so how it can be operationalized in practice.
- Our group supported the Working Group with a reserve system design tailored to the specifications for Massachusetts policies, and provided them with an Excel spreadsheet implementation of the system.

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- November 2020: MA adapted a reserve system for Monoclonal Antibody Therapy allocation.

MA Adopts a Reserve System for MAB Therapy Allocation

Massachusetts Department of Public Health
Guidance for Allocation of COVID-19 Monoclonal Antibody Therapeutics
November 27, 2020

c. Allocation framework

Infusion sites are encouraged to use the following allocation framework or a conceptually similar framework to allocate bamlanivimab and casirivimab/imdevimab in the event of scarcity (i.e., demand for infusion spots exceeds supply).

1. Units (infusion spots) will be allocated by hospitals to patients at least once per day (one interval/day) and ideally at least twice per day (two intervals/day) given the necessary short window (ideally < 72 hours) between test sample collection and time of administration.

2. At each interval, there will be two serial allocations for available infusion spots. The first allocation of 80% of available doses will be open to all identified patients entered into the allocation system, ("open allocation"). The second allocation of 20% of available doses will be open only to patients who live in a census tract with SVI (CDC's Social Vulnerability Index) > 50% or in a city or town with a 7-day average COVID-19 incidence rate in the top quartile ("vulnerable patient allocation") as reported in the most recent MA DPH weekly COVID report.

3. During the open allocation (80%), available units will be allocated first to patients with age ≥ 65 and/or BMI ≥35 (Tier 1), then to patients with other EUA criteria (Tier 2). If there are more people in a particular tier than available units, a lottery will decide which patients are assigned the units.

4. During the second allocation (20%), vulnerable patient units will be allocated exclusively to patients who live in a census tract with *SVI > 50%* or in a city or town with an incidence rate in the top quartile. First priority will go to patients with age ≥ 65 and/or BMI ≥ 35 (Tier 1), then to patients with other EUA criteria (Tier 2). If there are more people in a particular tier than available units, a lottery will decide which patients are assigned the units.

5. If there are remaining units after the vulnerable patient allocation by virtue of there not being enough vulnerable patients in the queue, those units will be assigned to the patients who were next in line in the lottery for the open allocation.

6. If there are inadequate numbers of vulnerable patients in the queue, there will need to be efforts to remedy that, and the vulnerable patient allocation may need to be increased in the meantime.

Example:

100 units available
150 total patients
75 vulnerable - 30 in Tier 1, 45 in Tier 2
75 not vulnerable - 30 in Tier 1, 45 in Tier 2

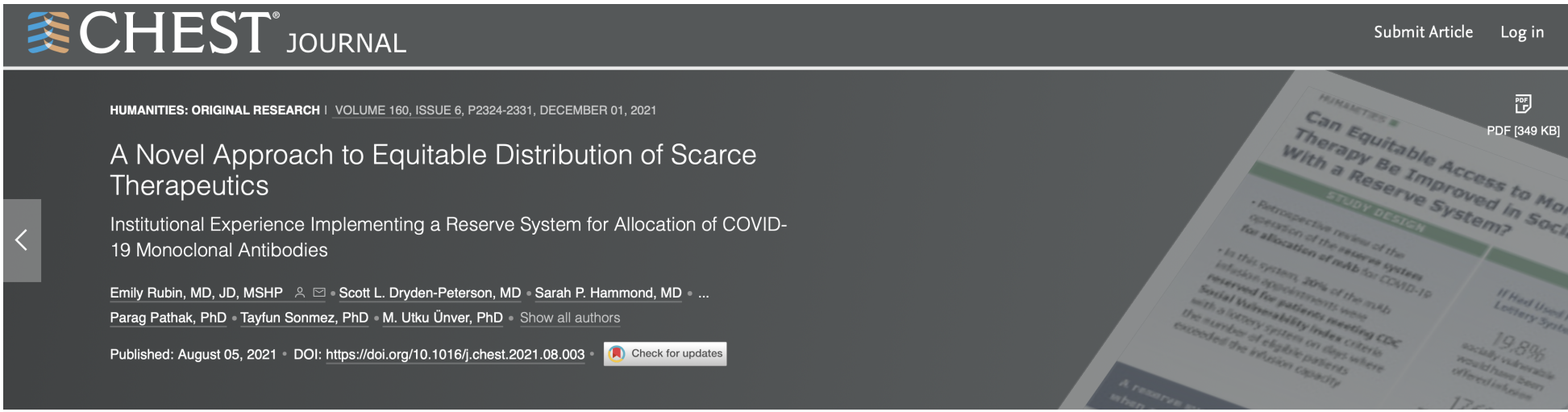
1. Open allocation: the first 80 units are allocated. All Tier 1 patients (vulnerable and non-vulnerable) are prioritized and are all assigned units – 30 vulnerable and 30 not vulnerable. The remaining 20 units are allocated to Tier 2 patients by lottery/random number generator. All 90 Tier 2 patients (vulnerable and non-vulnerable) will be placed into the lottery. Assume the outcome of the lottery yields 10 vulnerable and 10 non vulnerable patients are assigned units.

2. 20% allocation for vulnerable patients: The 20 units are allocated only to vulnerable patients. There are 35 remaining vulnerable Tier 2 patients. Those units are allocated by lottery/random number generator to 20 Tier 2 vulnerable patients.

Total allocation:
Vulnerable: 30 tier 1 + 30 tier 2 = 60
Not vulnerable: 30 tier 1 + 10 tier 2 = 40

Deployment at Mass General Brigham Health System

- Rubin et al. (2021) reports the successful deployment of the reserve system for allocation of scarce Covid-19 therapies in Massachusetts, and how it increased access to socially vulnerable patients.



Conclusion

- In the first few months of the COVID-19 pandemic, many societies were caught unprepared when they needed guidelines for a possible ventilator rationing.
- At present, there is a worldwide need for policies and mechanisms for equitable allocation of scarce medical resources.
- Poorly designed allocation mechanisms may damage the social contract between different segments of the society.
- Widely accepted but potentially competing ethical values for pandemic resource allocation require a mechanism to implement the desired balance of values.
- Finding the right mechanism to honor these principles is therefore important for maintaining the social fabric.

Conclusion

- Because the mechanism is a tool to realize ethical values and not an end in itself, it should permit a wide range of options.
- The exclusion or inadequate balancing of certain ethical principles may do more harm than good.

  "Maybe you end up saving more people but at the end you have got a society at war with itself. Some people are going to be told they don't matter enough."

  Quote attributed to Christina Pagel in New York Times

- When revising or modifying guidelines during or after the COVID-19 pandemic, a reserve system should be part of the arsenal.