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Bertilla FABRIS [a,1], Jason TUCKER [c,d] and Fabian LORIG [a,b]
[a] *Department of Computer Science and Media Technology, Malmö University, Sweden*
[b] *Sustainable Digitalisation Research Centre, Malmö University, Sweden*
[c] *Institute for Futures Studies, Sweden*
[d] *AI Policy Lab, Department of Computing Science, Umeå University, Sweden*

Abstract. We present an interactive agent-based model that showcases Spain's organ donation policy approach if applied to Sweden. The gamified experience fosters an understanding of complex public health policies.

Keywords. Agent-Based Social Simulation, Organ Donation, Serious Game, Policy Modeling, Healthcare, Spain, Sweden

1. Introduction

Organ donation systems (ODS) are inherently complex. Policy changes in ODS have a direct impact on patient's lives, and can be difficult to assess prior-to, or even immediately after, implementation [1]. Globally, there is a lack of organs for transplant, a situation that is worsening due to rising rates of diabetes and obesity, and the long-term impacts of the Covid-19 pandemic [2,3]. ODS rely on trust and participation from a range of societal actors. Compliance with organizational structures and legal requirements further complicates the improvement of ODS.

Thus, new approaches to ODS policy development and public engagement are required [4,5]. Agent-based social simulations (ABSS) are well suited to navigating complex socio-technical systems, as they afford bottom-up and top-down approaches [6]. Policy modeling can be conducted in a virtual world, minimizing harm through the collaboration of humans and AI systems [7], making it ideal for high-risk policy areas. ABSS is especially useful in areas, such as public health, where the acquisition of real-world data to inform policy and engage with policy actors is challenging [8]. Negative public responses to policy change could be identified through the ABSS, minimizing this risk and maintaining public trust in ODS [4].

In addition, ABSS models have the advantage of being designed to catalyze understanding and conversation across stakeholders [9]. Informative gamified learning, or serious games, has proved successful in heightening public awareness in similarly high-risk areas [10]. Modeling ODS policy via ABSS can thus become an informative platform to engage a range of publics, fostering informed consent, participation and understanding of the ODS.

[1] Corresponding Author: Bertilla Fabris, e-mail: bertilla.fabris@mau.se.

2. Organ donation in the context of Sweden

The gap between the demand for and supply of organs from deceased donors in Sweden remains persistent. Indeed, despite policy changes and a positive societal view on organ donation, this situation has worsened [5]. Worryingly, in 2022, Sweden experienced the highest rate of people declaring themselves non-donors, likely due to policy changes enabling organ preservation treatment for donation and the formal removal of familial veto [5,11,12]. In comparison, Spain holds the highest rates of donors per million people worldwide, twice the Swedish rate as of 2024 [13]. Systematic monitoring and cooperation across clinical and legal entities enabled this success. Spain also pioneered the practice of Intensive Care for Organ Donation (ICOD), which allows patients to enter ICUs for non-therapeutic treatment. We investigated whether the Spanish approach could be transferred to Sweden, and stakeholder response assessed through a serious game.

3. A serious game for organ donation policies

The model allows users to investigate the potential effects of policy scenarios on the amount of Actual Donors produced in the system. There are three agent types in the model: *Donors*, *Local Donation Clinicians* (LDC), and *Transplant Coordinators* (TC). The generation of patients follows a Poisson distribution calibrated on averages obtained from historical data. Donation occurs after four Donor state transitions: Possible, Potential, Eligible, and Actual. Following transition probabilities, Donor-agents progress towards the Actual Donor state. All probabilities were derived from publicly available data and further depend on the presence (or absence) of the Staff agents. The LDC are healthcare staff trained in Deceased OD procedures. If Staff is assigned to the Possible Donor, they proceed to the Potential state; their presence is determined by reported availability rates. The Staff agent will then contact a TC depending on probability named $contact\_TC$. TCs are available 24/7 for investigating patient conditions, medical viability, and their consent to donation. The TC returns the result of their assessment according to *Medical Viability and Consent*. Only if all assessments are cleared can the patient become an Actual Donor. The model is designed to represent each day as one tick. Of influence are the initial settings in terms of Population, and Infrastructure. We situate the model geographically upon a map of Sweden.

The three policies were inspired by Spain and their impact calculated on Swedish data. The implementation of the two Best Practice policies, one for *Contact to TC* and one for *Medical Viability assessment*, increases the likelihood of patients reaching the next stage by $\approx 20\%$. Simulating the ICOD policy enables access to a near-doubled rate of patients who suffered brain death, expanding the Possible Donor pool.

Users can play with parameters, generating a discussion on what is the most efficient policy, as opposed to what is the best policy. Why and how would ICOD increase the numbers of Actual Donors? What are the conditions and likelihood for organ donation to be considered? How does the individual's decision affect family members and clinical staff? Effects are forecast and visualised via the simulation. Note that as the model is in a prototype phase, user experience has yet to be enhanced.

By minimizing the informational asymmetry between clinicians, policy actors and the general public, a serious game based on ABSS encourages transparency, informs consent to donation, and reinforces trust in hybrid human AI systems.

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