Erasmus School of Health Policy & Management

Convergence

Founding Partners

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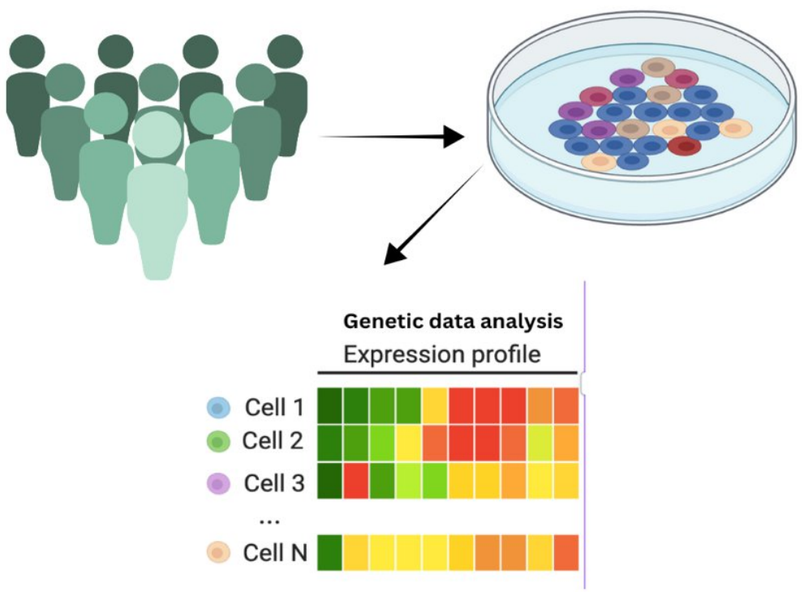
Unraveling the Challenges of Village in a Dish Technology Using the HTA Core Model

Introduction

Village in a Dish technology (ViaD) is an *in vitro* cell culture technology designed to analyze cells from many donors or patients in a single experiment to study the effect of genetic variation (Figure 1). It can overcome **cost, time and technical limitations** presented by conventional cell cultures and thereby accelerate **personalized medicine research and implementation in clinical care** with its various applications (Figure 2). However, this technology is in the early phase of development, and its intricate design poses several challenges. We conducted first early health technology assessment of ViaD to identify challenges and concerns across a wide range of different domains.

Figure 1: General concept of ViaD. Cells from many people are analyzed in a single experiment to study how individual genetics can influence disease risk and response to a particular treatment.



Methodology

- EUnetHTA's HTA Core Model 3.0 was used as a basis to perform this early HTA. This model comprises questions in domains ranging from clinical effectiveness to safety, costs and ethics.
- An extra domain (research effectiveness) was added since ViaD is primarily used as a research platform.
- The questionnaire was then completed using relevant literature. The findings were then examined and discussed with other stakeholders to identify challenges that may occur in the future development and later use of ViaD.

Results

The assessment revealed many challenges across most Core Model domains. Some of them are unique to ViaD and are not observed in conventional cell culture. Other challenges can occur in conventional cell cultures too but are amplified in ViaD. A few challenges overlap with conventional cell cultures but are still critical due to ViaD's expected clinical adoption (Table1 and 2). Additionally, some of these challenges were inherent to the ViaD platform due to its design (Table 1) whereas others only arise with specific application(s) (Table 2).

Objective

To identify the challenges of ViaD to assess its feasibility, limitations, and implications across basic lab science aspects, translational aspects, and societal aspects.

Figure 2: Different applications of ViaD. a) Disease modeling in the research sector to broaden understanding of a specific disease, b) and c) tailored treatment and optimal dosage in the clinical sector to improve the effectiveness of a treatment, d) infectivity risk testing in the public health sector to identify high risk individuals.

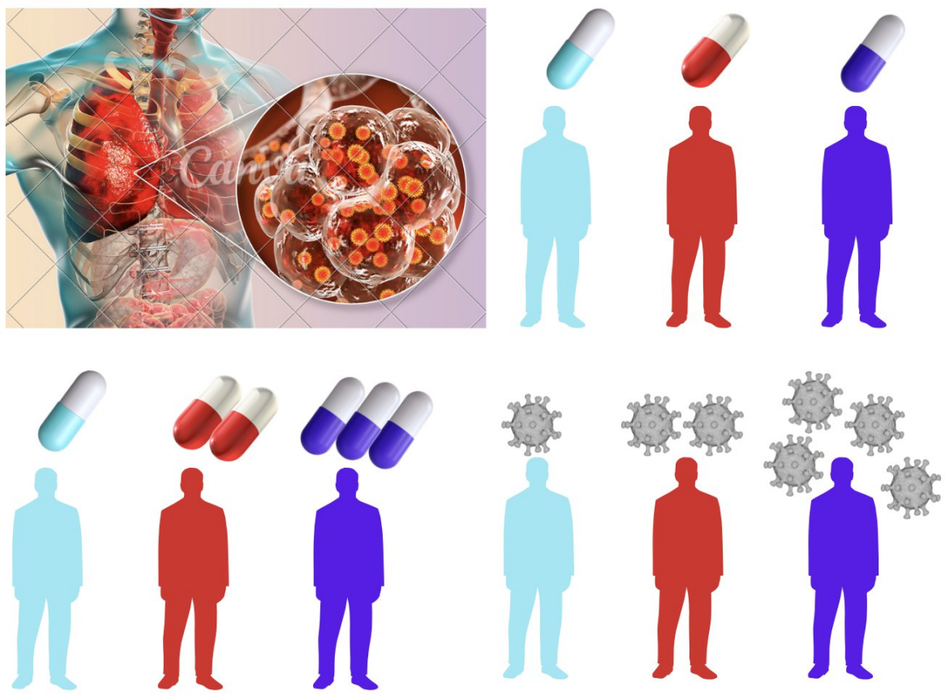


Table 1: Platform-related challenges. Challenges across HTA Core Model domains that arise due to multiplex nature of ViaD and are relevant for all uses of ViaD. These challenges are either unique to ViaD or become amplified compared to conventional cell cultures.

HTA Core Model Domain	Challenge	Unique / Amplified / Overlaps
Technical characteristics	Monitoring cell line growth rates to avoid dominance.	Unique
Research effectiveness	Proteome and secretome cannot be traced back to the donor.	Unique
Research effectiveness	Paracrine signaling between cells of donors complicates data interpretation.	Unique
Safety	Health concern for lab personnel due to exposure to pathogens.	Amplified
Costs	Heightened risk of cross-contamination can increase the costs.	Amplified
Costs	Higher upfront costs due to proliferation rate testing.	Unique
Ethics	Donor-specific cells cannot be selectively destroyed after pooling.	Unique
Organizational aspects	Hurdles in adoption in low-income countries due to advanced infrastructure needs.	Amplified
Patient and social aspects	Public misconception can lead to mistrust in cell donation.	Amplified

Table 2: Application-specific challenges. Challenges across HTA Core Model domains that occur only in specific applications.

HTA Core Model Domain	Challenge	Unique / Amplified / Overlaps
Technical characteristics	Not suitable for studying CD8 T+ cells due to alloreactivity.	Unique
Research effectiveness	Small variations across ViaD replicas reduce reproducibility and hinder drug approval.	Amplified
Research effectiveness	TGF-β secretion from donors can alter neural differentiation of recipient iPSCs.	Unique
Clinical effectiveness	Lab results may not reflect patient biology, risking poor clinical decisions.	Overlaps
Ethics	Inequality in access if not reimbursed.	Overlaps
Public perception	Whose preference takes precedence in the clinical setting, patient or caregiver?	Overlaps
Legal aspects	Liability for treatment decisions based on ViaD data.	Overlaps
Legal aspects	Disclosure of genetic risk to family despite patient refusal.	Amplified

Conclusion

Village in a Dish (ViaD) is an emerging technology with transformative potential for biomedical research and personalized medicine. This first early HTA identifies several key challenges spanning basic biological research to clinical setting to societal aspects. It provides biomedical scientists with insights about the technical and research challenges associated of ViaD and may assist health policy makers in making informed decisions about its future integration into healthcare systems, considering the costs, safety, ethical and legal concerns. By addressing these issues through multidisciplinary collaboration, ViaD can be effectively translated from laboratory research to clinical practice, supporting the future of personalized medicine.

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