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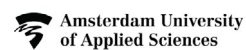
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# COLLABORATION IN OPEN INNOVATION HEALTH INITIATIVES: WORKING TOWARDS A SUSTAINABLE HEALTHCARE SYSTEM

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## Abstract

Open innovation initiatives in the health sector are considered spaces that can fuel systemic change. However, it is not clear yet how these initiatives contribute to the transition to a sustainable healthcare system. This research explores how actors in open innovation health initiatives contribute to a sustainable transition in healthcare by implementing the Quadruple Aim. The Quadruple Aim is a practical framework that helps organizations to innovate in healthcare. It consists of four aims: improving the health of the population, improving the work-life of care providers, enhancing patients' experience and reducing health cost. Sixteen interviews with professionals from

different backgrounds working in health initiatives in the Netherlands, highlight that 1) improving the health of the population is the main aim, 2) not all initiatives are considering all four aims, 3) solutions to one aim can cause new problems, and 4) the Quadruple Aim is not assessed in a structured way. This indicates that the implementation of the Quadruple Aim is highly challenging. A suggestion for future research is to focus on how design can facilitate the implementation of the Quadruple Aim in open innovation health initiatives.

Keywords: Quadruple Aim; open innovation; sustainable healthcare system; collaboration



## Introduction

Open innovation is seen as a promising direction for fuelling systemic change in the health sector (von Wirth et al. 2019). With different open innovation initiatives emerging rapidly, little is known about how these initiatives support collaborating actors to reconfigure the health ecosystems they are part of.

Emerging diseases like COVID-19 and the increasing number of chronic diseases around the world are putting considerable pressure on the healthcare system. The cost of care is continuously increasing, making healthcare systems of many countries unsustainable (Porter and Lee 2013). Thus, many actors are currently working on transitioning towards a sustainable healthcare system.

One approach that seems promising for this transition is the 'Quadruple Aim'; it is a clear and practical framework that can be adopted by organizations to innovate in healthcare. It consists of four aims: improving the health of the population, improving the work-life of care providers, enhancing patients' experience and reducing health cost (Pannunzio, Kleinsmann, and Snelders 2019; DiMatteo et al. 1993).

These four aims challenge how the healthcare system currently works. The implementation of the Quadruple Aim is not exclusively assigned to care providers, but also requires the involvement of other actors, such as government officials, companies, designers, and patients. In this study, we explore how the Quadruple Aim currently helps actors with different backgrounds to innovate together in open innovation initiatives. The research question is: How do actors in open innovation initiatives contribute to a transition into a sustainable healthcare system by considering the Quadruple Aim?

A qualitative interview study among open innovation initiatives in the Netherlands

was conducted to understand how actors implement the Quadruple Aim and which challenges they face. The following section presents a literature review on the Quadruple Aim and open innovation initiatives in healthcare. Then, four empirical observations regarding the implementation of the Quadruple Aim in open innovation initiatives are presented. The paper concludes with a suggestion for future research on how a design approach could contribute to implementing the Quadruple Aim in a more structured way.

## Theoretical Background

### The Quadruple Aim

Emerging diseases like the current pandemic COVID-19 and the increasing number of chronic diseases around the world are putting considerable pressure on the healthcare system, demanding more services, with higher quality and more efficiency. For example, due to COVID-19, hospitals in Spain have been forced to implement telehealth monitoring in a timeframe of two weeks (Bau 2020), resulting in a substantial economic impact for the hospitals. This example demonstrates how the cost of care is continually changing making the healthcare system unsustainable (Porter and Lee 2013).

In healthcare, an approach that can help transition towards a sustainable healthcare system has been defined, called the Quadruple Aim (Bodenheimer and Sinsky 2014; Spinelli 2013). This practical framework consists of four aims and is an improved version of the Institute for Healthcare Improvement's Triple Aim. The first aim, 'improving the health of the population' focuses on patients (and potential future patients). It is currently the core aim of care providers (Pannunzio, Kleinsmann, and Snelders 2019). The second aim 'improving the work-life of care providers', is currently underemphasized (Brik 2019), but should be considered

equally important as, for instance, low levels of job satisfaction among physicians reduce work performance (DiMatteo et al. 1993). The third aim, enhancing patients' experience, could also improve patient satisfaction and health outcomes (Rimer et al. 2004). Finally, the aim 'reducing health costs' relates to all different actors of the health system, including patients, care providers, government, among others. Existing cases, like the one of Johnson & Johnson who saved millions of dollars on care costs by investing in wellness (e.g. helping employees stop smoking), demonstrates that preventive measures can help reduce the cost of care by having healthy people demanding less care (Porter and Kramer 2011).

These four aims are interrelated. For instance, attempts to simultaneously improve the health of the population, patients' experience and reducing health cost may have a negative effect on the work-life of care providers as it further complicates their already stressful work-life (Bodenheimer and Sinsky 2014). Besides, these four aims challenge the way healthcare systems currently work. Implementing the four aims demands great inter-disciplinary efforts as existing governance structures, roles and relations between actors, and their current ways of operating need to be redesigned. Hence, implementing the Quadruple Aim is not a challenge exclusively assigned to care providers, but involves multiple disciplines and organizations.

## Open innovation in healthcare

Multiple disciplines and organizations can successfully innovate together through open innovation (Bergema et al. 2011), where actors with different backgrounds contribute with their unique perspective to solve a complex challenge. With this kind of collaboration, new ways forward can be discovered, and health practice can be strengthened. Existing research has also shown that open innovation provides

a space for collaboration that can fuel systemic change (von Wirth et al. 2019).

The presence of different actors from society, government, industry, and academia, and alliances between organizations contribute to foster knowledge to improve health, to provide more effective health services and strengthen the healthcare system (Leydesdorff 2012; Stone and Lane 2012). In open innovation, actors are dependent on each other's outcomes, and they need each other's knowledge to fulfil their responsibilities (Bergema et al. 2011).

In recent years, the term 'open innovation' has been popularized, and with this, multiple open innovation initiatives have emerged globally. For this research, we focused on open innovation initiatives in the health sector in the Netherlands.

## Method

The objective of this study was to explore how actors in open innovation initiatives approach the Quadruple Aim and find out which challenges they face. We wanted to gain a better understanding of their roles within the initiatives, their activities and how these allowed them to address the Quadruple Aim. A qualitative study with semi-structured interviews fitted well with this purpose (Patton, 2005).

We selected three different types of open innovation initiatives for this study: Innovation labs, Collaborative networks and Biotech spaces. Innovation labs focus on tackling complex societal challenges with an innovative approach and outcome (Brankaert and den Ouden 2017). Collaborative networks consist of organizations and actors that collaborate to achieve goals that they would not be able to achieve individually (Camarinha-Matos and Afsarmanesh 2005). Finally, Biotech spaces have the goal to provide space and equipment to start-ups or to other initiatives to accelerate their development process (Ledford 2015). A total of eight

initiatives were sampled, by identifying the purpose and the type of initiative through desk research, filtering out descriptions such as 'innovation network', 'collective design and production', and 'biomedical co-work space'.

Sixteen interviews were conducted; fourteen semi-structured interviews and two informal interviews. The interviews were designed to explore the purpose of the initiative and the role of the actors. Actors were asked to share examples of how they work on a project and the challenges they face, followed-up by questions regarding the four aims: improving the health of the population, improving the work-life of care providers, enhancing patients' experience, and reducing health costs.

For each initiative, one to three members with different roles and professional backgrounds were interviewed, to include different perspectives (Ravitch and Carl 2015). In addition, two people from an overarching subsidy program were interviewed (see Table 1). The interviews lasted between 40 to 90 minutes and were conducted face-to-face (7 interviews), through video call (6 interviews), or via phone call (3 interviews). All interviews were audio-recorded and transcribed verbatim except for the two informal conversations. The information was complemented by consulting the webpage for each initiative, reading papers shared by interviewees, and reviewing online publications.

Table 1. List of interviewees

Type of initiative	Role	Professional Background
Innovation lab		
I1	Program coordinator*	Industrial design engineering
	PhD researcher	Design for interaction
	PhD researcher	Industrial design
I2	Director*	Medicine
	Scientific co-director	Civil engineering
I3	Master student	Industrial design
I4	Designer & concept developer	Audiovisual and theatre
	Program developer	Psychology
Biotech space		
B1	Chief business officer	Biochemistry
B2	Director	Industrial Engineering
Collaborative network		
C1	Innovation manager	Business Information
	Innovation manager	Business innovation & entrepreneurship
C2	PhD researcher	Medicine
	Medical specialist	Medicine
Subsidy programme		
S1	Financial advisor	Social geography
	Project manager	Human geography
* Informal conversations		



The data analysis focused on how the Quadruple Aim is considered in each initiative. Hence, it was used as an analytical lens to explore what the initiatives deliver and miss regarding the four aims. For each interview, quotes related to each of the four aims were selected. The quotes per aim were then sub-clustered according to the type of activity or behaviour described. For example, for the aims 'improving the work-life of care providers' and 'enhancing patients' experience', sub-clusters such as 'health providers looking for data' and 'monitoring health through tools' were found respectively. Then, relationships between sub-clusters were explored. For instance, it was found that some innovations for the second and third aim were related to the roles of care providers (e.g. one relationship was labelled 'some innovations are creating new roles'). Based on the relations discovered, four observations of how open innovation initiatives address the Quadruple Aim were identified.

## Findings

Our data highlight how the Quadruple Aim (improving the health of the population, improving the work-life of care providers, enhancing patients' experience, and reducing health costs) is used by actors of open innovation initiatives to make the transition towards a sustainable healthcare system. Four observations regarding the implementation of the Quadruple Aim are presented below.

### 1) Improving the health of the population is the main aim

The data showed that improving the health of the population is a priority for the initiatives in this study. All the initiatives develop innovations to help or support patients, and to improve the lives of people. For instance, the scientific co-director of an Innovation lab mentioned:

Last week we started a new project focusing on how to support young adults with autism to empower them to have more control over their lives and to explore how technology could eventually support them, together with the caregivers and the case managers.

Some initiatives measure the impact of their innovation with regard to this core aim. The chief business officer of a Biotech space considered counting the number of patients that are being treated a success factor. While all initiatives focused on improving the health of the population, the other three aims are tackled differently in each initiative.

### 2) Not all initiatives are considering all four aims

What stood out was that none of the initiatives currently tackles all four aims present in the Quadruple Aim. Most initiatives do not even consider them all. For instance, some actors focus their initiatives on patients but do not consider improving the experience of health providers a priority.

The overall aim is to find a solution for medical needs. Whether the solutions make the surgeons' life easier is not necessary. But of course, we try not to make things more complicated.

(Chief Business Officer, Biotech space)

Another case relates to the reduction of care cost. Some actors consider reducing the cost of care impossible, while for others, reducing the cost of care is a priority. For instance, a PhD researcher in a collaborative network expressed that some innovations are expensive; therefore, reducing the cost of care is not possible. In Biotech spaces, the approach was completely different. One actor mentioned that cost reduction is a requirement to start a new project. Their aim is not only to experiment but also to commercialize because it is a public-private organization.

### 3) Solutions to one aim can cause new problems

Solutions to successfully implement a particular aim often raised challenges for the implementation of other aims. For example, a few members of Innovation labs mentioned they focus on preventive innovation, which could allow them to work towards a reduction of care costs.

So, prevention is a very hard challenge because you need to do a lot of things that you don't normally do in the health domain. But it is also one of the models where you have the biggest chances for cost reduction.

(PhD, Innovation Lab)

Not only a preventive approach but also e-health was mentioned as a promising approach to reduce the cost of care. However, these approaches create new roles that did not exist before. With these new roles, new challenges emerge. For instance, an emerging need is to define who will be looking at data and how the new approach will affect the work-life of care providers.

### 4) The Quadruple Aim is not assessed in a structured way

Finally, the data also indicates that most initiatives do not assess the Quadruple Aim in a structured way, because they either lack a sense of awareness on the topic or because they do not consider it as a priority. In some cases, some aims are being tackled indirectly, as a side-effect.

That [improving the work-life of care providers], is sometimes a side effect. [...] I think it has to do with the fact that if we are involved in a project with healthcare professionals, I transfer some knowledge because I facilitate a lot of workshops [...]. So, I am introducing design thinking methods, and they can use it in their daily work. [...] But I am not there in the hospital to see if they have used some of these methods or the insights we have

come across in the meetings. I think there is an impact, but I can't quantify it.

(Innovation manager, Collaborative network)

This example demonstrates that actors might be tackling more aims, but do not plan or intend this. It might be a consequence of another action realized. Hence, they do not always verify the impact of the aims because they might be tackled indirectly or unintentionally. Besides, in some cases, the impact does not come immediately, so the impact is difficult to measure.

## Conclusion

This study presents four observations related to how the Quadruple Aim is used by innovation initiatives to move to a more sustainable health system: 1) Improving the health of the population is the main aim, 2) Not all initiatives are considering all four aims, 3) Solutions to one aim can cause new problems, and 4) The Quadruple Aim is not assessed in a structured way. These four observations show that although the Quadruple Aim is a promising approach to transition towards a sustainable future, the implementation is still highly challenging.

Future research on how design can facilitate the implementation of the Quadruple Aim is recommended. We suggest making use of design methods and tools that can facilitate the process in practice. For instance, by supporting actors in considering and implementing all four aims in a structured way and detecting the possible impact of each aim within their initiative. Besides, tools could also focus on measuring or more structurally keeping track of the impact of implementing the Quadruple Aim.

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