Saving Lives With Gender Studies? Putting Technofeminism Into Practice

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Abstract: Although cardiovascular disease (CVD) is a major cause of morbidity and death for all humans, measurable differences can be observed as a function of both sex (e.g. in risk factors and clinical presentation, based on biological factors such as hormone levels or tissue structure) and gender (e.g. diagnosis, treatment, and clinical outcomes based on sociocultural factors such as roles, norms, behaviour; Kentner & Grace, 2017). Cardiovascular rehabilitation (CR) is known to significantly reduce CVD mortality and re-hospitalization rates, and increases quality of life for all genders. Nevertheless, women are less often referred to CR by physicians, which could be explained by multiple reasons, one of them unconscious sex and gender biases. Additionally, women face family responsibilities and lack of transportation options as greater hindering factors than men (ibid.). Those facts made CR a logical target for a medicine technology project, which developed (between 2018 and 2021) a multifunctional data patch for monitoring of vital signs and movements. These patches with printed ECG sensors can be worn on the skin for several weeks and thus can be used to support cardiovascular tele-rehabilitation. However, the use case of cardiovascular disease and the motivation to close the gender gap in its rehabilitation found its way into the technology design process only because the project received funding for implementing a gender perspective in an interdisciplinary team. The Austrian FEMtech research funding programme is an example of implementing a gender policy into practice by integrating gender as a cross-cutting issue in science and research as well as promoting gender equality in the research team itself. This paper analyses the application of a technofeminist approach (Wajcman 2004) in a project and outlines its implications. This started by raising awareness on the concept of "configuring the user as 'everybody' and the use of the 'I-methodology'" (Oudshoorn et al. 2004, p.30). It consequently followed a participatory technology design path, involving stakeholders from the very beginning. Thus, instead of only sticking to mandatory tasks of reflecting gender in meetings, the project team expanded their methodology and interdisciplinary setup into a transdisciplinary undertaking drawing on the RRI (responsible research and innovation) values of reflexivity, responsiveness, anticipation and deliberation (Stilgoe et al. 2013). In the long run, a gender-sensitive – technofeminist – research and design process should result in better and more comprehensive routines and products, thus, regarding medical and safety issues, potentially saving lives.

Keywords: technofeminism, feminist STS, medicine technology, participatory technology, cardio rehabilitation

1. Background

Although people of all genders can experience cardiovascular disease, such as heart attacks and strokes, there are measurable differences in both risk factors and consequences depending on biological and social sex. Kentner and Grace (2017) identify gendered risk factors including smoking, diabetes, and psychosocial influences such as stress, social isolation, and depression that are particularly relevant to women in the context of cardiovascular disease. However, a mixture of lack of awareness and unconscious perceptual errors ("unconscious bias") delay the diagnosis or treatment of women (e.g., ECG examinations). For example, in the context of heart attacks, women sometimes experience unique symptoms (such as anxiety, back pain, digestive disturbances, flu-like symptoms, fatigue) that are not recognized appropriately and therefore lead to late diagnoses and slower responses. On top of this, women themselves are more likely to seek help for others than for themselves (ibid.).

Cardiovascular rehabilitation (cardio-rehab for short) has been shown to be effective in significantly reducing mortality after cardiovascular disease and improving quality of life for all genders. Despite this, physicians are less likely to refer women for appropriate rehabilitation. One reason for this omission of treatment i gender biases. That is, a majority of physicians who explicitly report making their decisions regardless of their patients' gender actually judge women differently. For example, the benefits of cardio rehab for women are misperceived to be smaller and women are attributed with lower motivation for cardio rehab (Kentner & Grace, 2017).

In a meta-analysis that reviewed 623 scientific articles, nineteen studies were examined in more detail, providing data from 241,613 participants, including 80,505 women. The meta-analysis found that women were significantly less likely than men (49.4%) to be referred to cardio-rehabilitation programmes (39.6%) (Colella et al. 2014). Time, money, accessibility, and also the ascribed lower benefit for women lead to lower participation rates of women in cardio-rehab programmes. Some women are not educated about of cardio rehab

programmes, exercises that are not tailored to them might be experienced as painful and tiring, and in addition, family responsibilities and lack of mobility discourage more women than men from regularly participating in cardio rehab (Kentner & Grace, 2017). Furthermore, outpatient cardio rehab programmes provide structured exercise, knowledge, interdisciplinary support, and counselling and have a risk-minimizing and preventive effect. However, women are significantly less likely to be referred to outpatient cardio rehab programs, and men are one and a half times more likely to be referred than women (Colella et al. 2014).

What sounds like the logical starting point of a research and development project – the aforementioned knowledge about the glaring gender gap in cardio rehab – is actually one of the outcomes of the first of the two medicine technology projects, this paper is referring to. The first project, VITAPATCH, will be described in the next chapter, the follow-up project is only a proposal so far, which is outlined in the final chapter of this paper. What lies in the centre of both projects is a technofeminist approach, which combines gender and technology expertise – brought in by the author and her team – along the whole technology design process.

2. Gender-sensitive participatory technology design

This chapter analyses results and collaborative research process of a completed medicine technology project, which received funding for implementing a gender perspective in the interdisciplinary team[1]. Its aim was to develop a multifunctional data patch for monitoring vital signs and movements in everyday environments. Data patches are ECG sensors and piezoelectric elements on ultra-thin stretchable adhesive foils, which send signals to a smartphone app. The potential applications were envisioned from everyday use for fitness monitoring (like a fitness tracker but with the accuracy of a clinical apparatus) to dedicated medical purposes. Based on one year of research the project team decided on a specific use case focusing on cardio rehabilitation. Expert and stakeholder experiences and knowledge had been used by the gender researchers to develop different use case scenarios. Thus the applied gender research could be seen as a technofeminist approach "… of a mutually shaping relationship between gender and technology, in which technology is both a source and a consequence of gender relations." (Wajcman 2004, p. 107).

2.1 The methodological framework of the technofeminist approach

The gender researchers started the project VITAPATCH by integrating knowledge about feminist techno-science into the technology design process, for instance raising awareness on the concept of "configuring the user as 'everybody' and the use of the 'I-methodology '" (Oudshoorn et al. 2004, p.30). I-methodology is based on the fact that technology is developed without involvement of actual users, but by designers and engineers who construct a general idea of a user (an 'everybody') and try to put themselves in the role of the users. The problem with this is that the users' requirements and needs are derived from those of the designers.

Already in the stage of collaborative proposal development between physicists, engineers and feminist STS[2] researchers it became clear that the requirement of integrating gender can be used to apply a participatory technology design approach which includes stakeholders from the very beginning. Later on, when the interdisciplinary team met in their first meetings to exchange ideas about the cooperation, it was agreed that not only an intersectional gender approach, but also ethical, wider societal and even environmental aspects are of relevance and importance to the whole team and this innovation project.

So instead of sticking only to the demanded tasks of reflecting gender in meetings, the project team expanded their methodology and interdisciplinary set-up into a transdisciplinary undertaking drawing on the RRI (responsible research and innovation) values of reflexivity, responsiveness, anticipation and deliberation (Stilgoe et al. 2013) and gender knowledge of the author and her team shaped the whole research process.

[1] The project VITAPATCH – "Multifunctional Data Patch for Vital and Movement Monitoring in Everyday Environments" – was funded by the Austrian Research Promotion Agency (FFG) as a „FEMtech research project" and ran from 2018-2021 (https://www.ifz.at/en/projekt/vitapatch-multifunktionales-datenpflaster-fur-das-vital-und-bewegungsmonitoring). FEMtech projects must consider gender equality in the research team and gender as a cross-cutting issue on a research content level. The project partners were the Human Research Institute of Health Technology and Prevention Research GmbH (project leader), JOANNEUM RESEARCH Forschungsgesellschaft mbH, and the Interdisciplinary Research Centre for Technology, Work and Culture (IFZ). The gender research has been carried out by the IFZ team Anita Thaler (2018-2021), Lisa Scheer (2018-2019) and Julian Anslinger (2019-2021).

[2] STS refers to Science, Technology and Society Studies. Feminist STS respectively feminist technoscience analyse how gender in intersections with other social structures and identity markers is intertwined in sociotechnical practices and politics (c.f. Åsberg & Lykke 2010).

The empirical fieldwork – which put technofeminism into practice – (table 1, part 1 & 2) followed 27 specific objectives and a complex methodology comprising 49 meetings and workshops within the project team, four interviews and four workshops with experts and stakeholders. Additionally, the author and her colleagues in the 'gender team' regularly reflected on the project and the gender dimension among themselves, and assigned another colleague (social scientist) to evaluate the project using semi-standardised interviews with seven project team members (results of the evaluation see: Suschek-Berger & Thaler 2021).

Table 1: Empirical methods used by the gender researchers (part1)

Method	Objectives	Nr.	Actors	Space of time	Docu-mentation
Team meetings	1. To update all project partners about recent technology design activities. 2. To share gender and diversity knowledge relevant for the technology development. 3. To co-create knowledge on participatory technology design with a gender-sensitive approach (e.g. avoiding I-methodology). 4. To exchange information on planned and completed dissemination or publication activities.	45	Engineers and gender researcher(s)	Oct. 2018-Dec. 2019: 8 face to face; Mar. 2020-Sept. 2021: 36 online; Nov. 3 2021 final face to face	Minutes, log
Techno-logy workshop and lab tour	5. To understand the background, functionality and scope of the technology research. 6. To experience the working environment of the technology research.	1	Engineers and gender researcher(s)	Oct. 25, 2018	Log, slides, photos
Gender work-shops	7. To share knowledge about the background of the gender in technology-research approach (Feminist technoscience, STS; RRI) 8. To build a common understanding of 'gender', with special emphasize on queer, intersectional and diversity theories.	2	Engineers and gender researcher(s)	Nov. 21, 2018; May 31, 2021	Log, slides, photos
Expert interviews	9. To explore real life user scenarios for the patch application. 10. To assess potential ethical and/or technological difficulties. 11. To estimate the concrete demand of potential stakeholders.	4	Engineer(s), gender researcher(s) and potential stakeholders (physical therapy, sports science, cardiological rehabilitation, work psychology)	Dec. 4, 2018; Mar. 8, 2019; Mar. 28, 2019; Sep. 26, 2019	Summaries
Self-use tests	12 To experience the piezoelectric functionality of the multifunctional data patch from a user's perspective. 13. To obtain photos for dissemination activities.	1	Engineers and gender researcher(s)	Apr. 5, 2019	Log, photos, videos
Use case scenario workshop	14. To facilitate a decision-making process by presenting all potential use case scenarios including their technological requirements. 15. To assess benefits and difficulties of all scenarios concerning gender dimensions, ethical issues, technological relations. 16. To deliberate about whether a multifunctional data patch application can exceed other existing technologies, and how. 17.To collaboratively decide for one use case, which would be the basis for technology specifications and lead to	1	Engineers and gender researcher(s)	Apr. 5, 2019	Minutes, photos

Method	Objectives	Nr.	Actors	Space of time	Docu-mentation
	upcoming stakeholder /user participation activities.				
Stake-holder work-shops and user feedback	18. To share knowledge about the current development status of the technology. 19. To receive knowledge about different perspectives (hospital/cardiology, physical rehabilitation, patients) of cardiological rehabilitation. 20.To co-create gender-sensitive knowledge about the future application of the multifunctional data patch in the concrete use case of cardiological rehabilitation 21. To decide on a specific cardio-rehab-exercise (to be done at home), to calibrate the functionalities of the multifunctional data patch. 22.To discuss expectations and receive feedback on the multifunctional data patch and its app.	4	Engineers, gender researcher(s), therapists and sport scientists from cardiological rehabilitation, cardiologist, representative of the association aiming at rehabilitation and prevention of cardio-vascular diseases ("Austrian heart association")	Dec. 9, 2019; Apr. 29, 2020; Jul. 7, 2020; Aug., 23, 2021;	Minutes, log, photos
Eval-uation interviews	23. To evaluate whether the gender perspective could add value to the technology development. 24. To evaluate the potentially co-created knowledge within the research project.	7	Engineers and gender researchers	Jul. 2021	Evaluation report
Reflection meetings	25. To reflect on the role of gender research within the technology development project. 26. To reflect on literature, methodology and results from empirical work. 27. To discuss planned and finished activities of the gender team in the project.	28	Gender researcher team	Oct. 2018 - Sept. 2021	Log

All interviews have been summarised, all meetings and workshops documented in a project log written by the gender researchers, additional meeting and workshop minutes have been written in turn by and shared with the whole interdisciplinary team. In the following section I describe a specific phase of the project in greater detail, in order to highlight the role gender research can play within a technology design project using a technofeminist approach.

2.2 One result in detail: Deciding on the use case of cardio-rehab

In the beginning of the project (December 2018 to March 2019) a series of interviews – done by the previously mentioned gender team and an engineer[3] – with experts from physical therapy, cardiology and work psychology led to a broadening of potential applications of the data patch and its app. Furthermore, these interviews brought attention to ethical, legal and other challenges of the project.

By choosing the experts who are talked to, the direction of the technology development can be strongly influenced, what can be seen as "politics of representation" (Rohracher 2005, p. 15) – "When one representation of users becomes dominant, other possible representations are always covered up or 'silenced'." (ibid. p. 16).

However, in the eyes of the gender team the 'greater danger' was to not commit to a specific use case and "configure the user as everybody". Physicists and engineers did not need the specification of a field of application to pursue their work on sensors, the variations of the ultra-thin foil, the miniaturisation of electronics or even the smartphone app> They focused technical difficulties. All these technical solutions can be engineered with a wide variety of use cases in mind.

Yet the author recognised that by keeping the technology supposedly "open" implicit use of I-methodology becomes much more likely. The technology development needed decisions, for instance on the sensors used to

[3] Anita Thaler and Lisa Scheer (gender researchers at IFZ) and Matthias Frühwirth (engineer at HRI) did these interviews in the course of the project VITAPATCH.

measure what kind of body functions (e.g., if the heart rate and a dynamic movement had to be monitored) and the exact location of the patch on the body (which has consequences on the layout of the patch and the design of amplifiers). It all resulted in the need to come up with specific movements of the body which could be monitored by the sensors. Lacking a defined use case, the engineer running the tests in the lab decided on a physical exercise which was ideal for showing features of the monitoring device: rowing. But none of the expert interviews suggested the rowing machine as a potential field of application. The suggestion of rowing then became an example of keeping the technology development 'supposedly open' to 'everybody' and simultaneously showed the potential gendered consequences of this strategy. It was indeed a case "in which designers develop artifacts for 'everybody' [yet] they often unconsciously base their design choices on a one-sided, male user image" (van Oost 2003, p. 196).

In April 2019 the technofeminist team finally organised a scenario workshop for the whole project team, which portrayed all potential fields of applications discussed in previous expert interviews plus additional ideas from media and literature research. When the most relevant use cases were discussed and assessed, the team decided to focus on a societal relevant technology and chose cardiological rehabilitation as field of analysis and application.

In hindsight, this was the phase, where the gender researchers had the strongest influence on technology development. By demanding to configure 'the user as somebody' the relative openness and many options were narrowed down to a specific use case. This can be seen as "closure" in the actor-network theory, although this closure is not a singular event but rather a process, which can theoretically be re-negotiated (Bammé & Spök 2014).

The technofeminist approach of a gender-sensitive participatory technology design has in the meantime been integrated in a series of webinars by the author and her colleagues[4]. Between June 2021 and January 2022, 27 researchers and managers from thirteen Austrian research performing and two research funding organisations participated, to co-create gender equality knowledge specifically for technology research. A follow up project of VITAPATCH is now emerging which I briefly outline in the next chapter.

3. Outlook

In this final chapter I demonstrate how the developed technology of VITAPATCH can result in better and more comprehensive routines and products with an ongoing gender-sensitive technology design. This more comprehensive design approach profoundly impacts medical and safety issues, potentially saving lives.

During the Covid 19 pandemic and associated lockdowns, outpatient cardio-rehab centres expanded tele-rehabilitation services by 52%, according to a Belgian study (Scherrenberg et al. 2021). It showed that videos (71%) and information on websites and via e-mail (64% each) were most frequently offered. Only a minority offered real-time online exercise (14%) and asked their patients to monitor their physical activities via technical monitoring devices (e.g., fitness watches or other wearables) (29%). None of the centres used a smartphone app.

Patients value cardio-telerehabilitation programmes because they are not limited to clinical settings and can be flexibly adapted to everyday life. Telerehabilitation is generally better accepted and more engaging when the programme is consistent with the patient's self-image, can be integrated into daily life, and is not perceived as an extra challenge (Knudsen et al 2021).

In contrast, high dropout rates from the use of mobile technologies in cardiac rehabilitation have been seen due to a lack of acceptance, usability, and user-friendliness of the technologies. Participatory technology development can in turn help to increase acceptance and usability (Meinhart et al. 2021).

In a review of the effectiveness of mobile technologies (such as existing tracking devices, fitness watches, etc.) for promoting physical activity in cardiac rehabilitation, Meinhart and colleagues (2021) found that all thirteen studies analysed addressed the underrepresentation of women, yet women made up for only 14% of

[4] The webinar series was part of the project CHANGE, which has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 787177. The Austrian team at IFZ, who coordinates the project, Anita Thaler, Sandra Karner and Julian Anslinger, was also responsible for the mentioned webinar series (more info see: https://www.change-h2020.eu/).

participants in total. Future research must include gender equality already in the sampling, the authors argue (ibid.).

The VITAPATCH project team therefore plans a new gender-sensitive technology design project based on the idea of co-construction of technology and its users (Oudshoorn & Pinch 2003). Harald Rohracher (2006) called this co-construction approach "Mutual Shaping of Design and Use" to underpin the fluidity in technology development as well as use. Specifically, this means that there must be constant back and forth between technology developers, anticipated users, and real users, and that the technology development process must be iterative (Oudshoorn & Pinch 2003). In a next step, VITAPATCH will therefore be expanded into a transdisciplinary project to include experts from cardio-rehabilitation, IT usability, patient representatives, a women's health centre, and a female cardiologist.

The planned project will again integrate critical diversity theory (Herring & Henderson 2012), as it is particularly important to target previously understudied populations in this research field. This is because in order to reach potential rehabilitation clients as comprehensively as possible, it is important to pay attention to "lost clients" in addition to already active rehabilitation clients, so as not to widen the gender gap in cardio-rehab even further by introducing a new technology. A meta-study showed that women were significantly less likely than men (49.4%) to be referred to cardio-rehabilitation programmes (39.6%) (Colella et al. 2014).

The proposed technology should reach potential rehabilitation clients, referred to as non-users in technological terms, should also be targeted. On the one hand, this is to avoid tailoring new technologies only to the target group that is already well reached with existing rehabilitation measures. On the other hand, this is a socio-technical system that does not only consist of a single technology, but is integrated into an interaction of technology and social interactions, in the concrete case with effects on the way cardio-rehab is carried out, who it reaches, how it is integrated into existing programmes, how it is financed, etc. Finally, technologies can also have an impact on non-users (cf. Sally Wyatt's example of non-drivers who are also affected by the socio-technical system of car transport, Wyatt 2003). The goal of the planned project and its gender-sensitive participatory technology design approach is in particular to minimize the gender gap and to consistently target the technology to older and female (potential) users and thus to reduce mortality of patients with cardiovascular diseases, especially women.

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