

Implementation and Scale-up of Telemonitoring in the Netherlands

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Abstract. The healthcare system requires reforms for equitable and sustainable care. Telemonitoring offers a solution, yet its implementation lacks research. In the Netherlands, University Medical Centers (UMCs) lead healthcare transformation through the Citrien-2 network, scaling up three telemonitoring programs from 2020 to 2022. An uncontrolled before-after study design was used to evaluate upscaling. Primary outcomes focused on telemonitoring normalization using the Normalisation Process Theory (NoMAD). Secondary outcomes included patient uptake and qualitative analyses. Results show implementation across projects and UMCs, with overall increased patient uptake. Healthcare professionals perceive telemonitoring positively, but challenges persist in integrating it into workflows. Continuous assessment is crucial for addressing implementation complexities and maximizing telemonitoring's impact on healthcare delivery.

Keywords. Remote patient monitoring, telemonitoring, implementation, network

1. Introduction

The healthcare system faces unprecedented strain due to an aging population, rising expenditures, and a shortage of skilled professionals. The impact has been further exacerbated by the onset of the COVID-19 pandemic [1]. To ensure equitable and sustainable care for all, healthcare reforms are imperative [2]. Digital technology offers a pathway to address these challenges, facilitating the delivery of high-quality, accessible, and sustainable healthcare [3,4].

Telemonitoring (TM), a promising tool for managing long-term conditions remotely, has the potential to reduce costs and improve patient access to primary

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healthcare [1]. TM involves using information technology to monitor patients' health status from a distance. It encompasses data collection, transmission, evaluation, and communication between patients and healthcare providers or extended care teams [5].

Despite its promise, there is to date limited research on the implementation of eHealth solutions [6,7]. Governments and policymakers recognize the urgency of scaling up digital innovations like telemonitoring to future-proof healthcare systems [8]. In the Netherlands, the Ministry of Health, Welfare, and Sport (VWS) has tasked University Medical Centers (UMCs) with leading healthcare transformation [9]. Collaborating through a national health program overseen by the Dutch Netherlands Federation of University Medical Centers (NFU), UMCs in the Netherlands are forming a robust network known as "Citrien Implementation and Upscaling" (Citrien-2) to drive digital healthcare advancements, aimed to scale up three telemonitoring initiatives in all UMCs nationwide [10].

The aim of this study is to evaluate to what extent three telemonitoring programs are scaled up in all seven Dutch University Medical Centres (UMCs) between 2020 and 2022.

2. Methods

2.1. Study design

An uncontrolled before-after study design was used to evaluate upscaling of three telemonitoring applications in the Citrien-2 program over the years 2020 to 2022:

1. Telemonitoring for patients with cardiac rhythm abnormalities (TM Cardio)
2. Telemonitoring of blood pressure in pregnant women (TM Antenatal)
3. Continuous wireless monitoring of vital functions on hospital wards (TM Vitals)

The detailed study protocol for this Citrien-2 implementation program has been previously published [11].

2.2. Primary outcome

To interpret individual- and group behavior for the implementation of telemonitoring we used the Normalisation Process Theory and the associated Normalisation Measurement Development tool (NoMAD) based on this theory [12]. Citrien-2 program project leaders within each UMC recruited participants for each telemonitoring project to take part in an online survey.

2.3. Secondary outcomes

The absolute number of patients using telemonitoring within each UMC were collected. Additionally, in a two-step qualitative design, the perceived value of the Citrien-2 network was evaluated using a questionnaire and a focused group interview (FGI).

2.4. Data collection

Counts, frequencies and means were used to describe the sample and summarize the primary and secondary outcomes. The data was collected between January 2020 and January 2023. Every three months, the uptake was reported. The data was collected by the project leaders in each UMC.

The FGI was analyzed based on qualitative content analysis. The transcript of the interview was examined independently by two researchers (HG and TvdB). Both researchers performed open coding and categorization of codes independently. After independent categorization, consensus was reached on categories based on discussion. The categories were structured according to the NASSS framework [13].

2.5. Ethical considerations

The study was conducted according to the ethical principles outlined in the Declaration of Helsinki (World Medical Association, 2008). The study was reviewed as non-WMO research and ethical approval for was obtained from the AmsterdamUMC Medical Ethics review board (nr: 2023.0208).

3. Results

In total, 160 professionals were invited to participate in the NoMAD survey. After three reminders, 98 (61%) invitees responded and completed the full survey. The majority of respondents (81.7%) of the NoMAD were healthcare professional like doctors, nurses or midwives. Further analysis of the 16 sub constructs of (un)successful implementation are presented with mean scores and frequency distribution of item responses in Figure 1.

All UMCs actively operate telemonitoring, although not all three telemonitoring projects were implemented in each UMC. In total, the cumulative number of patients using TM increased from 700 patients in January 2020 to 17.000 end of December 2022. (Figure 2) TM Cardio in all UMCs has increased from 190 patients January 2020 to 5185 patients end of 2022. The number of patients using TM Antenatal has increased from 41 to 1162. An increasing number of patients were continuously remote monitored, from 2666 in January 2020 to 13630 end of 2022.

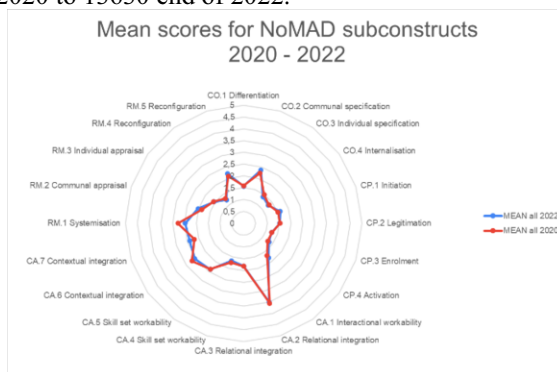


Figure 1. Spider chart showing mean scores of 1) all responses 2022, and 2) all responses 2020. CO: coherence, CP: cognitive participation, CA: collective action, RM: reflexive monitoring.

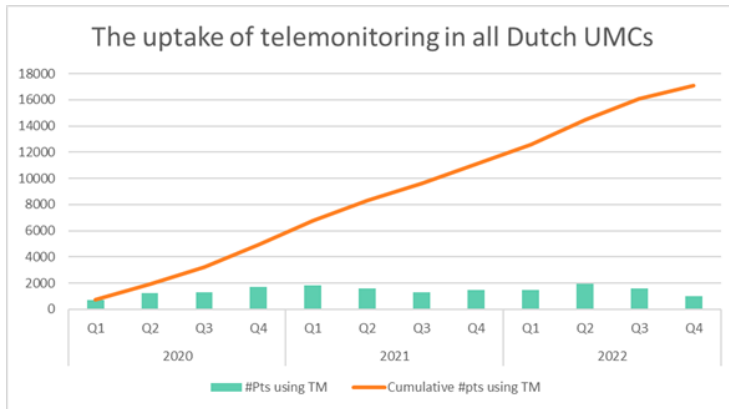


Figure 2. The total uptake of three telemonitoring projects in all Dutch UMCs between 2020 and 2022

Based on the FGI, the Citrien-2 network provides several benefits, including: Encouraging the sharing of ideas and actively exchanging documents, fostering collaboration, incorporating project management from Citrien-2, offering either financial or in-kind support and encouraging the purchase of devices with a financial boost. More in general, participants appoint the Citrien-2 network as a catalyst for implementation and upscaling.

4. Discussion

The aim of this study was to evaluate the upscaling and normalization of telemonitoring within Dutch UMCs. There is consensus among HCP regarding how telemonitoring will alter their work and the associated value. Healthcare professionals also consider the application of telemonitoring with their colleagues in their workplace. Despite the clear upward trend in telemonitoring utilization, as indicated by uptake figures, it is noteworthy that the results of the overall NoMAD results remain largely consistent with the baseline measurement taken in 2020.(14) More in depth analysis will be published elsewhere. When considering the integration of telemonitoring into the routine workflow, it is evident that healthcare providers involved in telemonitoring express a more positive outlook on the resources, training required for telemonitoring and managerial support. An exception is that HCPs in 2022 are better informed about the literature on the effects of telemonitoring compared to 2020. Moreover, a clearer difference can be observed between respondents involved in TM projects and HCP not involved.

Our qualitative study demonstrates that the Citrien-2 network is considered as a valuable contribution to overcoming barriers, such as regulatory issues and reimbursement. One of the findings of our study is the perceived added value of the network in accelerating implementation. This is fully in line with the Dutch government's stated societal mission to provide care at a distance wherever possible. (2) The role of acting as an innovation catalyst also fits in with the role that the UMCs see for themselves in optimising innovation through networking. (15) Future research will elaborate on this qualitative analysis.

5. Conclusions

This study evaluates the upscaling of telemonitoring in Dutch UMCs by measuring the degree of normalization and patient uptake. The integration of telemonitoring in clinical workflows shows positive perceptions among involved healthcare providers, with program-specific variations. Overall uptake of telemonitoring increased across all three telemonitoring projects. The study found a consensus among healthcare professionals regarding its impact. Despite consistent NoMAD results and increased uptake, challenges remain in achieving normalization in day-to-day work and uncertainties persist regarding the association between uptake and outcomes. The findings confirm the complexity of telemonitoring implementation.

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