Integrating digital medication adherence technologies into person-centered interprofessional care

The ENABLE repository

Alexandra L. Dima, PhD, Principal Researcher, Avedis Donabedian Research Institute (FAD); Universitat Autònoma de Barcelona (UAB); PRISMA, Institut de Recerca Sant Joan de Déu (IRSJD); CIBERESP

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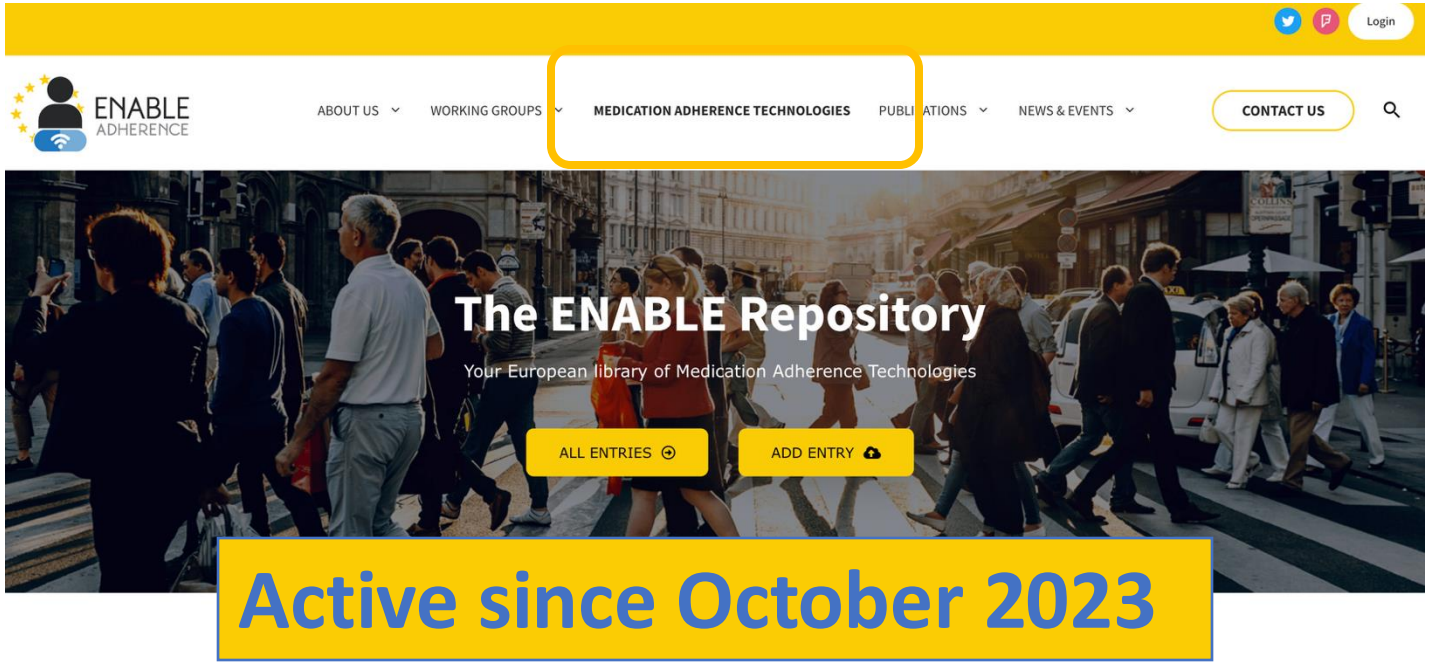
ENABLE ADHERENCE

The ENABLE repository of medication adherence technologies



Active since October 2023

About the repository

In recent years, many solutions have been developed to support users take medication as recommended to achieve the expected therapeutic benefit. We call these solutions **Medication Adherence Technologies** – in short: **MATech**. These may be for example electronic devices that record medication intake, dose dispensers that instruct on time or mode of administration, mobile applications that provide information about a health condition or medication or reminders, etc.

The ENABLE repository aims to raise awareness on the diversity of technologies available and the evidence base relevant for decision making, and showcase technologies available in different European countries. Through this repository, the ENABLE network intends to promote collaborations for the continued development and adoption of technologies in routine care, and connect potential users with technologies that may match their needs and preferences.

https://enableadherence.eu/enable-repository-matech/

FARMAME

Meddox

HealthLy app

AsthmaTuner

FindAir ONE pMDI

Pill Connect

Medimi®Smart

Dosell

SENO

HIPR

Pilloxa

Calendula SERGAS

Digital Health Passport: Asthma & Allergy Tracker

Lung Health for Kids

Mobile App AIFA Medicinali

Hailie Smart Inhaler

Mobill™ e-dosett

Smart Health TV Solution

Comprehensive medication management services

Mymemo

My Medication Review (MijnGiB)

Albert Health

MySpira

OMRON Asthma Diary

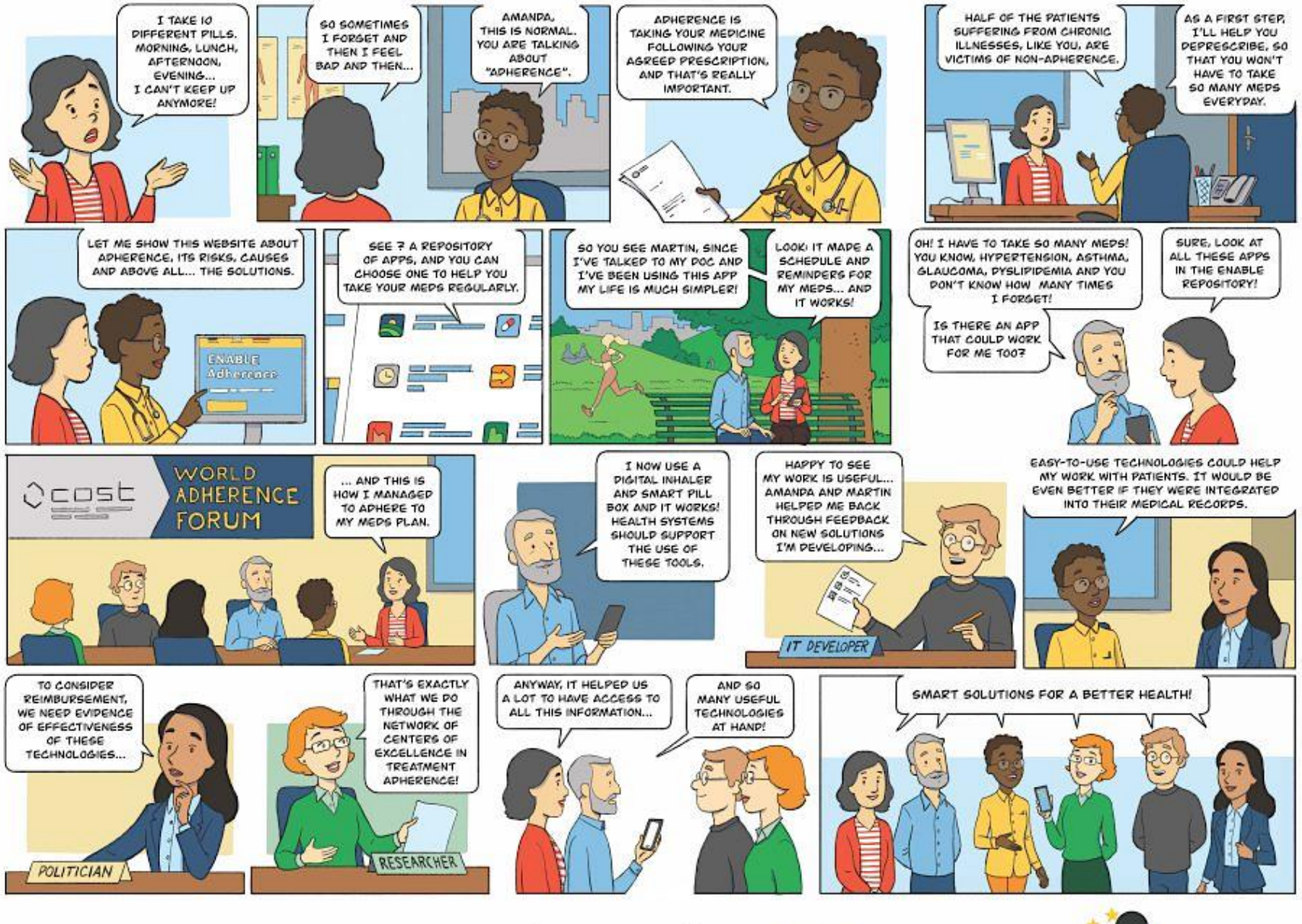
TERAH

My Health Everyday App

SPUR

Mepill

Medose



This article/publication is based upon work from COST Action ENABLE, supported by COST (European Cooperation in Science and Technology)

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The ENABLE COST Action (2020–2024)

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Current practices & unmet needs

- Survey of ≈3000 HCP in 37 European countries on practices, barriers and facilitators
- Medication adherence in HCP training curricula

Adherence technologies

- The ENABLE adherence technologies repository & taxonomy

Implementation & sustainability

- Survey of 39 countries on reimbursement of adherence technologies

Communication

- 200+ member network, 40 countries – meetings, training schools, short-term mobilities
- National/regional expert centers/networks
- Patient engagement guidelines for adherence technology development

enableadherence.eu

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Do we have common ground on what is relevant to know about technologies?

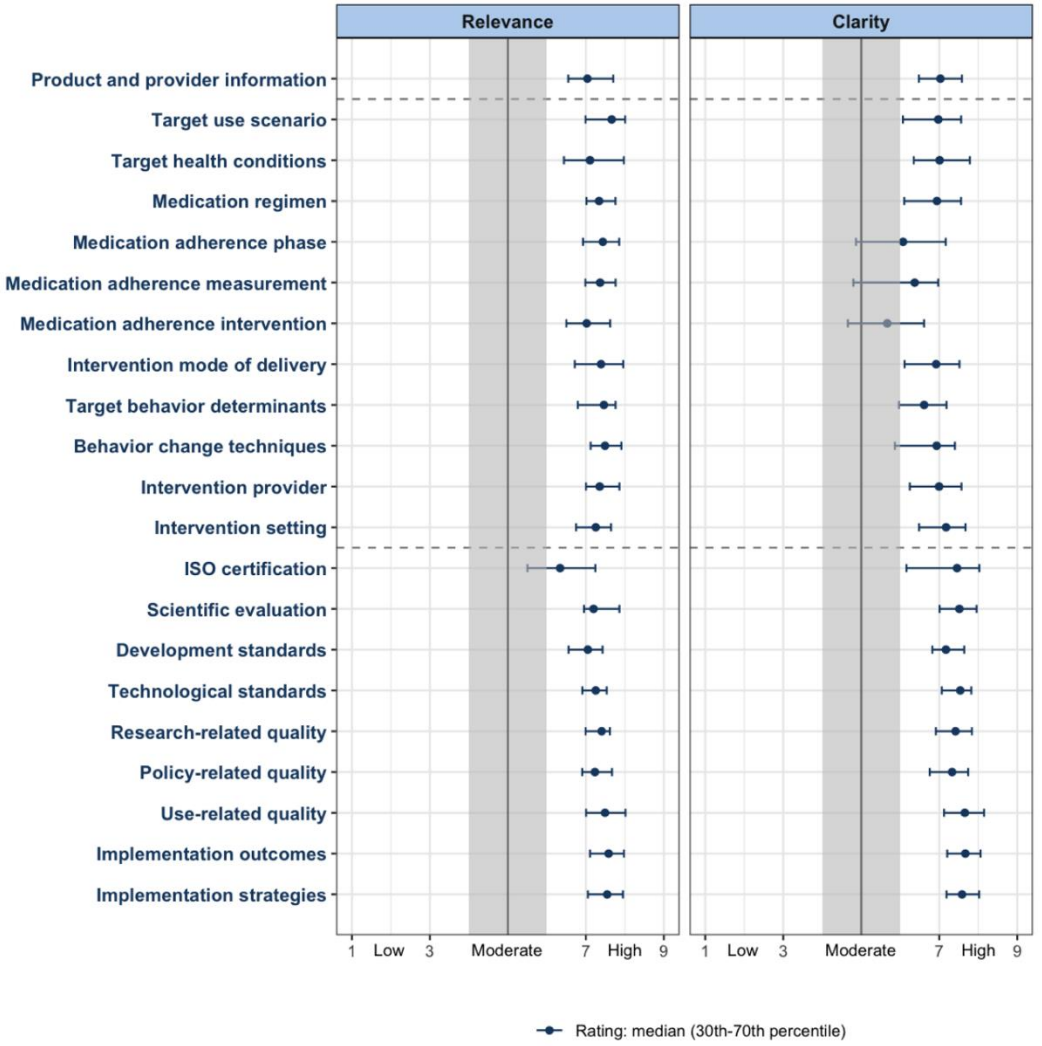
JOURNAL OF MEDICAL INTERNET RESEARCH Dima et al

Original Paper

Stakeholder Consensus on an Interdisciplinary Terminology to Enable the Development and Uptake of Medication Adherence Technologies Across Health Systems: Web-Based Real-Time Delphi Study

Alexandra Lelia Dima[1,2,3], PhD; Urska Nabergoj Makovec[4], PhD; Janette Ribaut[5,6], PhD; Frederik Haupenthal[7], MD; Pilar Barnestein-Fonseca[8], PhD; Catherine Goetzinger[9], PhD; Sean Grant[10], PhD; Cristina Jácome[11], PhD; Dins Smits[12], PhD; Ivana Tadic[13], PhD; Job van Boven[14], PhD; Ioanna Tsiligianni[15], PhD; Maria Teresa Herdeiro[16*], PhD; Fátima Roque[17*], PhD; European Network to Advance Best Practices and Technology on Medication Adherence (ENABLE)[18,19*]

Figure 1. Median ratings with interpercentile range for relevance and clarity per attribute cluster (N=83). ISO: International Organization for Standardization.



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What technologies are available?

What behaviour change features they include?

Patient Preference and Adherence

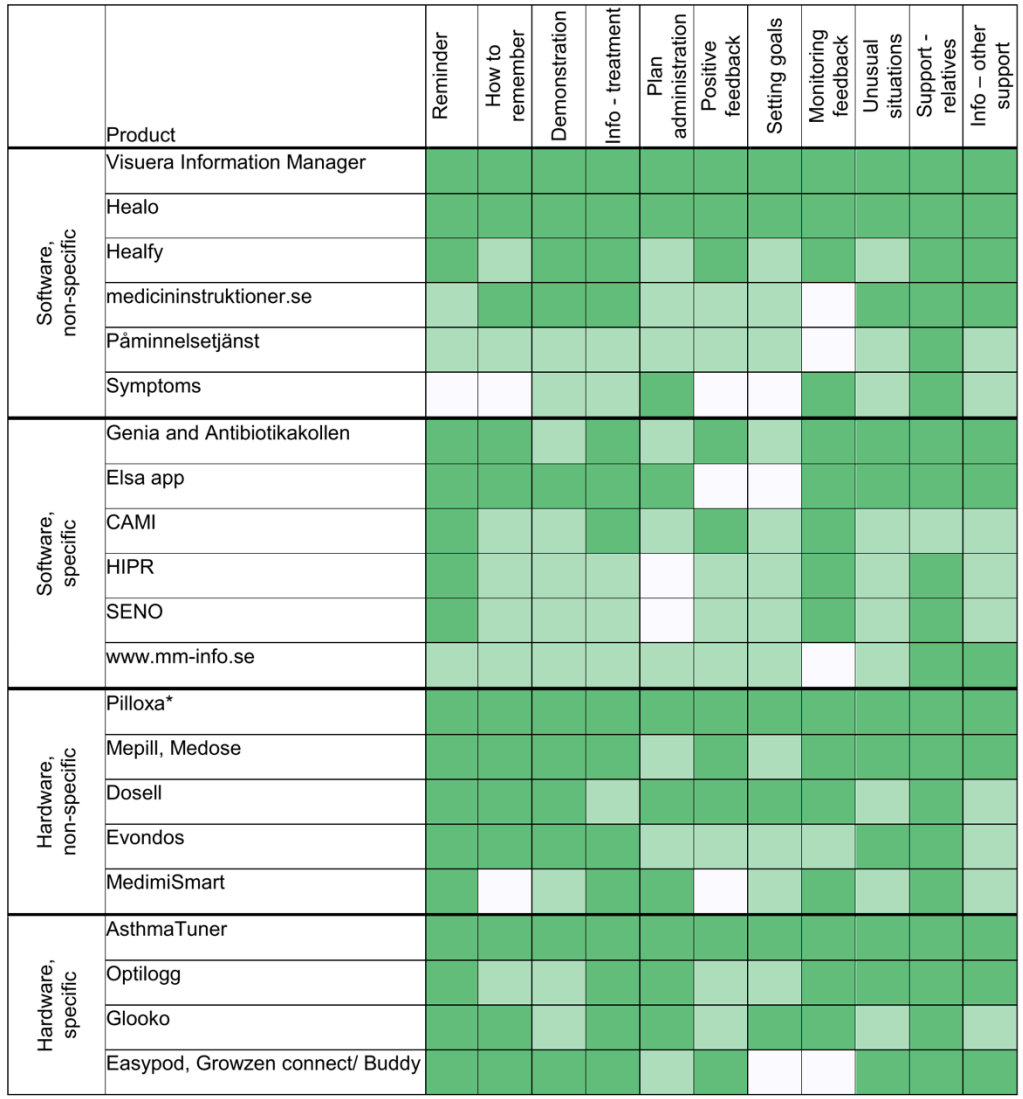
Dovepress

Open Access Full Text Article

ORIGINAL RESEARCH

A Cross-Sectional Study Identifying Medication Adherence Technologies (MATech) in Sweden Using Behavior Change Techniques

Marie Ekenberg, Fanny Landin, Björn Wettermark



	Product	Reminder	How to remember	Demonstration	Info - treatment	Plan administration	Positive feedback	Setting goals	Monitoring feedback	Unusual situations	Support - relatives	Info – other support
Software, non-specific	Visuera Information Manager											
	Healo											
	Healfy											
	medicininstruktioner.se											
	Påminnelsetjänst											
	Symptoms											
Software, specific	Genia and Antibiotikakollen											
	Elsa app											
	CAMI											
	HIPR											
	SENO											
	www.mm-info.se											
Hardware, non-specific	Pilloxa*											
	Mepill, Medose											
	Dosell											
	Evondos											
	MedimiSmart											
Hardware, specific	AsthmaTuner											
	Optilogg											
	Glooko											
	Easypod, Growzen connect/ Buddy											

Figure 2 Behavior change techniques included in the MATech; dark green =features included, light green = features not included, white =not reported/ unknown. Specific; specific for a disease or medication. Complete questions and BCTs can be found in Table S1. *Could also be used without the hardware, software only.

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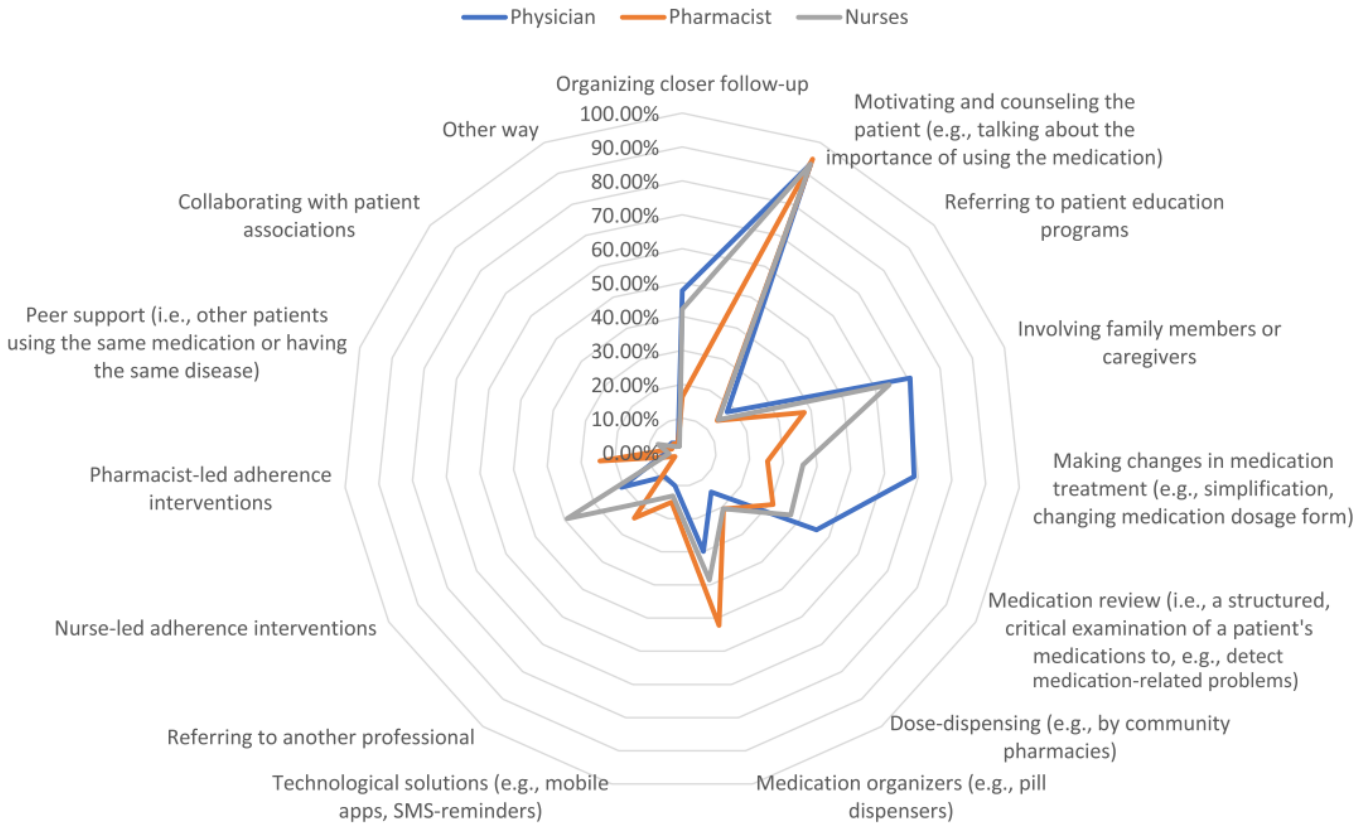
How do healthcare professionals support adherence?



BJCP British Journal of Clinical Pharmacology

ORIGINAL ARTICLE | Open Access

Pan-European survey on medication adherence management by healthcare professionals

Maria Kamusheva, Emma Aarnio, Miriam Qvarnström, Gaye Hafez, Sara Mucherino, Ines Potočnjak, Indre Trečiokiene, Jovan Mihajlović, Marie Ekenberg, Job F. M. van Boven, Francisca Leiva-Fernandez, European Network to Advance Best Practices and Technology on Medication AdherencE (ENABLE)

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What barriers and unmet needs do HCPs face?

Barriers and Unmet Educational Needs Regarding Implementation of Medication Adherence Management Across Europe: Insights from COST Action ENABLE

Gaye Hafez, PhD[1], Emma Aarnio, PhD[2], Sara Mucherino, Pharm D, PhD[3], Maria Kamusheva, PhD[4], Miriam Qvarnström, PhD[5], Ines Potočnjak, MD, PhD[6], Indre Trečiokiene, PhD[7], Jovan Mihajlović, PhD[8,9], Marie Ekenberg, PhD[5], Job F. M. van Boven, Pharm D, PhD[10], and Francisca Leiva-Fernández, MD[11]European Network to Advance Best Practices Technology on Medication AdherencE (ENABLE)

Training needs	Count (%)	Count (% within European Region)		
	Europe	Western Europe	Central Europe	Eastern Europe
How to monitor and evaluate medication adherence	1032 (35.9)	307 (29.3)	537 (39.7)	188 (39.6)
How to get patients to take an active role in their medication adherence management	889 (30.9)	367 (35.0)	401 (29.7)	121 (25.5)
Healthcare professionals' roles and responsibilities in medication adherence management	873 (30.4)	266 (25.4)	484 (35.8)	123 (25.9)
How to talk with patients about medication adherence	747 (26.0)	244 (23.3)	376 (27.8)	127 (26.7)

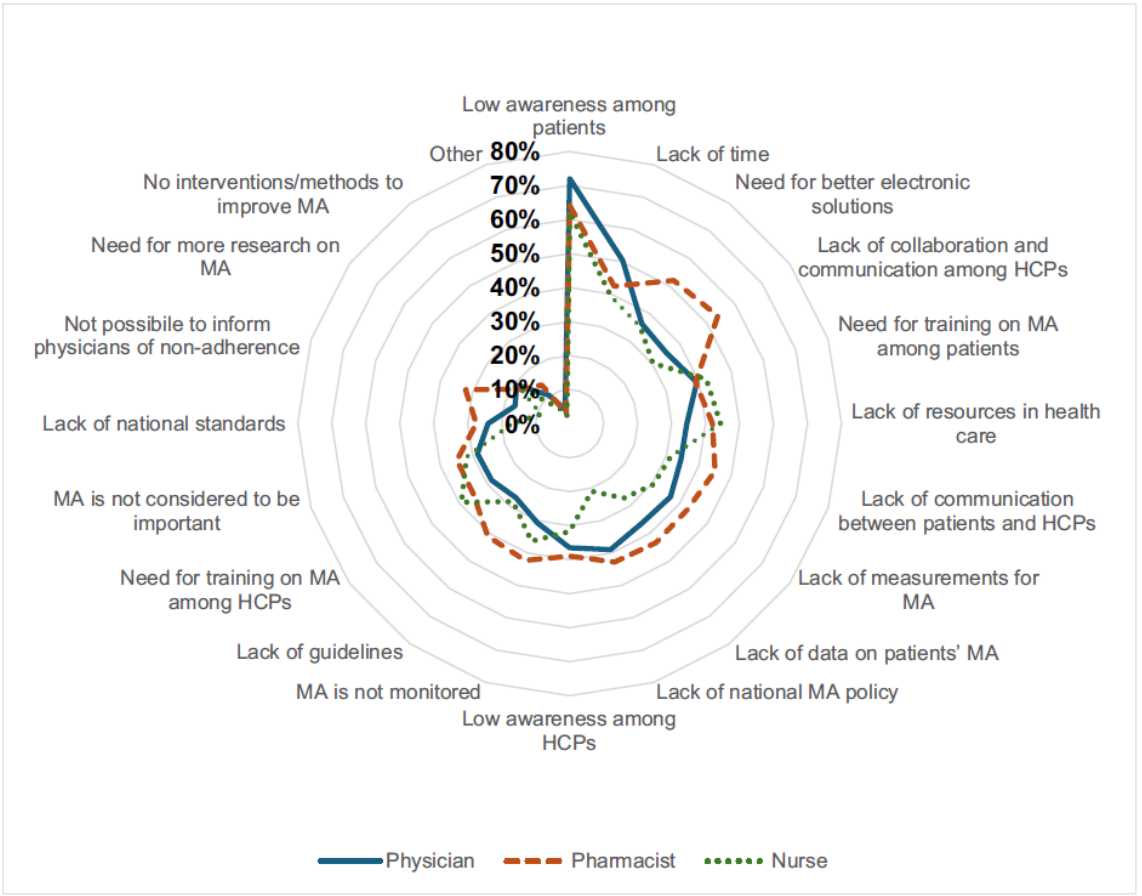

Fig. 1 Unmet needs regarding medication adherence reported by European healthcare professionals, stratified by profession.

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What adherence interventions are reimbursed in Europe?

frontiers | Frontiers in Pharmacology

Reimbursed Medication Adherence Enhancing Interventions in European Countries: Results of the EUREcA Study

Tamás Ágh[1,2†], Maja Ortner Hadžiabdić[3†], Kristina Garuoliene[4†], Anne Gerd Granas[5,6†], Emma Aarnio[7†], Enrica Menditto[8†], João Gregório[9†], Pilar Barnestein-Fonseca[10†], Vildan Mevsim[11†] and Przemysław Kardas[12†] European Network to Advance Best Practices and Technology on Medication Adherence (ENABLE)*

TABLE 2 | Characteristics of identified reimbursed medication adherence enhancing interventions.

Type of Intervention	Country	Year of Introduction	Level of Intervention	Target Population	Who Pays the Reimbursement?	Who Gets the Reimbursement?
Multi-dose drug dispensing	Belgium	2012	National	Elderly patients	Public insurance /Public healthcare system /Government	Pharmacy
	Denmark	2001	National	Elderly patients		
	Finland	2006	National	Reimbursed only for patients ≥75 years of age and using ≥6 drugs suitable for drug dispensing		
	Norway	Early 2010s	National	Elderly patients		
	United Kingdom	2014	National	Elderly patients, or those otherwise struggling to cope with their medication		
Medication review	Hungary	2019	National	40–65 years old patients with chronic disorders	Public insurance /Public healthcare system /Government	Primary care (GP)
	Slovenia	2016	National	Patients with drug related problems; identified and referred by a GP		Primary care (clinical pharmacist)
	Spain	2012	Regional	Patients with chronic diseases and polypharmacy		Primary care, Hospital and Pharmacy
	United Kingdom	Years ago	National	Patients on long-term medication		Pharmacy and Hospital
Smart device	Finland	2019	National	Patients on rheumatoid arthritis medication	Pharma company	IT company
	Netherlands	2020	National	Patients with asthma/COPD	Public insurance /Public healthcare system /Government and Pharma company	Pharmacy
Mobile application	Denmark	No information	National	Patients with mental disorder	No information	No information
Patient education	Hungary	2016	National	Newly transplanted patients	Patient organization	Healthcare providers

COPD, chronic obstructive pulmonary disease; GP, general practitioner; IT, information technology.

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Would national/regional expert centers/networks help promote adherence?

pharmaceutics

MDPI

Perspective

Half a Century of Fragmented Research on Deviations from Advised Therapies: Is This a Good Time to Call for Multidisciplinary Medication Adherence Research Centres of Excellence?

Przemysław Kardas [1,*], Tamás Ágh [2,3], Alexandra Dima [4], Catherine Goetzinger [5,6], Ines Potočnjak [7], Björn Wettermark [8,9] and Job F. M. van Boven [10]

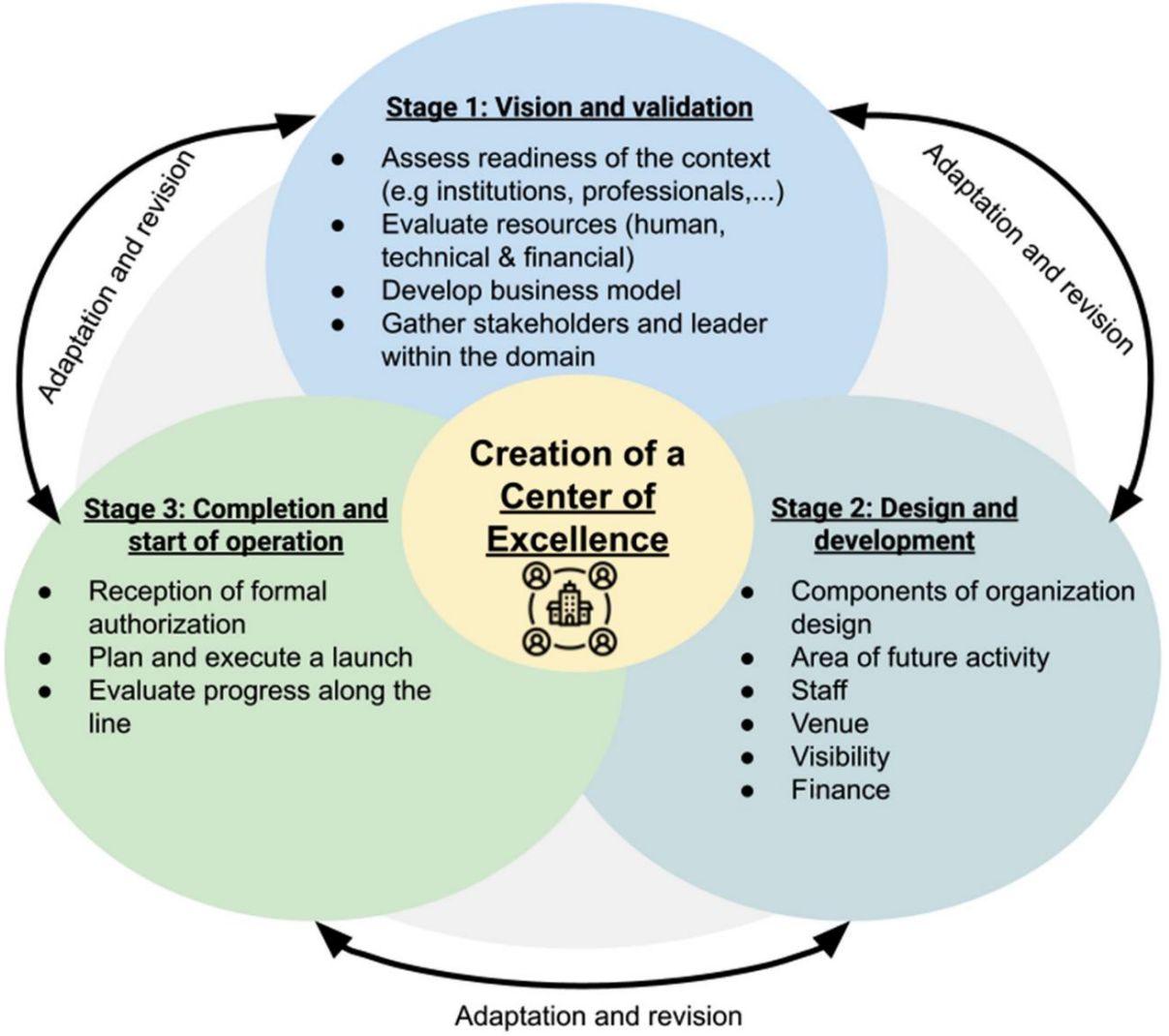

Figure 2. The 3-stage model of creation of a medication adherence research centre of excellence.

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How to develop and implement person-centered technologies for medication adherence?

INNOVATION

1. Context Analysis & Problem Definition
   - Analysis of factors and needs of the target group
   - To identify and clearly understand the problem
2. Ideation & Conceptualization
   - To overview existing scientific evidence and horizon scanning
   - To flesh out possible solutions
   - To familiarize with existing guidelines and regulations
   - To define a theoretical foundation or framework
3. Funding
   - To secure financial resources necessary

RESEARCH & DEVELOPMENT

1. Proof of Concept
   - To demonstrate idea viability
2. Prototype Creation
   - To design and develop a preliminary version of the technology
3. Testing & Iteration
   - To test and refine the prototype (usability, attractiveness, technical performance)
4. Regulatory Checks
   - To ensure compliance with relevant regulations (digital health technology vs. medical device)
5. Early Phase Value Framework
   - Identification of value attributes
   - Early phase health-economic analysis
6. Critical Evaluation
   - Verification, analytical validation and clinical validation of the technology
7. Health Technology Assessment
   - Multidisciplinary evaluation across various aspects

LAUNCH & IMPLEMENTATION

1. Regulatory
   - To acquire approvals from relevant regulatory bodies
2. Financing & Reimbursement
   - To secure funding and ensure reimbursement for technology use
3. Marketing & Promotion
   - To create awareness and interest through targeted campaigns
4. Implementation in Healthcare
   - To integrate the technology into clinical settings with proper training
5. Real-world Evidence
   - To assess real-world effectiveness and implementation aspects of the technology
6. Iterative Improvement
   - To refine the technology based on feedback and real-world data
   - To consider scientific, regulatory and technical developments

EXPERT REVIEW OF PHARMACOECONOMICS & OUTCOMES RESEARCH
2024, VOL. 24, NO. 7, 853–860
https://doi.org/10.1080/14737167.2024.2373184

Taylor & Francis
Taylor & Francis Group

ORIGINAL RESEARCH

OPEN ACCESS Check for updates

Engagement of medication users in the development and implementation of digital medication adherence technologies: a multi-stakeholder study

Dalma Hosszú[a,b], Alexandra L. Dima[c,d,e], Francisca Leiva Fernández[f], Marie Paule Schneider[a,h], Liset van Dijk[i,j], Krisztina Tóth[a,k], Mark Duman[l], Wendy Davis[m], Cristian Andriciuc[n], Rebecca Egan[o], Bernard Vrijens[p,q], Przemyslaw Kardas[r], Noemi Bitterman[s], Iva Mucalo[t], Cristina Mihaela Ghiciuc[u] and Tamás Ágh[a,v]

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Are HCPs trained in medication adherence?

Gottlieb et al. BMC Medical Education (2025) 25:339
https://doi.org/10.1186/s12909-025-06909-1

BMC Medical Education

RESEARCH Open Access

Medication adherence in the curricula of future European physicians, pharmacists and nurses – a cross-sectional survey

Hanna Gottlieb[1*], Laura Seghers[2], Francisca Leiva-Fernandez[3], Cristina Mihaela Ghiciuc[4], Gaye Hafez[5], Maria Teresa Herdeiro[6], Ana Tomas Petrović[7], Teddy Novais[8,9,10], Marie P. Schneider[11,12], Alexandra Dima[13,14,15], Marie Ekenberg[1], Björn Wettermark[1,16] and European Network to Advance Best Practices Technology on Medication Adherence (ENABLE)

Teaching content reported (selected topics; count (%))	pharm. (n=82)	medical (n=56)	nursing (n=58)
The definition of adherence to medication	59 (72.8)	29 (52.0)	35 (60.3)
The five categories of adherence determinants	55 (69.9)	28 (50.0)	24 (41.4)
Patient-reported adherence assessment	61 (75.3)	41 (73.3)	29 (50.0)
Manual pill count and electronic detection of package entry	48 (59.3)	25 (44.6)	20 (34.5)
Electronic prescription and/or refill/dispensing data	57 (70.4)	25 (44.6)	16 (27.6)
Medication Management	61 (75.3)	37 (66.1)	29 (50.0)
Interprofessional collaboration and communication	47 (58.0)	21 (37.5)	24 (41.4)
Patient provider communication	54 (66.7)	31 (55.4)	35 (60.3)
Patient education	56 (69.1)	35 (62.5)	40 (69.0)
Patient engagement	47 (58.0)	22 (39.3)	24 (41.4)
Behaviour change techniques	28 (34.6)	12 (21.4)	12 (20.7)
Digital tools for adherence support	41 (50.6)	20 (35.7)	14 (24.1)
Economic impact	55 (67.1)	32 (57.1)	27 (46.5)
Clinical impact	72 (87.8)	47 (83.9)	44 (75.9)
Social impact	39 (48.2)	22 (39.3)	18 (31.0)

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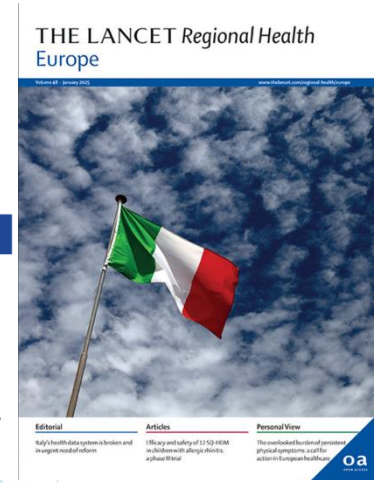
World Adherence Forum, Brussels, August 2024

→ Policy recommendations



CORRESPONDENCE · Volume 48, 101164, January 2025 · *Open Access*

Download Full Issue

Leveraging digital medication adherence technologies to enhance sustainability of European health systems: ENABLE's key recommendations

Job F.M. van Boven [a] · Alexandra L. Dima [b,c,d] · Björn Wettermark [e] · Ines Potočnjak [f,g] · Tamás Ágh [h] for the ENABLE collaborators [i]

Acknowledge

- Around 50% of medication is not taken as prescribed
- Medication non-adherence is associated with an estimated 200,000 deaths and a financial burden of €125 billion annually in Europe
- Enhancing medication adherence improves clinical outcomes, while reducing the financial and environmental burden on health systems

Inform

- Adoption of digital technologies can effectively support medication adherence and improve patients' health outcomes
- Innovative digital technologies foster communication and collaboration among healthcare professionals and patients, and should be made more accessible

Incentivise

- Increased investment and incentives to accelerate sustainable, cost-effective implementation of digital adherence technologies in health systems are necessary
- Digital adherence technology should be an integral part of clinical trials to support efficient drug development

Steer & support

- Data-driven European strategies to improve medication adherence are essential
- Reimbursement of effective digital adherence technology is critical to unlock their full potential of making health systems more efficient

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The future of ENABLE

Cooperation Framework Agreement for the ENABLE COST Action Assets Management:

ENABLE Adherence Network & Innovation Hub

- cooperation between 22 organisations
- global reach
- 5 initial directions (working groups):
  - Raising awareness
  - Training
  - Research
  - Repository
  - Policy
- Leads: A.Dima (FAD); B. Wettermark (UU)
- 1st Steering Group meeting: 14 Oct 2026

The future of ENABLE

- 3-year strategic plan with activities in the 5 WGs
- Yearly open call for membership (oganisational, +individual)
- Collaborations with other organisations active in medication adherence
- more information soon: mailing list & website updates

→ **Join us to keep informed!**

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