Developing a functional taxonomy for Digital Health Interventions in Addiction Services

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DHI implementation with addition services is more than deploying new technologies or devices

"It has to be realized that implementing digital health is about more than simply deploying new technologies or devices . It requires **system-level thinking** and **coherent national strategy** that comprises **effective legislation, regulations** and **oversight** – all of which are needed to ensure **quality, safety and security and interoperability** of digital health services, including telemedicine."

Diana Zandi, technical officer, WHO

Digital health and COVID-19. Bull World Health Organ. 2020 Nov 1;98(11):731–2.

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Digital Health Interventions

Digital Health Interventions (DHI) describes

"tools and services that use information and communication technologies (ICTs) to improve prevention, diagnosis, treatment, monitoring and management of health and lifestyle" and can range from electronic health records used by service providers to mobile health apps used by consumers.

Why a functional taxonomy?

Taxonomy is derived from the Greek words *taxis*, meaning order or arrangement, and *nomos*, meaning law. The term has been interpreted to mean lawful arrangement, orderly distribution, and hierarchical classification.

Taxonomy helps to lay the foundation for information retrieval and knowledge management. In our context, *taxonomy* refers to the structure(s) we use to organize and categorize data relating to DHI, enabling the user to search for and find the right resource to meet their service-user or organisational needs.

Why a functional taxonomy?

- *Digital technologies—eg, apps, wearables, and software algorithms—have the potential to support a technology-enabled health system in which care interactions are moved away from formal settings and citizens are encouraged to manage their own health and illness.*
- *The scalability and often low marginal cost of digital interventions suggest they might deliver cost benefits to stretched services facing the demands of ageing populations living longer with higher levels of chronic disease.*
- *At the same time, a publicly funded health system has both financial and moral reasons to spend money conscientiously and judiciously to provide evidence-based effective care for its citizens*

Greaves F, Joshi I, Campbell M, Roberts S, Patel N, Powell J. What is an appropriate level of evidence for a digital health intervention? Lancet *2018; 392: 2665–67*

Applying structure to chaos (aka complexity)

Chaos/complexity theory (C/CT) is a transdisciplinary systems theory that deals fundamentally with change.

Addiction treatment services are complex systems of care, with multiple interdependent and interconnected components and individual, autonomous actors whose agency in carrying out their everyday roles can hamper or disrupt attempts to introduce sustainable change

We used the framework for Successful Healthcare Improvement From Translating Evidence in complex systems (SHIFT-Evidence).

The steps included:

- combining knowledge with context,
- understanding that each local system is unique
- responding to complexity from the micro- to macro-system and
- engaging and empowering stakeholders in developing the taxonomy.

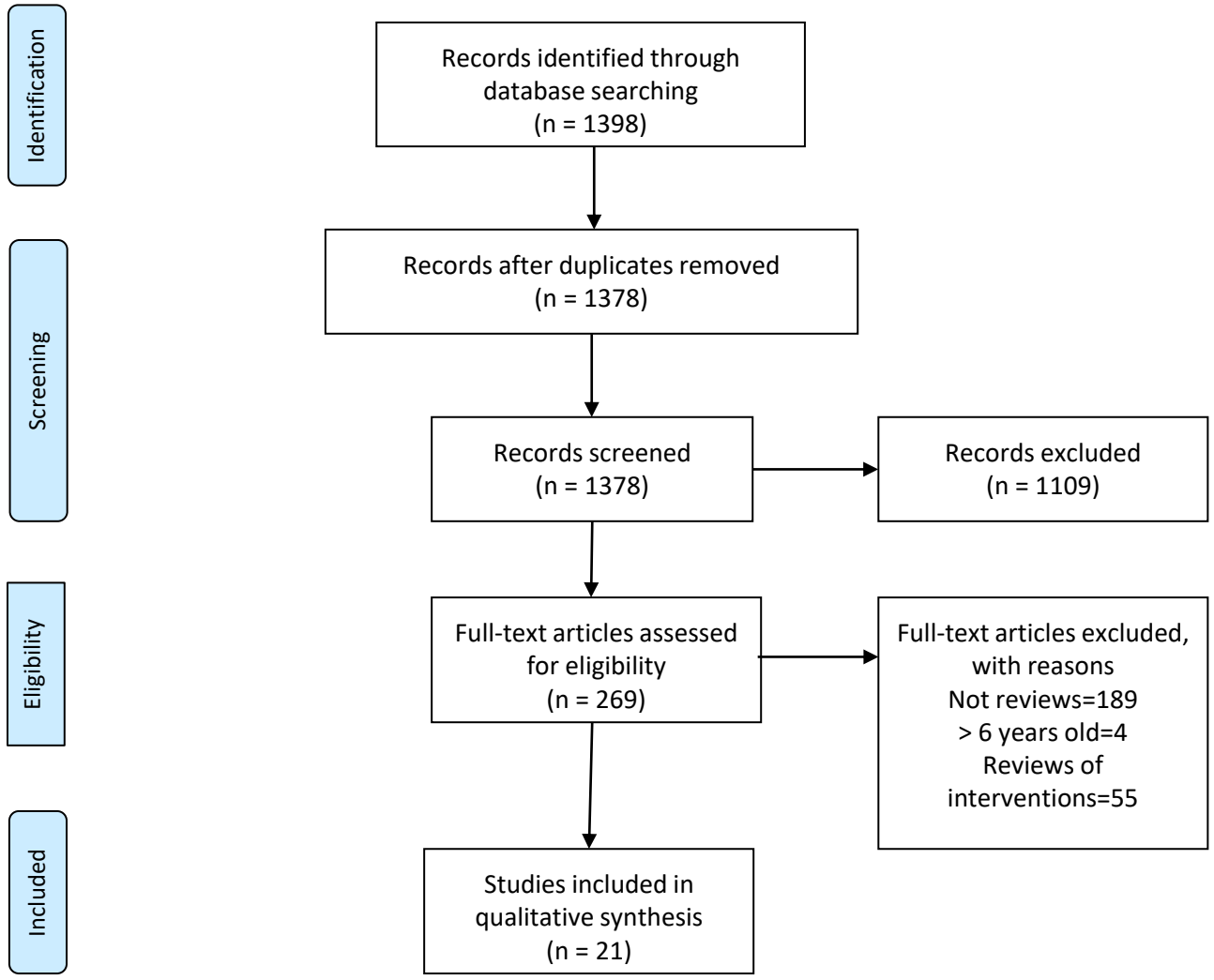
SHIFT-evidence simple rules	Application to the digitAS DADE project
Understand the problem and opportunities	Functional typology
Identify, test and iteratively develop potential solutions	Using data reported from core EMCDDA organisations, we identified bottom up innovation
Invest in continual improvement **Build a culture of willingness to learn and freedom to act** **Assess whether improvement is achieved, capture and share learning**	Through the EMCDDA best practice portal, we hope to develop user centric evaluation frameworks
Understand practices and processes of care	By definition, as we explored organisation generated innovation, identified case studies fit with organisational structures
Understand types and sources of variation	We have explored legislative differences and country level healthcare structures as one expel
Identify systemic issues	Case study approach allows cross comparisons between services to identify where barriers are
Seek political, strategic and financial alignment	The European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) is the leading authority on illicit drugs in the European Union. The Lisbon-based agency provides independent scientific evidence and analysis on all aspects of this constantly changing threat to individual lives and wider society. Its work contributes to EU and national policies to protect Europe's citizens from drug-related harms.

Therefore this taxonomy is informed by the existing literature but also through broad and iterative consultation with key stakeholders from EMCDDA member states. We first conducted a systematic review of reviews to identify approaches to evaluation or assessment and guidance development for DHI.

Search strategy

- 3 databases: Web Of Science, OVID EMBASE & OVID MEDLINE
- Search conducted 21/08/2022
- Limited to English language, preceding 6 years, review papers
- Search terms examples:
- A. Digital Health Interventions (telemedicine, telecare, tele-consult, telehealth, tele-rehabilitation, e-health, m-health, e-mental health, e-psychiatry, e-therapy, medical informatics, internet, applications, electronic mail, smartphone, smart-home, web based, wearables, artificial intelligence)
- B. Evaluation frameworks (frameworks, appraisal, assessment, models, guidance, implementation, evaluation, evidence based)

Prisma diagram for systematic review of reviews



Distribution of papers by DHI

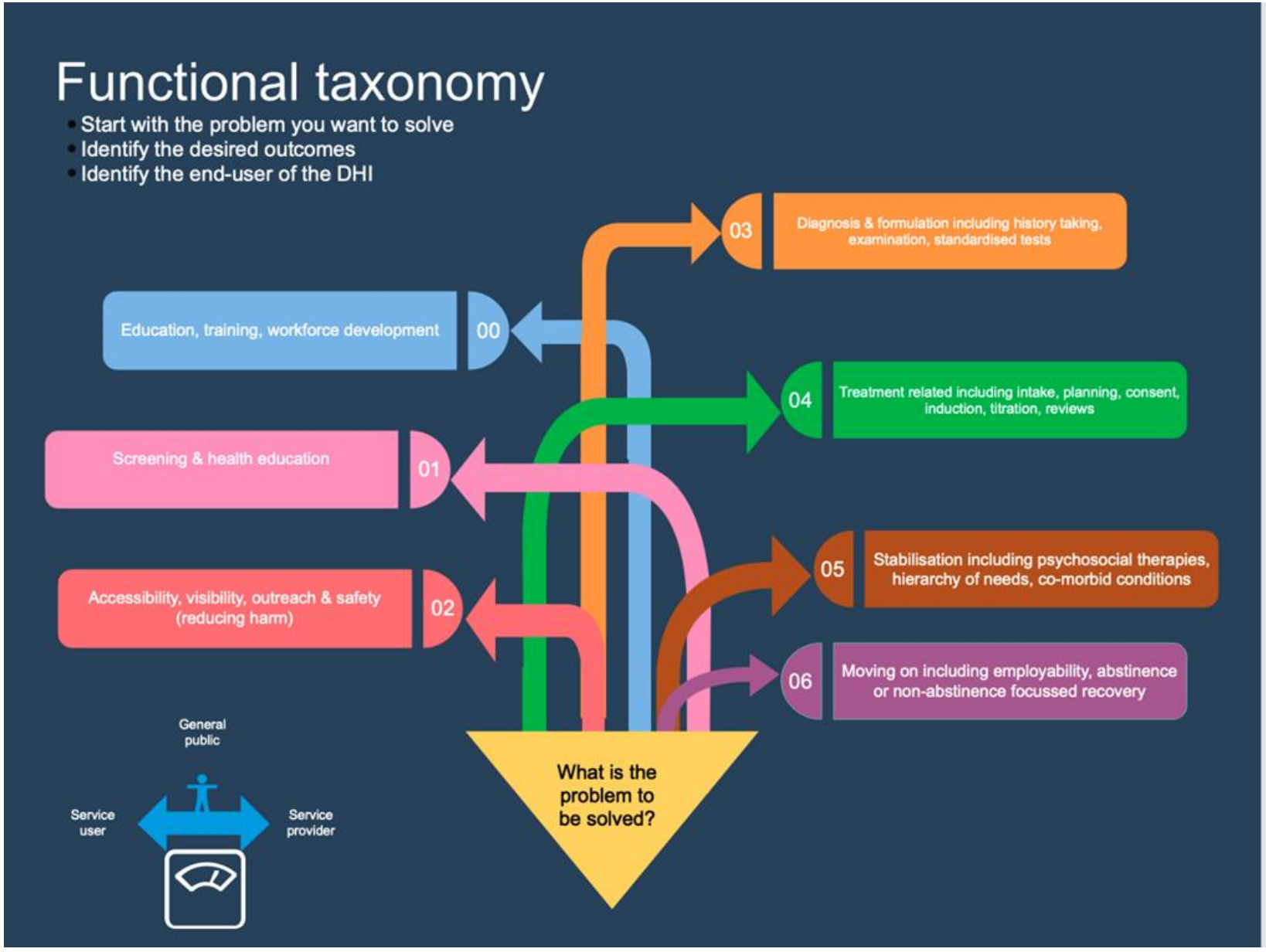
Type of DHI:	Number of papers Sum:
▶ DHI	4
▶ Big data	2
▶ Artificial intelligence interventions	2
▶ Apps	10
▶ Immersive Virtual Reality	1
▶ Electronic Health Resources	1
▶ Digital Maturity of Health Services	1

Area of interest according to DHI

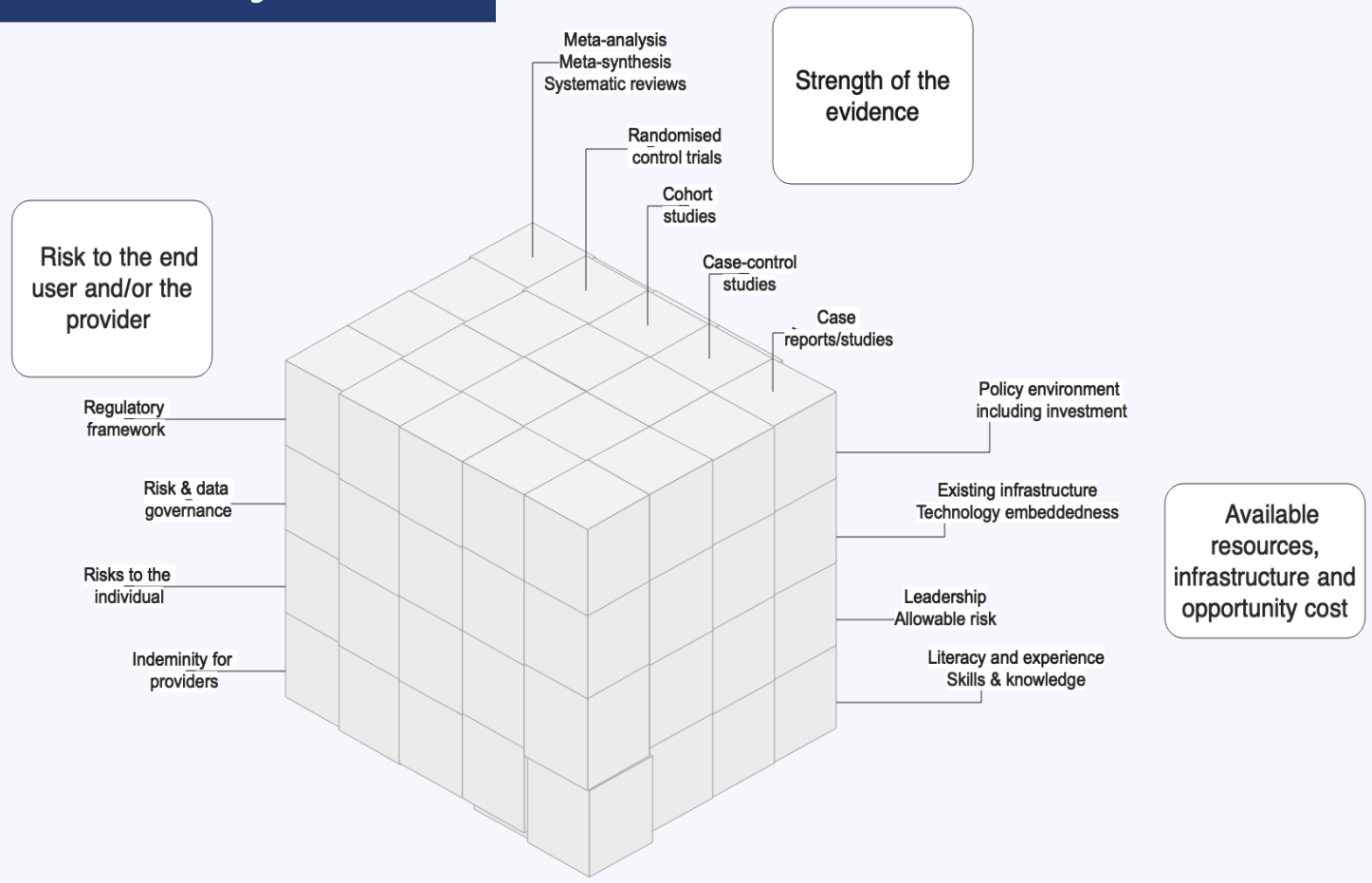
- ▼ DHI
  - ► Evidence Standards Framework
  - ► Generative Participatory Design Methodology
  - ► How to value
  - ► optimal frameworks to implement or evaluate
- ▼ Big data
  - ► Impact on health and recommendations
  - ► Ethical issues.
- ▼ Artificial intelligence interventions
  - ► Application in OUD
  - ► Guidelines
- ► Apps
- ▼ Immersive Virtual Reality
  - ► Clinical Relevance in the Assessment and Treatment of Addictive Disorders
- ▼ Electronic Health Resources
  - ► Participatory Methods to Engage Health Service Users in development
- ▼ Digital Maturity of Health Services
  - ► A Patient-Centered Framework for Evaluation

Area of interest for Apps

- **Apps**
  - **Best Practice Guidance**
  - **Popularity and Quality Standards**
  - **Methods of usability testing**
  - **Practical Framework for Evaluation**
  - **Benchmarking Government Guidance**
  - **Assessment Framework**
  - **Consensus Approach Toward the Rating and Clinical Recommendation**
  - **Evaluation and quality improvement**
  - **Evaluation Frameworks for Use in the Health Technology Assessment**
  - **Framework for the effectiveness evaluation**


Functional taxonomy
• Start with the problem you want to solve
• Identify the desired outcomes
• Identify the end-user of the DHI
03
Diagnosis & formulation including history taking, examination, standardised tests
Education, training, workforce development
00
04
Treatment related including intake, planning, consent, induction, titration, reviews
Screening & health education
01
05
Stabilisation including psychosocial therapies, hierarchy of needs, co-morbid conditions
Accessibility, visibility, outreach & safety (reducing harm)
02
06
Moving on including employability, abstinence or non-abstinence focussed recovery
General public
Service user
Service provider
What is the problem to be solved?

Multidimensional taxonomy



Checklist derived from the Taxonomy 3/3

	Service-user	Service-provider	General public
What is the problem we are trying to solve?	– Health status - Quality of life - Self-management of substance use - Improved access to addiction services - Avoiding stigma & shame - Reducing the impact of addiction and addiction treatment on daily life	- Improving workflow & processes - Quality improvement (reducing drug related deaths, HIV/HCV other targets) - Reducing costs, sustaining services - Service-user satisfaction	- Increased public awareness of addiction issues - Public safety, public health - Increased accountability for public funds
Resources & opportunity costs	- Technical literacy - Training - Health insurance/ income - Privacy - Bandwidth - Technology	- Policy environment - Training provision - Leadership - Logistics - Initial investment costs (devices, infrastructure, network)	- Prevailing culture & relationship with technology - Health beliefs - Resilience to change

Checklist derived from the Taxonomy 2/3

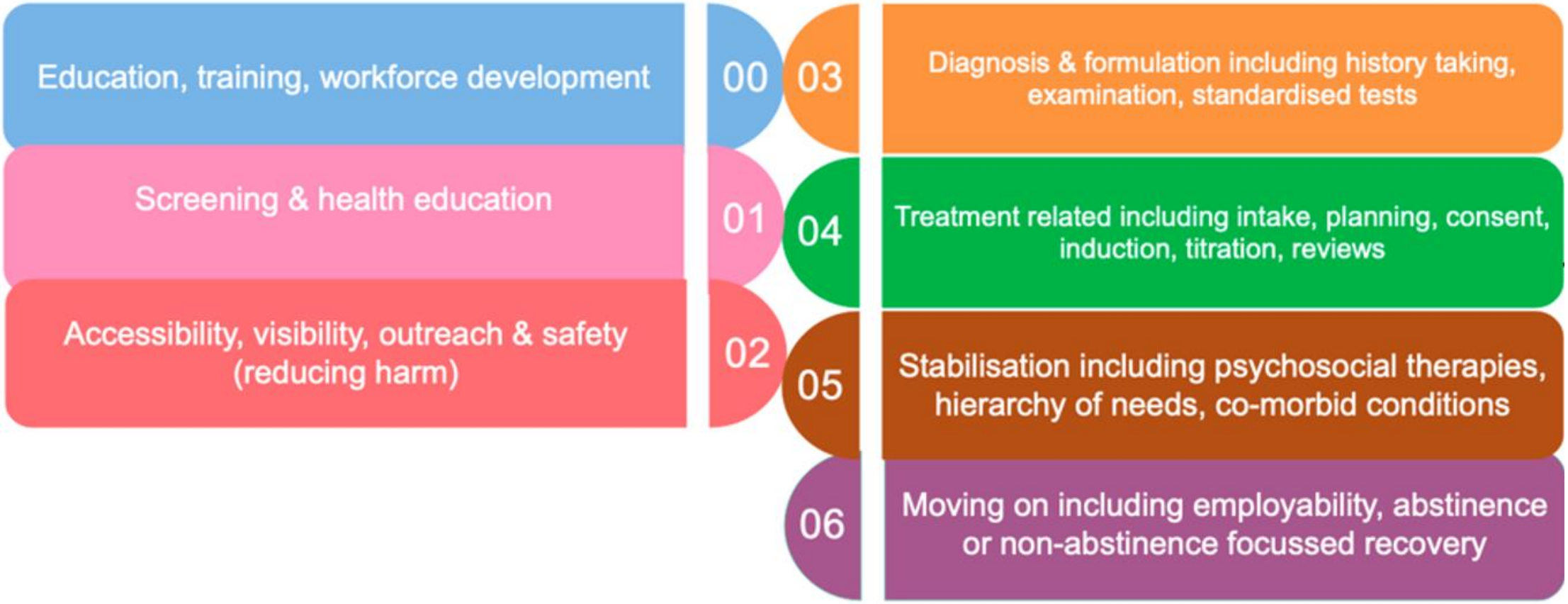
	Service-user	Service-provider	General public
Risks	- Technical (security, privacy, electricity- related) - Clinical and behavioural - Inadequate contents (lack of updates, evidence- based functions or information) - Economic (inc. costs, time) - Ethical (stigma due to visibility of devices)	- Technical (data-related: leak, loss, error; electricity-related) - Decrease in quality of care (not integrated or in contradiction with operating pathways, protocols) - Economical (increased costs if the solution is not cost-effective, or due to overuse of services) - Litigation and rising indemnity costs	- Decrease in quality of care (ineffective solutions) - Economical (increased costs due to technical or clinical cost, overuse of services) - Inequality of access (if cost for the end user is too high) - Unintended consequences such as over-diagnosis

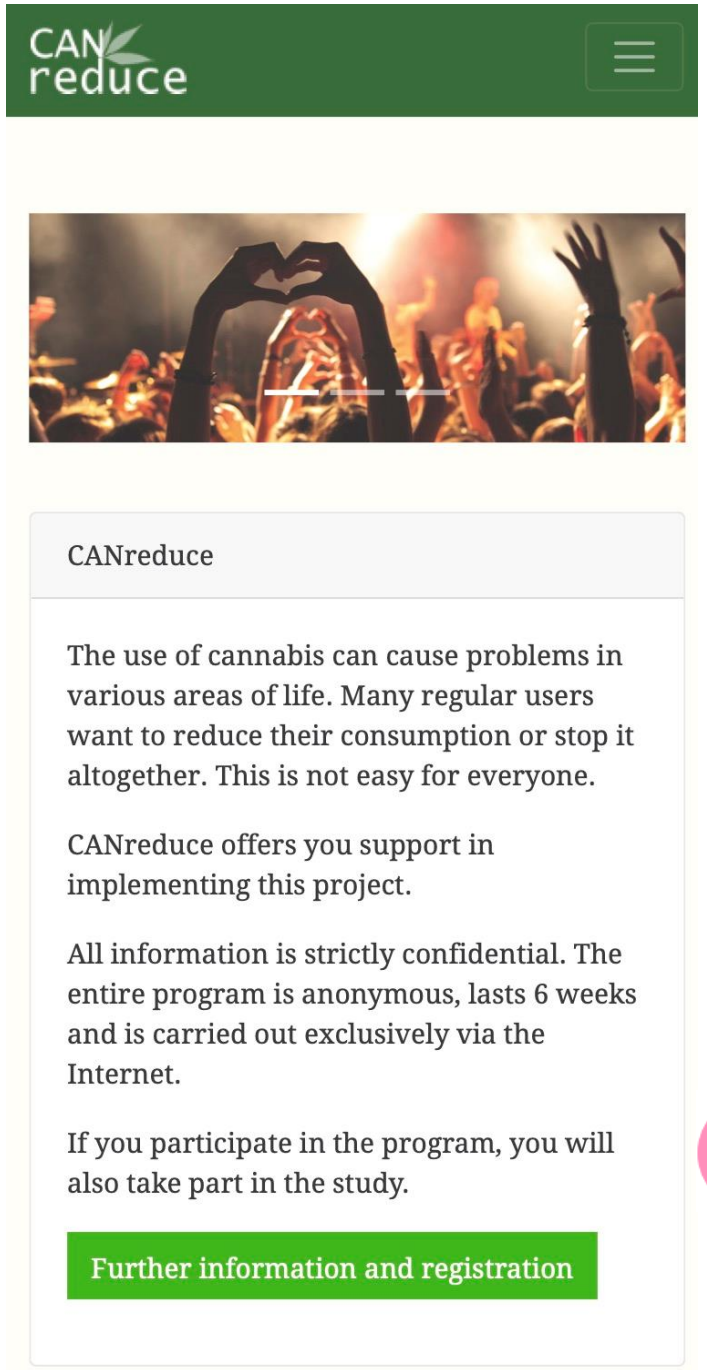
Checklist derived from the Taxonomy 3/3

	Service-user	Service-provider	General public
Design, TECHNICAL quality & the Evidence base	- Usability - User experience - User-centred design - Suitability - Reliability - User relevant outcomes	- User support - Compliance with interoperability standards - Clinical Integration (IT and protocols) - Implementation - Reliability	- Legal compliance (data protection) - Regulatory compliance (if medical device) Both relating to public safety

Applying the taxonomy

Functional Taxonomy Categories





- Website for cannabis reduction
- Provides
  - a self-help program,
  - access to educational content that is based on CBT and motivational interviews,
  - an online diary to track use,
  - learning modules and other resources.
- Aim is to reach a greater number of people untreated with substance use disorder
  - found they attracted a different population with higher cannabis use than those that enter outpatient addiction treatment (Schaub et al., 2015, Baumgartner et al. 2021)
- Several versions: CANreduce1.0 (2013), CANreduce2.0 (2018) and CANreduce mindfullness (2021)

Who is the target user? *General Public*

01 **Screening & Health education**

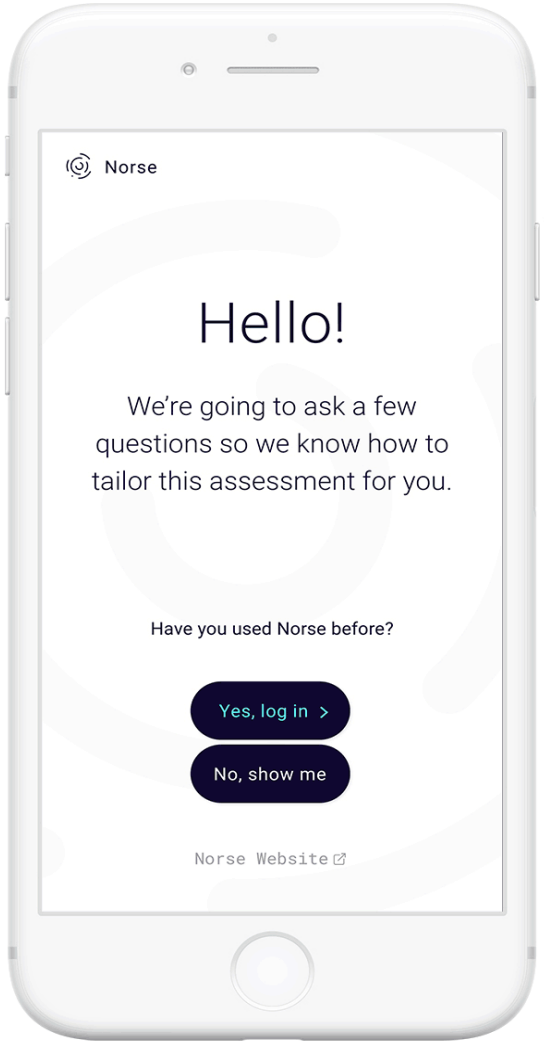
02 **Accessibility, visibility, outreach**

05 **Stabilisation, pyschosocial**

Norse Feedback

THE WORLDS FIRST DYNAMIC FEEDBACK TOOL FOR MENTAL HEALTH AND SUBSTANCE USE

Know who to help – Know how to help



- Personalized digital clinical process tool/dynamic feedback tool
  - Adjusts the questions according to the respondents' answers and collects data in real time.
- Aimed to
  - Empower patients in collaboration with health services
  - Increase efficiency/effect of services
- Used to
  - support traditional services,
  - ensure effectivity, monitor effect and guide treatment choices in telehealth sessions (especially since the COVID pandemic)
    - By identifying relevant symptoms, together with the processes and alliance goals in therapy to provide a clear picture of what is happening in therapy.
- The technology is an App/Website integrated with electronic health record

Who is the target user(s)? *Service-user* and *service-provider*

01 **Screening & Health education**

05 **Stabilisation, psychosocial**

@healthmail.ie

- Secure encrypted outlook based e-mail system that allows communication between doctors and other healthcare professionals including pharmacists , allowing them to send and receive patient identifiable clinical information securely.
- Prescriptions can be sent by e-mail to a patient's local pharmacy for pickup without the need to conduct an in-person physical examination of a patient.
- For OST, coupled with phone and video patient examinations.
- Healthlink is a platform for receiving the results of diagnostic tests and other communications including discharge letters from hospitals.
- The pandemic has resulted in a greater proliferation of video consultations. Healthmail app and healthlink program is downloaded as a desktop app. These platforms are generally used by doctors but also other healthcare professionals including consultant secretaries.

Who is the target user(s)? *Service-user* and *service-provider*

Typology categorisation: 04 **Treatment related, and other, administration**

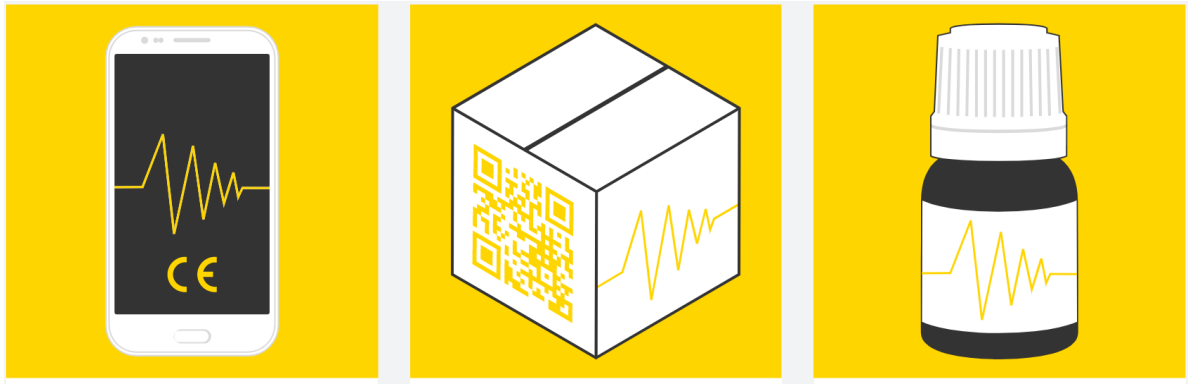
- Digital prevention campaign aimed at young adults raising awareness of the environmental impact of the dumping and discharging of synthetic drug waste
- A 3D virtual reality environment
- It is an interactive game involving different perspectives.
- Also used website videos, live stream on YouTube, social media campaign (Snapchat and Instagram) and Audiotour
- Used for research on people's change in attitude

Who is the target user(s)? *General Public*

01 **Health education**

02 **Accessibility, visibility, outreach**

RUMA®
Marker-System



- Urine marker technology allows patients to provide urine samples without therapist contact.
- Use blockchain technology to address urine testing manipulation problems, ensuring that the urine sample that is being tested originates from the right person and is available in the appropriate quality.
- Urine testing independent of location or appointment.
- Physician can check the digital recording of the patient's marker intake at his own convenience.
- **Typology categorisation:** 03 **Diagnosis** 04 **Treatment**

Type of technologies

OD alert 

OD response 

Combined alert and response

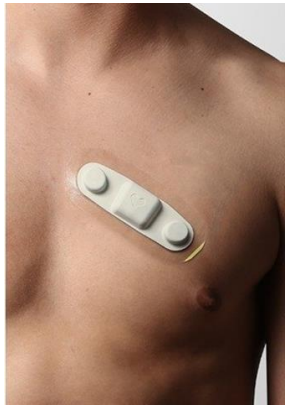
OD alert

- Nine papers
- Devices designed to monitor vital signs, such as respiratory rate, SPo2, movement, temperature or heart rate, and prompt an alert if threshold for OD is reached

Roth, A. et. al., (2021)
Usability of clothing patch (resp rate and motion)

Nandakumar et al. (2019) Smartphone using sonar to detect OD

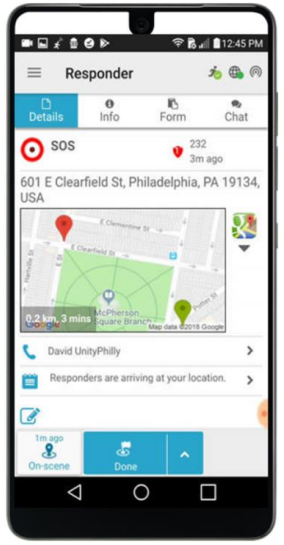
Ahamad et al., 2019. Willingness of PWUD to wear a device (skin patch) that can detect and alert others of an overdose



OD response

- Ten papers
- Technologies that focus on directing potential responders to an OD and facilitating a response
- Mostly based on smartphone applications
- Main purpose is to send an alert for an OD in a close location to someone who can attend it, which usually involves being in possession of naloxone

Marcu et al. (2020) Piloted app to connect potential bystanders and responders



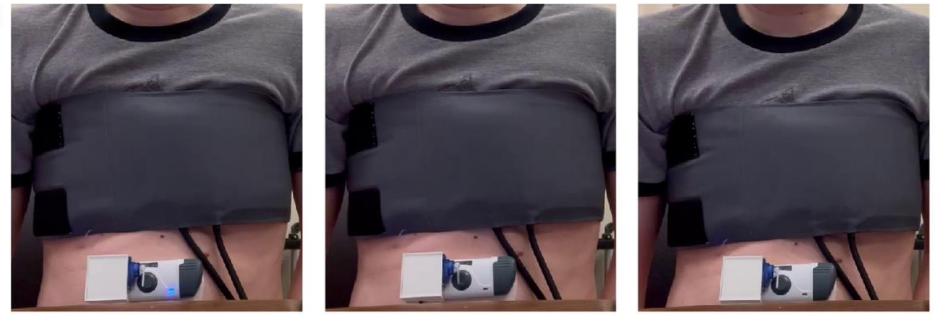
Tukel, C. A. et al., 2020 Comparing time required for a drone carrying naloxone to traverse various distances, against the time required for ambulances

Khalemsky, M. and Schwartz, D., 2017. Simulation of community response through app vs. historical EMS data

Combined alert and response

- Eleven papers described devices combined both alert and response are linked
- Commercial devices in grey literature
- some devices being developed that attempt to cover both functions by acting as a closed-loop system

Chan, J. et al., 2021. Closed loop device formed by sensor and naloxone injector



Normal breathing | Simulated apnea | Post-injection

Kanter, K. et al., 2021 Willingness of PWUDs to wear a device (wrist band) that can detect an OD and prompt response.

Bristowe, S. K. et al., 2021. Protocol for piloting a telephone-based supervised opioid consumption service

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Thank you!!

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