Steps to Develop a Matrix using the Concepts of Core Functions and Forms in the Context of Complex Interventions.

Dr. Penny Hawe originally coined the concepts of functions and forms informed by complex systems thinking. In a previous paper [1], we expanded Hawe's work [2,3] to develop comprehensive definitions of these two concepts and readers are referred to this source for additional information.

Functions refer to the intervention's standard purposes or goals and are rooted in change theories.[3] What promotes change based on the intervention's theory or framework? Those are your core functions! They are linked to fidelity because their absence can seriously compromise the integrity or fidelity of the intervention and the implementation process. Hawe P., calls it 'fidelity to function'.[4] This is the first step; now comes the delivery of the intervention in local contexts. *Forms* refer to the concrete strategies, workflows, steps, or activities implemented to deliver the intervention. They must be flexible to adapt to evolving contexts.

Abbreviated Table

Steps to Develop a Function and Form Matrix tool to Inform the Design and Evaluation of a Complex Health Intervention.

Step	Step Description
1. Identify the 'who'	Convene a group of experts, including partners by training and partners with lived experience expertise, to be involved in the matrix development process. Your partners can include patients and other key partners that can inform the matrix.
2. Identify the local need(s)	Discuss with partners, communities, and experts why this intervention is needed in the system, community, or population of interest.
3. Identify the 'why' / Core Functions	Rely on your intervention's theory or framework to understand how it explains individual, system, and/or population change. That understanding will lead to identifying the core functions, which are defined as "*standard competencies or purposes around the intervention's process of change or transformation process.*"[1]
4. Identify the 'how' / Forms	For each core function, identify concrete activities, procedures, tasks and/or workflows (including implementation strategies if defined as 'forms') that will be implemented in your local context/system/group of individuals.

The literature can inform these four steps. See the next section on page 2 for details.

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FILLABLE FUNCTIONS AND FORMS MATRIX

Intervention: _____ **Local Context:** _____ **Date:** _____

MOTIVATING NEED/PROBLEM	CORE FUNCTION(S)	FORMS	NOTES/COMMENTS
1.	A.	A1.	
		A2.	
	B.	B1.	
		B2.	
	C.	C1.	
		C2.	
2.	A.	A1.	
		A2.	
	B.	B1.	
		B2.	
	C.	C1.	
		C2.	

Fillable Functions and Forms Matrix

Intervention: _____ **Local Context:** _____ **Date:** _____

Motivating Need or Problem	Core Function(s)	Forms	Notes or Comments
1	A	A1	
		A2	
	B	B1	
		B2	
	C	C1	
		C2	

Motivating Need or Problem	Core Function(s)	Forms	Notes or Comments
2	A	A1	
		A2	
	B	B1	
		B2	
	C	C1	
		C2	

If you are ready to explore the process of developing a complex intervention's functions and forms, this document describes the steps in detail.

Methods

Next, we will walk you through a five-step method for developing a Functions and Forms Matrix tool. Your active involvement is key, as the matrix needs to be informed by the literature and your partners (e.g., patients and practitioners). This is a recursive process in which the matrix is constantly reviewed and refined with your partners (e.g., patients, practitioners, policy-makers, research teams, and community members).

SECTION I

Step 1: Identify the who. Convene a group of experts, including partners with lived experience expertise, to be involved in the matrix development process.

Convene a group of experts by training and by lived experience (3-6 individuals or based on your project's needs) to play an active role throughout the subsequent steps. This is a collaborative effort, and their voices and input are crucial. Include patients with experience navigating multiple healthcare systems and researchers who are experts in complex health intervention research and the content area of research. The group meets bi-monthly or more often for 45-60 minutes (Session # 1) to engage in the following activities: reach an agreement that the intervention of interest is a complex health intervention, determine that developing a matrix is suitable for the project aims, discuss the goals and timeline of the project, and how to make decisions. You and your partners will be involved in the next steps below.

Step 2: Identify the need(s). Discuss why this intervention is needed in the system, community, or population of interest.

What is the motivating problem or need(s) that sparked the need for the intervention to begin with? This area may refer to the needs of the individual (i.e., patient), the population, and the system. How would you know? Perform a formal needs assessment, summarize the relevant literature (i.e., a research team member can run a narrative search using published or online sources- See section II for details), or discuss with your partners based on their goals and resources. It is advisable to start building the matrix from this area because it offers an overarching anchor to guide the alignment of the upcoming intervention's core functions and forms. An alignment at this step means linking the intervention's upcoming core functions and forms to these identified needs. Use a flip board if meeting in person or an online whiteboard to write ideas (Meeting # 2 as a workgroup / 60-90 minutes).

Step 3: Identify the why (core functions).

Rely on your intervention's theory or framework to understand how it explains individual, system, and/or population change. That understanding will lead to identifying the core functions, which are defined as "*standard competencies or purposes around the intervention's process of change or transformation process.*"[1]

See a brief example below:

Intervention: Patient-Centered Medical Home (PCMH) defined as a service delivery model "in which patients are engaged in a direct relationship with a chosen provider who coordinates a cooperative team of healthcare professionals." (Primary Care Collaborative).

PCMH Framework: It states that improved access to and coordination of care among patients served by primary care services is achieved through a "complex set of changes and innovations that go well beyond the

boundaries of the practice setting and include provider and hospital networks, insurers, and Federal agencies."[5] These changes are focused on evidence strength and quality, patient-centeredness, process of care, population needs and resources, and culture/safety."[5]

PCMH Core Functions: See Figure 1 at the end of this document for a full PCMH example of a matrix.

Step 4: Identify the forms (how). For each core function, identify concrete activities, procedures, tasks and/or workflows (including implementation strategies if defined as 'forms') that will be implemented in your local context/system/group of individuals.

Be mindful that the forms of complex health interventions could be presented as outcome variables by others or in the literature. The expert group and partners in your team play a key role in disentangling an intervention's forms from its outcomes. For example, a study may present the scheduling of same-day appointments as a PCMH care outcome. However, changes in patients' use of primary services when needed could be considered an outcome, and the same-day scheduling as an activity (form) leading to this outcome.

A critical step in developing your F&F matrix is linking forms to a particular function. For example, the availability of 24/7 patient access to clinical advice is a form aligned with the function of remote access to health consultation and clinical advice. Functions will likely have multiple forms and a single form may fulfill more than one function. Identifying these nuances is another task for the expert team.

SECTION II

Inform your F&F matrix by conducting a literature review.

Identify needs, functions, and forms from the literature to inform your and your partners' discussions and development of the matrix. The type of review (e.g., narrative or systematic literature review) depends on your timeline for the project, staff, and/or funding capacity.

Analyze documents using a top-down approach

Use a broad search strategy to identify and select sources by topic (e.g., Patient-Centered Care interventions in primary care settings) and for each area of the matrix. Likely, the reviewed sources will not explicitly refer to an intervention's "core functions".

Narrow and prioritize sources using the following eligibility criteria

(a) The source closely meets the definitions for motivating needs, core functions, and/or forms as specified in advance and agreed upon by the expert team (see matrix), [1]

(b) The source offers a novel or alternative perspective on the complex health intervention and it is valuable to include that perspective, and

(c) The source originates from a well-established outlet such as a federal agency or national professional association. The identification of top sources of information is important because the amount of published data can become unmanageable.

Analyze documents using a bottom-up approach

The information can be entered into a centralized system such as an Excel database. Create a separate tab for each area of the matrix (i.e., motivating needs and problems, core functions, forms). Then, enter each selected top source so each row represents a source. For each source, enter a full citation, the coded text and the page

number where the coded text can be found in the original document or the area in the online website. The expert group then uses the information gathered in the Excel database to populate and align the matrix. The team identifies and enters information for the core functions that align with a specific motivating need or problem. Last, the team identifies the menu of forms that carry out a particular function. This step is essential to achieving a logical alignment across the three areas of the matrix. Note that it is difficult to capture every single form since some may not have been developed, published, or reported.

Refine the matrix through invested partner(s) input.

To develop a matrix aligned with local contexts, it is essential to include invested partner(s) feedback to ensure it speaks to their clinical work and reality in the field. This step is meant to foster the translation of the matrix, initially informed by the national literature and expert review, to field testing. Invested partner(s) input can be incorporated through focus groups or interviews with local practitioners and health care managers. This step aims to elicit insights on the relevance of the identified system needs and problems and core functions for a particular intervention. Invested partner(s) feedback can also enrich the developed matrix by providing additional forms in their settings. These added forms can reflect local innovation and cultural richness that were not captured in the literature review. The expert team incorporates invested partner(s) feedback and performs final changes to the matrix.

Analytic strategies of rigor: (1) Use two coders to agree on selecting initial sources from the literature review to be entered into the database for further analysis. Based on their diverse expertise, the expert team also leads the selection of the top sources for each area of the matrix as previously described; **(2)** Hold ongoing debriefing meetings with the entire expert group throughout the various steps of the process to establish a feedback loop, troubleshoot, identify additional sources of information, agree on how the team defines functions and forms for the particular intervention, develop a menu of forms, and discuss the alignment of each area of the matrix; and **(3)** Engage partners (e.g., patients and practitioners) in member-checking meetings to refine the matrix and assess relevance to the clinical setting of interest (i.e. align the intervention to local contexts' needs, resources, priorities).

See the next page for an example of a PCMH matrix.

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Figure 1. Example of a Functions and Forms Matrix using the Patient-Centered Medical Home Model.

Table 1 PCMH Function and Forms Matrix

Patient-Centered Medical Home (PCMH) principles 1–5		
Motivating need/problem	**Core functions (standardized)**	**Forms (tailored)**
1. Accessible care Unreliable patient access to health care when needed	A. Offer enhanced options for access to in-person care	I. Examples: • *In-person care outside of traditional business hours*[31–33] • *Schedule same day appointments*[33, 34]
	B. Facilitate and document remote access to health consultation/ clinical advice	II. Examples: • *24/7 patient access to clinical advice*[31, 35] • *24/7 on-call patient access to PCMH team*[33]
	C. Create written process and defined standards to facilitate patient access to their EHR	III. Examples: • *Online patient portals*[32, 36] • *Secure electronic messaging*[31]
2. Coordinated care Lack of communication and coordination across health care providers and institutions	A. Create an infrastructure to exchange information via shared records	IV. Examples: • *Electronic health records to access, document, and share patient data*[38] • *Tracking mechanisms to ensure notification of patient encounters and creation of appropriate transition plans*[35, 39]
	B. Provide guidance to patients to navigate and cooperate within a team-based care approach	V. Examples: • *Tracking and follow-up for all tests and results, with identified time frames for notifying patients of results*[36, 39] • *Regular case review meetings with interdisciplinary team*[40]
	C. Create explicit workforce agreements regarding division of labor	VI. Examples: • *Dedicated care manager who is responsible for overall management of patient's care plan*[40] • *Clear process for providing care management services*[34]
3. Committed to quality care Care is not consistently driven by scientific evidence and supported by clinical information systems	A. Deliver care guided by evidence-based principles	VII. Examples: • *Documented clinic-wide improvement strategy with performance goals (derived from patient/-family, and other team members feedback), publicly reported measures, and areas for clinical and operational improvement*[31]
	B. Enable a system for decision support and education to facilitate use of evidence	VIII. Examples: • *Electronic prescribing*[32, 35, 36, 38] • *Evidence-based clinical decision-making tools*[40]
	C. Track population health status and create mechanisms to encourage/achieve	IX. Examples: • *Registry and risk stratification tools to assess health status and needs of the entire practice*[38]

(continued on next page)

Table 1. (continued)

Patient-Centered Medical Home (PCMH) principles 1–5		
Motivating need/problem	**Core functions (standardized)**	**Forms (tailored)**
	health promotion and prevention	• *Performance reports to track and compare results for the established population of patients in the practice*[36, 39]
	D. Monitor and measure care as delivered to assure adherence to evidence-based standards	X. Examples: • *Health home provider makes use of available HIT and accesses data through the regional health information organization/qualified entity*[41]
4. Comprehensive care Care is episodic. Lack of innovative models of team work to support team-based care	A. Identify needs and services in health continuum, including social and behavioral needs	XI. Examples: • *Care plans that are longitudinal and meet patients' complex healthcare needs*[38] • *Care plans that include community-based and other social support services*[40]
	B. Establish sources of services and arrangements to deliver and document service delivery	XII. Examples: • *Policies and procedures to support effective collaborations with community-based resources*[40] • *Screening strategy for mental health, substance use, and developmental conditions with documentation of onsite and local referral resources*[31]
5. Patient-centered care Care is often inconsistent with, and not planned or carried out in consideration of, patient preferences and values. Lack of physician-patient relationship that is based on mutual responsibility and trust.	A. Assess patient values, needs and preferences	XIII. Examples: • *Written materials published in primary language(s) of the community*[33] • *Providers or telephonic trained interpreters speak a patient and family's language of choice*[31]
	B. Take patient values and preferences into account to design and deliver care	XIV. Examples: • *Care plan identifies family members and other supports involved in the patient's care*[40] • *PCMH-related communication tools*[36, 39]
	C. Foster a relationship-based care (vs. impersonal) with an orientation to whole person care	XV. Examples: • *Patient-centered care planning to engage patients in their care*[33] • *Peer supports, support groups, and self-care programs to engage patients in their care*[35]
	D. Educate and support patients in learning to manage their own care and fully participate in care decisions	XVI. Examples: • *Strategies for patient/family's participation in a health care decision using informed and shared decision-making*[38] • *Individualized care plan for patients includes complex medical and social concerns*[33]

Source for Figure 1: (Do not reproduce without permission from Journal): Perez Jolles, M., Lengnick-Hall, R. and Mittman, B.S., 2019. Core functions and forms of complex health interventions: a patient-centered medical home illustration. *Journal of General Internal Medicine*, *34*, pp.1032-1038.

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