The implementation of Population Health Management: bridging science and practice

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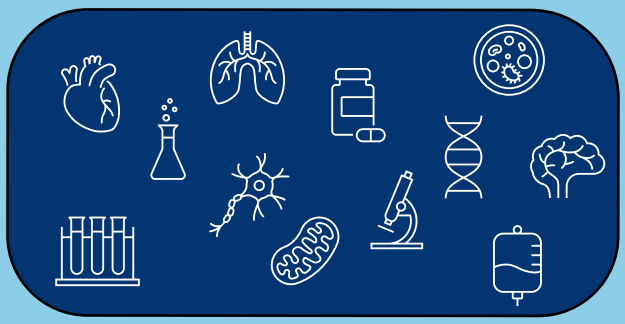

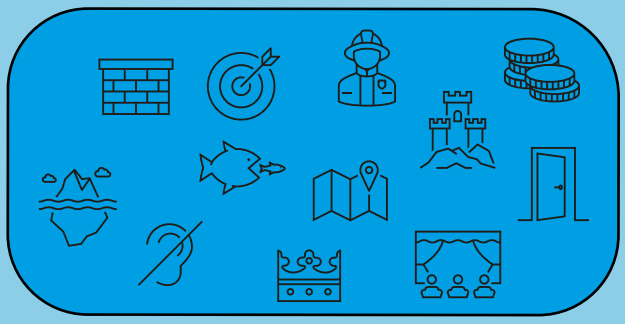

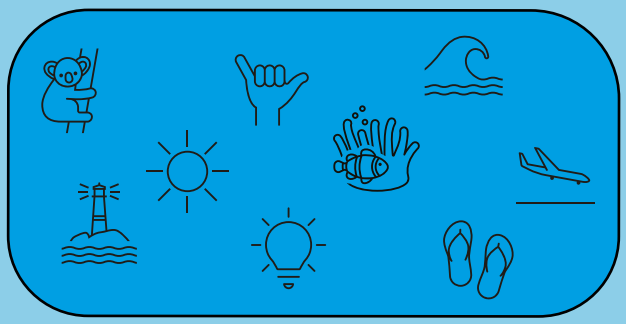

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General discussion

The main objective of this dissertation was to gain insights in how to successfully implement Population Health Management (PHM) in order to improve the Quadruple Aim in a regional setting. This chapter synthesizes the main findings presented in this dissertation, giving answer on what we now know about PHM implementation. Then, scientific challenges in PHM implementation are discussed. Next, the implications of this research, as well as directions for future research are presented. This chapter is concluded with an epilogue on the use of PHM for pharmacists.

Main findings on PHM implementation

What emerged from the results reported in the previous chapters is that PHM implementation is very complex. Taken together, the results provided important insights into this complexity and how to cope with it in practice. By ordering the items retrieved from literature in different ways, in **Chapter 2** the interrelatedness of over 80 items that influence PHM implementation was displayed. The items were structured in the six elements of PHM: In 'accountable regional organization' most items relate to collaboration, organization, and leadership; in 'cross domain business model' most items relate to financial decision making in funding, payment, and resource allocation; in 'integrated data infrastructure' most items relate to building this data infrastructure; in 'co-designing workforce and community' most items relate to the empowerment of local citizens and professionals within the initiative; in 'population health data analytics' most items relate to being able to use the data efficiently; and in 'emergent implementation strategies' most items are examples of strategies to enforce continuous progress. While previous articles have addressed certain elements, this study represents the first comprehensive synthesis of these topics, especially within the framework of PHM. (1, 2)

The results of **Chapter 2** were used as basis for **Chapter 3**, in which expert opinion was used to construct the PHM Maturity Index (PHM-MI). The PHM-MI consists of all items divided into the six elements of PHM that the experts deemed relevant and important for PHM implementation. These findings displayed how knowledge only of the earlier introduced PHM cycle is not sufficient for sustainable implementation. Commissioned by the Dutch Ministry of Health, an informative visual was created on how the six elements of PHM relate to the PHM cycle (figure 1). The middle of the visual illustrates the steps of the PHM cycle to choose and implement interventions that achieve the most significant impact on the health of a predefined population. (3) I hypothesize that the more mature the six elements of PHM are on the outside of the PHM cycle, the easier it should be to execute the steps in the inner circle over and over again for multiple subpopulations, and consequently the healthier the whole population would become over time. This

is an important issue for further research as it would implicate that sustainable PHM implementation doesn't only revolve on the PHM cycle, but needs to evolve around maturity of the six elements of PHM, PHM implementation maturity, as well.

Figure 1: The PHM-MI visual.

The results also include insights to strengthen PHM initiatives retrieved from real-world settings. The research in **Chapter 4** demonstrated that the PHM-MI supported change and provided strategical guidance to PHM implementation maturity. And also, that the PHM-MI has the potential for use across regional and national contexts. Its international orientation was confirmed by the pilot in an Australian region. The tool was developed in a different national context using international literature and Dutch and mainly European

panellists. However, the Australian stakeholders recognized the relevance and importance of the items for their regional context. The findings suggested that the items in the PHM-MI are universal for PHM implementation across the world. Further research is needed to advance the PHM-MI into a reliable analytical tool that can support international benchmarking opportunities on PHM implementation maturity. Additionally, the study in **Chapter 5** presented evidence that within PHM initiatives continuous learning and reflection are necessary because of the complexity of the change. The results underscored that, given the complexity of healthcare transformation, fostering learning and reflection as competencies among the involved stakeholders is paramount and cannot be overstated. This insight suggested that adaptability and a nuanced understanding of regional dynamics are more critical than strictly adhering to a predefined blueprint.

Starting with PHM implementation

The following section delves into the nuanced interpretations of the obtained results, indicating their significance in the context of healthcare change. This is done by, based on the results, providing two suggestions how to start off your PHM implementation endeavours. The first suggestion is to define the population carefully, the other one is to assess your PHM implementation maturity.

Define the population

The first suggestion is to start a PHM initiative with collaboratively defining the population which you want to serve. This definition of the population can be made based on several criteria such as geographical area, organizational boundaries, and disease-oriented characteristics (all patients from hospital x, all policy holders from health insurer x, all citizens of municipality x, all people living in state x, all patients diagnosed with x, all employees of organization x). (4) This first step may seem rather straightforward as it is the first step in the PHM cycle. However, the results described in this dissertation suggest that the inner PHM cycle is strongly connected to the six elements of PHM in the outer circle, as will be illustrated in the following paragraphs with some examples where the corresponding PHM element is put into brackets. Therefore, this first step in the PHM cycle of defining the population has severe consequences for the ability to implement PHM to its full strength using the six PHM elements. The importance of defining the population is reinforced by the fact that in the scoping review of Steenkamer et.al. on defining PHM 14 out of 18 included articles have included a population definition in their definition of PHM. (5)

One of the consequences of defining the population is the amount of stakeholders in decision making and the need for bridging their perspectives (PHM element 'accountable regional organization'). Choosing a population based on organizational boundaries seems appealing, especially if only one organization is involved. You then are able to work with the data that you have from that population within your organization (PHM element 'integrated data infrastructure') and you can deal with your organizational interests, with limited influences from external stakeholders (PHM element 'accountable regional organization'). However, this has major limitations as well. (6) Often, the current way healthcare is organized, the data collected by a single organization presents just one perspective of the population, for example all hospital visits. In this example, this limits the ability to risk stratify on the social determinants of health (SDH). The analysis from Gesundes Kinzigtal, an initiative that defines their population by using all policy holders from health insurer AOK in the region Kinzigtal, demonstrates the challenges encountered in evaluation of such an approach. (7, 8) In addition, scholars argue that focusing on a population based on one organization would be a limited form of PHM or should not even be called PHM, but panel management for example. (9, 10) But, broadening the population definition beyond organizational boundaries requires interorganizational consensus on the population definition (PHM element 'accountable regional organization').

Discussing the population definition with multiple health and care organizations requires bridging of their perspectives on the scale of the initiative. From the perspective of a GP practice, a neighbourhood seems a most reasonable choice. However, a hospital usually covers a wider area. As all different organizations in healthcare do not share the same catchment area and therefore naturally serve a different population, deliberating the scale of the initiative is important for the success of the initiative. (11, 12) While it remains unclear which exact scale of PHM implementation is optimal, I hypothesize that there is a minimum economy of scale for PHM implementation maturity. While I think that this minimum is more likely closer to 200.000 citizens than 30.000 citizens, the exact minimum probably differs per region and health system. A minimum is required to reach and measure impact (PHM element 'cross domain business model') on the one hand and build PHM implementation maturity in a cost-effective way on the other. For example, the investment to build an 'integrated data infrastructure' should flow back from the savings per person based on the health interventions. In a smaller population, the savings per person need to be higher to cover the same investment costs. Next to this, the minimum scale depends per system and region on the existing catchment areas of important stakeholders such as the hospital and the payers. Their motivation to collaborate partly depends on external incentives such as formal responsibilities or financial gain, which again will depend on the health system they are in. (13) This minimum economy of scale

is in line with a recent study on integrated governance in Finland that demonstrates the benefits of joint authorities between smaller municipalities. (14) In contrast, individual interventions, that are designed with the process of the PHM cycle, may target a smaller subpopulation, for example older persons without a social support network. The interventions for this subpopulation may differ per neighbourhood based on what support structure is already present and what suits the people in that neighbourhood (PHM element 'co-designing workforce and community'). However, these interventions benefit from PHM implementation efforts that are initiated from the larger initiative, such as the 'integrated data infrastructure'. This stresses the importance to connect these smaller scale interventions to the regional ambition. In this way, with a portfolio of interventions, the collaboratively defined population is supported to their needs to the best of the ability of all stakeholders involved.

Assess PHM implementation maturity

The second suggestion that is made is to start with assessing PHM implementation maturity using the PHM-MI. This is based on the assumption that the maturity dictates which next steps should be taken, rather than the existence of a general blueprint for PHM implementation that would work for all initiatives (**Chapter 5**). A likely explanation for this can be found in the theory of complexity science. (15) In complexity thinking, healthcare is considered a complex adaptive system (CAS), which is marked by dynamic complexity and intertwined causality. (16, 17) In CAS, different actors, such as the items of the PHM-MI, are considered to behave interdependent and interconnected, leading to unpredictability, uncertainty, and emergence. Therefore, it is argued that CAS should be studied as a whole, because relationships of interdependent parts of components may result in undesirable systemwide behaviour. (18) Due to this complexity, next steps greatly depend on the existing PHM implementation maturity. The assessment thereof is an important starting point. This is supported by previous research that demonstrates that the maturity of an initiative is often overrated based on its reputation. (19) Therefore, a nuanced understanding of strengths and weaknesses of PHM implementation maturity is a starting point for initiatives to adapt and continuously learn and reflect rather than trying to set out a stringent process.

This first assessment of the PHM implementation maturity of the initiative influences several strategic decision domains across the six PHM elements. While these domains are often treated as separate issues, the research in this dissertation demonstrates the interrelatedness of these domains. In the following paragraphs, several examples of this interrelatedness are shortly presented. These examples are incomplete and give rise to new research questions and hypotheses on PHM implementation, on which

multiple dissertations could be written. These include questions on the minimum degree of maturity per PHM-element, the optimal sequence for implementation and the interdependencies of items. However, for this dissertation, the examples are used to illustrate the significance of connecting these domains in practice.

One of the strategic decision domains previously mentioned is the quality and use of health data (PHM elements 'integrated data infrastructure' and 'population health data analytics'). If data of different organizations for the whole population is not yet aggregated into an integrated data infrastructure, it limits the ability of the analytics. In a broad range of recent published studies the challenges of data governance, data aggregation, and data application are described. (20-22) Especially when SDH are included in the integration, which is sought after for PHM, more challenges arise on data governance and data aggregation. (23) This is because the indicators for the SDH are usually collected and stored by different organizations than healthcare indicators, so that new collaborations have to be formed. These limitations also lead back to the accuracy and predictive capability of the business case (PHM element 'cross domain business model') which relies on the data analytics. Therefore, these specific data challenges illustrate the importance of addressing them, as doing so can significantly enhance PHM implementation. The mentioned studies indicate the connection of these topics with the governance of the initiative, setting shared goals and creating trust among so-called data owners, which are the people in the population (PHM elements 'accountable regional organization' and 'co-designing workforce and community'). This example illustrates the complexity and presents how maturity on data is influenced by other domains and influences the possible next steps itself.

Another domain is that of governance of the initiative (PHM elements 'accountable regional organization' and 'co-designing workforce and community'). The items in the PHM-MI are consistent with previous literature on this topic. Although, particularly important in the findings is the need for a combination of strong local leadership and regional joint leadership. In recent literature, examples from Finland, Canada, and a seven country comparison demonstrate the lack of one or the other. (14, 24, 25) In this regard, public administration and change management research offer a plethora of theories and frameworks, with terms as health governance, collaborative leadership, collaborative governance, intersectoral collaboration, governance network theory, and interorganizational multilevel healthcare networks. (26-31) Connecting the theoretical knowledge from these disciplines to the context of PHM implementation maturity may aid to ascertain how maturity on this domain helps to achieve PHM success. (32) Future work is needed to develop transdisciplinary research processes to integrate the existing

theoretical knowledge of multiple disciplines, implement it and evaluate the effects.
A final example of a domain that is impacted by PHM implementation maturity is that of implementation strategies (PHM element 'emergent implementation strategies'). Most of current literature in implementation sciences focusses on implementation of health interventions or specific innovations, such as eHealth. (33) While the PHM-MI focusses on a broader perspective including managerial and system level challenges, most strategies that are generalized within implementation sciences do overlap with the PHM-MI in either 'emergent implementation strategies' or in one of the other PHM elements. (34) One specific theory that shows the connection to PHM implementation maturity and timing of such implementation strategies is the theory of diffusion of innovation. This theory states that the timing of dissemination can be crucial to diffusion. Therefore, potential adopters should perceive the attributes of the innovation and the availability of implementation support is necessary in anticipation of demand from providers and patients. (35)
The examples from the different domains illustrate the significance of connecting these domains in practice. They underscore the need for integration of the PHM elements, which is argued for in different wording in existing research. (36, 37) However, it is not feasible to work on all these examples at the same time. Therefore, explicating the strengths and weaknesses of overall PHM implementation maturity of an initiative provides the overview necessary for strategic decision making in practice to choose what to focus on first. In the meantime, new and existing research may focus on the new research questions and hypotheses on PHM implementation maturity.

Scientific challenges in PHM implementation

This dissertation is among the first to bring the various parts of PHM implementation together. But, this is not without its challenges and limitations. One of these challenges is merging knowledge from different disciplines, professions and perspectives, in literature often referred to as transdisciplinarity. (38) The challenge of this need for transdisciplinarity is interwoven throughout this dissertation. In bridging perspectives I see three main connections that can be set out in a 2x2 table (figure 2).

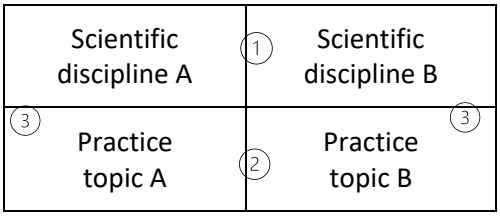

Figure 2: Bridging perspectives is necessary across 1. scientific disciplines, 2. practice and 3. between science and practice.

The discussion in **Chapter 2** points out limitations that current routines have for literature review on PHM, bridging several scientific disciplines (point 1 in figure 2). It demonstrates how knowledge is dispersed over various sources and how the use of a variety of terminology, databases, and grey literature such as reports hinder knowledge synthesis. Specific for scientific literature is the disparity per discipline in how terminology is applied, how articles are constructed, which databases are used, and how knowledge is created. This limits the ability of monodisciplinary trained researchers to create an overview of the complexity of the phenomenon. Similarly, the research described in **Chapter 3** demonstrates the difficulty to bring people with different perspectives together (point 2 in figure 2). In the first three rounds of this Delphi study, researchers and people with practical experience were asked to reflect on the items in just one of the PHM elements that most suited their expertise. While this was compensated by the validation of the international panel in rounds 4 and 5, it also illustrates the practical difficulty of bringing perspectives together in practice. In trying to bridge science and practice (points 3 in figure 2), the transdisciplinarity also challenged the scientific component (**Chapter 5**). This came forward in understanding each others perspectives and using different language, a constant balance between action and agility from practice and rigidity and structure from a scientific perspective, and the use of experiential knowledge or scientific knowledge. It shows that bridging all these perspectives is hard work, but adds to our understanding and implementation of PHM.

In the following paragraph a reflection is made on the research design choices that were made. Despite a growing recognition of the importance of implementation sciences, current literature provided little high-quality research on PHM implementation. (39) This led to an approach of exploration rather than evaluation and testing hypotheses. The strength of this dissertation is that each separate study described uses a different kind of methodology. In this way, it was possible to provide an answer to the overall research question building on multiple sources, strengthening the outcomes. This approach also fitted the complexity of PHM implementation as this asks for methodologies that allow for rich theorizing, generative learning, and pragmatic adaptation to changing contexts. (18, 40) This was especially seen in **Chapter 5**. Using case-oriented methodology, validity and reliability was sought by using multiple sources of evidence, explanation building, and analytical generalization. (41, 42) The added value of the methods of inquiry lies in understanding how and why changes occurred. For example, in the pilot study of the PHM-MI (**Chapter 4**), the evaluation of maturity is based on self-assessment of the items by a limited number of individuals involved in the initiative. This self-assessment creates feedback on the mutual understanding of the team about the situation and what is worked on. When items are scored differently, this shows that participants have a different

understanding, which is an outcome in itself as it could hinder the change efforts. So, while the transdisciplinary nature of PHM complicated the design choices, the multitude of methodologies improved the generalizability of the overall results.

One of the methodologies that is not included in this dissertation is objective, quantitative comparison of PHM implementation. Based on the newly derived knowledge on the complexity of PHM implementation, it is questionable if objective comparison between initiatives or regions is feasible. Due to the complexity and scale, an experimentally controlled setting cannot be achieved. On top of that, the interdependencies make it difficult to attribute improvement to a preconceived, constructed change. And, the diverse implementation in every region and the continuous and evolving nature of PHM implementation maturity add to the complexity. (43) This limits the possibilities to match regions to create a proper control. The scientific evaluations of PHM seen in literature often face these limitations, focusing either on specific patient populations or lacking proper comparisons with control regions. (44, 45) Evaluations where progress is measured against itself and where improvement is compared, such as difference in difference, might be more insightful. (46) However, for these kind of evaluations to be useful for strategic decision making in practice you will need high quality data. (47) Gathering this data and making these evaluations feasible (PHM elements 'integrated data infrastructure' and 'population health data analytics') is in some form already improvement of PHM implementation maturity, provided it is sustainably designed. Therefore, I believe it is wise to consider PHM implementation maturity as part of the process evaluation of the whole initiative and to be careful with comparison to other initiatives. (48) The main reason, next to the aforementioned challenges, is that too much standardization on outcomes conflicts the complex character of PHM and the diversity of populations. With mediocre data quality this may divert the implementation efforts away from what they should be about: serving the population. Future research is needed to explore how PHM implementation maturity can attribute to proper interpretation of objective data and relates to PHM outcomes. (21, 49)

Implications and future directions

In this part of the discussion I turn the acquired knowledge on PHM implementation towards the future: What potential does this offer to work in a transdisciplinary manner towards population health? I consider this in light of the challenge to merge knowledge from different disciplines, professions and perspectives. Ultimately, this leads to a call for hyperspecialists to do what they do best while providing room for generalists to bridge the perspectives.

Most of all, the results are testimony that we need each other to change healthcare provision for the benefit of the population. However, collaboration is challenging and takes time. Within the transdisciplinary nature of PHM implementation – as with the elephant in the introduction – persistently pushing your own perspective does not contribute constructively to building a shared understanding. We need all existing expertise to complement each other, but this can only function when we are in connection. This call for transdisciplinarity and collaboration in health and care resonates loudly. Several academic speeches of new Leiden Professors from the last two years mention it and at the same time reveal the difficulties: It takes time; people should be supported, encouraged, and rewarded; the balance of knowledge and power between stakeholders should be managed; incentives help; there is a lack of frameworks to assess the quality of transdisciplinary research; and within such a collaboration some people will have to adjust their focus in the interest of the group. (50-55) I recognize all these points in the projects I was involved with. And at the same time, while these difficulties cannot be ignored, the value of looking at a problem from multiple perspectives is also recognised. So how to proceed in PHM implementation?

The good thing is that there is already a lot happening all over the world. Successful or not, lessons are shared and progress is made. (37, 56, 57) However, the frustration is that a lot of health interventions, PHM tools, or PHM element improvements are made and used in isolation of each other. As pointed out in the introduction, this disconnection leads to reinventing the wheel, double work, and resource depletion among others. So, while specialists work on improving the PHM cycle with tools for practice (58, 59), other specialists work in health and social care to provide the right care and support, and some specialists work in the domains of the PHM-elements to improve budgeting, governance, data management, and community engagement, (29, 47, 60) we need generalist thinkers to bring it all together. One strong strategy that is already in place is educating the workforce of the future, which is happening in the Master Population Health Management at the LUMC/Leiden University amongst others. Another example is the Ontario Health Teams (OHT) impact fellow program, in which postdocs support the implementation and evaluation of health interventions and the rapid learning of OHT with a year-long fellowship. (61) However, the connection also needs to be made on board levels. So, high-level leaders need to step up themselves or give room to a new generation of generalist thinkers to connect the dots.

Specifically for academia, the results of this dissertation suggest that PHM is not an discipline on itself, but instead relies on several research disciplines. Therefore, there is a need for interdisciplinary trained researchers who are not bound to the partiality of

one specific discipline. To be an innovator for health, these researchers need to start connecting, be aware of assumptions, and perceived functional barriers in research. For example, they should not be led by the data they have, but they should try and acquire the data they need. To do so, these (young) researchers should be encouraged and supported to overcome institutional barriers, old-fashioned thinking structures, and to push for new ways. This will not be easy, as the incentives point in a different direction throughout the academic system.

For future research, some hypotheses and suggestions were already presented throughout this dissertation. However, to proceed in practice and research both, some questions are more pressing than others. For policy, it would help to improve the PHM-MI from application for qualitative understanding towards quantitative measurement of PHM implementation maturity. This would help in monitoring progress and effect of targeted policy funding in PHM implementation initiatives. This would need further validation of the tool and also includes questions around the context-dependency of the items. For practice, it would help to know which items of the PHM-MI are to what extent necessary and in what order they should be implemented. And again, to what extend this relies on context and existing maturity. Scaling up the use of the PHM-MI in different regions and in the same regions over time would create an international database on the progress of regions across the world. This would allow for comparison research to analyse patterns in successful items to build PHM implementation. In turn, this knowledge can feed back into practice to inform how to successfully implement this approach to improve the health and wellbeing of the population in a sustainable way. Lastly, a more long-term research topic would be to connect PHM implementation maturity to the successful execution of the PHM cycle for multiple subpopulations to ultimately improve the health of the population. However, this would require at least one region with a mature level of PHM implementation. To prove that, if implemented correctly, PHM brings supply and demand of health and care support for the population closer together in a sustainable way by 1. Encouraging continuous learning and adaptation, 2. Using existing knowledge to the best of our ability, and 3. Bridging the perspectives of so many different people.

Epilogue

After three years of being submerged into PHM, a reflection on how this knowledge affects my profession cannot be left out. As a pharmacist, I was trained to handle everything from the earliest start of pharmaceutical product development to the delivery of pharmaceutical care and everything in between and around this process. So how can the perspective of PHM implementation be an asset for pharmacists?

As concluded in this dissertation, providing care for the population should be done together. Therefore, all pharmacists, wherever their position in the system, should look around and dare to see beyond their own role. They should analyse where in the network they are and where they would like to be. For example, pharmacists in the pharmaceutical industry could evaluate their role in market access of medicinal products, thinking about what they can do to enhance the availability, accessibility, and high quality of the products they are responsible for. And more specifically for PHM thinking, making sure that these products reach only that part of the population that can benefit from it, safeguarding the impact on the whole population. In line with this, community pharmacists should reflect on the unique role they and their pharmacy-team have in a neighbourhood. Using this position, signalling the needs of individuals and groups of people, they can bring people and professionals together.

Population health management should not be perceived as a contradiction to personalized or evidence-based care, but as an approach to serve the population according to their needs. The example of pharmacogenetics demonstrates how innovation may start with impact for a small population in a hospital setting and then slowly can make its way to a broader population. (62) As with all health providers, not all pharmacists need to be the generalist thinkers we need, because we also need the specialists to deepen our knowledge and practices. However, we need some thought leaders to represent others in the broader network, to take up the collaboration, and connect with the different actors in the system. For example, community pharmacists can represent and support each other in different primary care networks. This connection is beneficial for all in the network, as all parties can bring their own strengths to serve the population. Further integration on all levels requires collaboration on all PHM-elements which starts with putting the common interests first. To do so, it is important to learn about those close in the network, discuss each others interests, find the corresponding aims and work together to improve the health of the population and the experience of care for people and carers within the boundaries of costs. So, which population do you serve?

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