

Approaches to Population Health Management

Informing Ontario's Health System Transformation

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The Health System Performance Network (HSPN) is a collaborative network of investigators, visiting scholars, post-doctoral fellows, graduate students and research staff working with health system leaders, and policymakers to improve the management and performance of our health system. Building on Ontario's established record of performance measurement created by the 1998 ground-breaking Hospital Report Research Collaborative, the HSPN was established in 2009 and has built a track record in performance measurement, research, evaluation and improvement in Ontario with expertise in multiple domains of health system performance including perspectives of patients, providers, population health, and cost. The HSPN receives funding from the Ontario Ministry of Health.

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Executive Summary

Background

Population health management (PHM) is the concept of gathering data and insights about population health and well-being across multiple care and service settings, with a view to identifying the main health and social needs of the community and adapting services accordingly. This is accomplished by integrating services across health, prevention, social, and welfare services. The enactment of the Connecting Care Act in Ontario in 2019 launched a number of health system reforms, including the creation of Ontario Health Teams (OHTs). Under the Act, OHTs have a mandate to organize and deliver care using a PHM approach. This report aims to provide practical information to leaders, managers, and practitioners involved in the creation and implementation of OHTs derived from international examples of PHM initiatives.

Purpose

This report is guided by the following questions:

1. What are the descriptive and contextual characteristics of existing international PHM systems?
2. To what extent are international PHM systems effective?
3. What can be learned from the experiences of other jurisdictions implementing PHM?

Methods

Five case examples of PHM systems are examined through the lens of the Population Health Alliance (PHA) analytic framework. The systems were selected for variability in geographic location, level of maturity, and political and health system context. Two systems reflect country-level PHM initiatives while the remaining three reflect local-level PHM initiatives within countries. The context and organizational structure of each system is described, followed by key insights regarding various steps of the PHA analytic framework that are most pronounced in each system.

Findings

Characteristics of international PHM systems:

The population health alliance analytical framework identifies 6 steps in population health management:

- | | |
|--|------------------------------------|
| 1. Population identification | 4. Citizens-centered interventions |
| 2. Triple (or Quadruple) Aim assessment | 5. Impact evaluation |
| 3. Risk stratification / population segmentation | 6. Continuous quality improvement |

Essential features of PHM systems include :

- | | |
|--|--------------------------------|
| • integrated care programs | • accountability and financing |
| • attention to social determinants of health | • measurement and evaluation |
| • system governance | |

PHM systems are supported by macro supports (including supportive legislation, integrated policies and consistent payment systems), meso level factors (financial alignment, data sharing, organizational readiness for change), and micro level including provider readiness for change and informed, motivated and prepared patients and families.

All 6 steps in the PHA analytic framework were represented in varying strengths across local and national PHM programs. Additional enabling factors included an early focus on building trust (Netherlands), changes in funding and investment in primary and community care (Singapore), effective e-health and practice improvement coaches (Kaiser Washington), coaching and systematic quality improvement culture (Jönköping), and rigorous evaluation (Gesundes Kinzigtal). More components of PHA were

observed and reported within the three local system summaries compared to the national policy initiatives. PHM can be more fully developed and implemented at the local level, though there is value in national (or provincial) supports.

Evaluation results:

While evaluation is a key component of the PHA analytic framework, detailed evaluation results are not always available and some PHM systems are not mature enough to have final or impact evaluation results. Gesundes Kinzigtal can be considered a more mature PHM system that has moved from developmental to more summative evaluations. External and internal evaluations have demonstrated a reduced mortality rate for those enrolled compared to those not enrolled and generated a savings of 16.9% against the population budget, compared to members of sickness funds from different regions. Academic literature describing the implementation of early integrated care programs contribute to an understanding of PHM system implementation. Qualitative evaluations have identified challenges with acceptability of the program for patients, and difficulties with rolling out integrated electronic medical records. Jonkoping has been designing and implementing directed PHM approaches for over 20 years, and ranked first among Sweden's 20 county council health systems on an overall index score of system performance indicators in 2010.

Key Learnings

- An early focus on building relationships and trust between organizations, starting with small initiatives can help facilitate this. (Netherlands)
- Population segmentation plays a critical role in both the organization and delivery of population health management (Kaiser).
- A built-in quality improvement culture, structures, and processes are critical to long-term success. Coaches for implementation are drawn from front line providers and trained to implement quality improvement. (Jonkoping)
- Increased investment in primary and community care was necessary to ensure infrastructure and leadership were there to support collaboration. (Singapore)
- Financial risks and benefits must be regionalized to support accountability; ensuring certainty in payment for providers (e.g. hospitals) during transition to community-based care provides important stability. (Netherlands)
- Shared savings contracts and provider shareholder agreements allow for shared accountability for outcomes, as well as reinvestment in the integrated care system. (Gesundes Kinzigtal)

Conclusion

A number of recommendations for OHTs are made based on key learnings from the five international PHM systems. Some recommendations provide guidance for the development and evaluation of OHTs, while others highlight a need for early and concerted upfront investment in relationship building between different OHT stakeholder groups and in community engagement.

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Introduction

What is Population Health Management?

Population health management (PHM) is the concept of gathering data and insights about population health and well-being across multiple care and service settings, with a view to identifying the main health and social needs of the community and adapting services accordingly¹. Generally, health systems adopting a PHM approach aim to address the health needs of the entire population at all points along the continuum of health and well-being². This is done by integrating services across health, prevention, social, and welfare services². It is common for PHM systems to shift the focus to prevention, determinants of health, equity, and intersectoral action³. This population health approach is increasingly relevant for today's health and care systems, which are facing growing demand from a larger population with long term conditions and funding challenges resulting from the availability of new treatments and therapies, longer lifetimes with one or more chronic conditions, and a considerable population with unmet health needs^{1, 2}.

Several definitions of population health and PHM exist and there continues to be an absence of a broadly agreed-upon definition². **We adopt an early definition of population health as the health outcomes of a group of individuals, including the (equitable) distribution of such outcomes within the population group⁴.** In response to contemporary health system challenges, population health has evolved to include methodologies for identifying people at low-, medium-, and high-risk of physical and mental ill health and strategies to integrate services across healthcare, prevention, social care, and welfare^{1, 2}.

An Analytical Framework for PHM

The Population Health Alliance (formerly the Care Continuum Alliance) Population Health Guide is purported to be the most comprehensive model developed for framing and evaluating PHM². It acts as a guide to the implementation of PHM initiatives, describing the six sequential steps involved in the PHM approach. In 2015, Jeroen Struijs, along with colleagues from the National Institute of Public Health and the Environment in the Netherlands, sought to extend the Population Health Alliance (PHA) framework and transform it into an analytical framework. Briefly, they refined the quantitative portion of the PHA model and extended the model with the inclusion of a qualitative perspective. This extended version of the PHA model, which we have dubbed the PHA analytical framework, guides the assessment of PHM initiatives included in this report. The PHA analytical framework is comprised of the following six steps:

1. Population identification (by geography, enrolment or otherwise);
2. Triple Aim assessment (to identify opportunities for improvement);
3. Risk stratification (optimized segmentation of the population);
4. Citizens-centered interventions (tailored intervention as well as contextual factors and information needs);
5. Impact evaluation (including Triple Aim and for interventions in segments); and
6. Continuous quality improvement ².

Figure 1 provides a schematic of the PHA analytical framework. A full explanation of each step is provided elsewhere². Equity across racial and socioeconomic factors must be considered at each step.

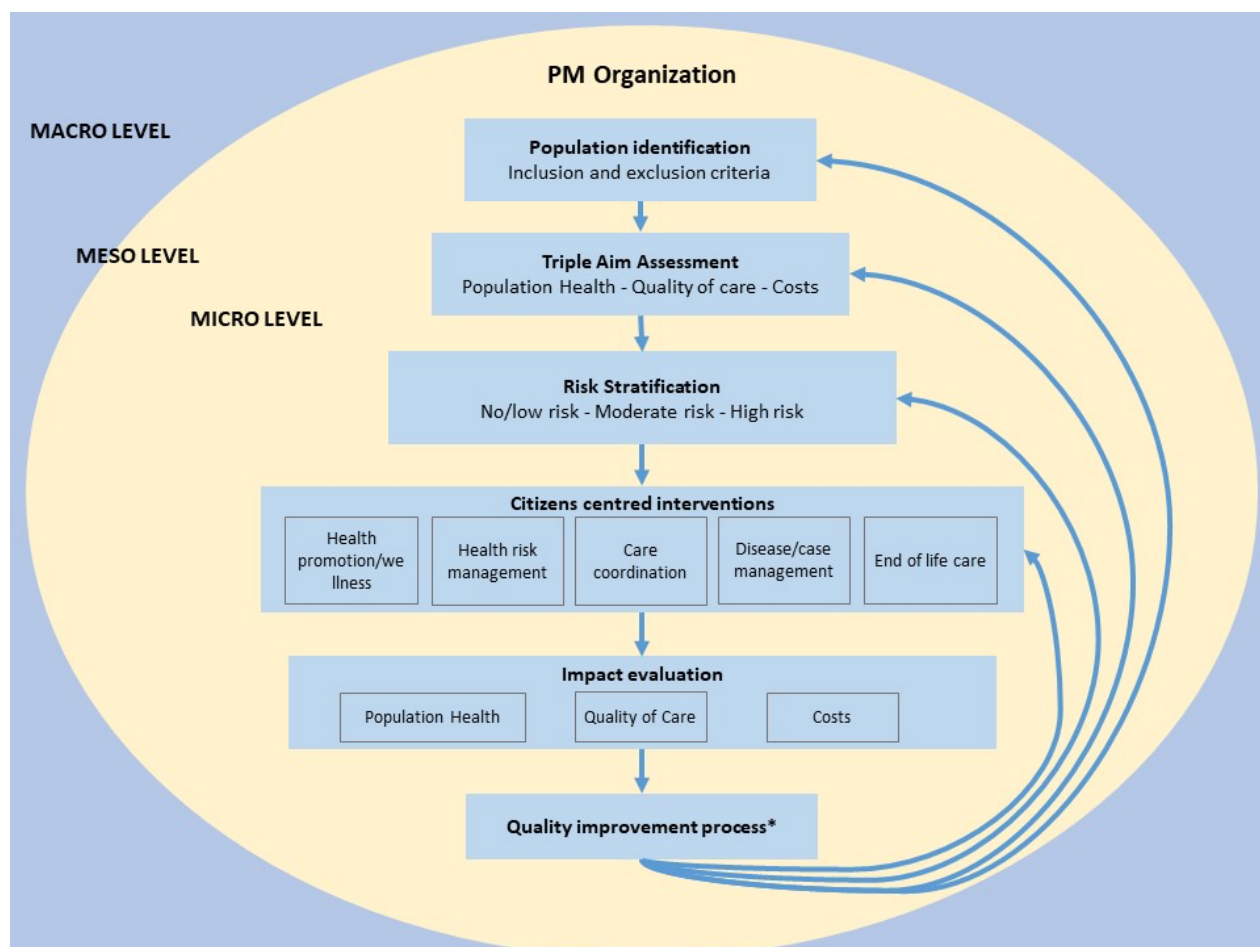


Figure 1 Population Health Alliance Analytical framework as adapted by Struijs and colleagues, 2015

Contextual Factors

In addition to the six steps of the PHA analytical framework, Struijs and colleagues also acknowledge the importance of implementation and organizational structures in evaluating PHM systems. In their analytical framework, they include contextual factors which are relevant at each of the six steps and are meant to be evaluated qualitatively. The contextual factors include:

- macro level factors, including supportive legislation, integrated policies, and consistent payment systems;
- meso level factors, including regional and local market structures, financial alignment between providers, existing data sharing, organizational readiness for change;
- and micro level factors, including provider readiness for change, and informed, motivated, and prepared patients and family².

Information Needs

Information needs of PHM systems are also acknowledged as being important for the design, implementation and evaluation of systems. Availability of integrated patient data, epidemiological and demographic data, and claims data in a format that is linked is considered a fundamental prerequisite for the effective implementation of PHM systems².

Features of Population Health Management Systems

There is a growing body of academic and industry knowledge exploring the concepts of PHM systems and the evaluation of their implementation and outcomes. Outlined below are core features of PHM systems.

1. Relationship between integrated care systems and PHM systems: Systems and health initiatives using a PHM approach can be considered a type of integrated care system. Thus, the models and theoretical frameworks underpinning integration of care are relevant. Some PHM initiatives rely on the Triple Aim framework, while others emphasize elements of the Chronic Care Model, or socio-ecological models to drive the type of integration³. An important distinction is that all PHM systems are designed to deliver integrated care, but not all integrated care is delivered under the purview of a PHM system; some integrated care programs serve very narrowly defined population groups.
2. Social determinants of health: A recent scoping review that examined integrated care systems transitioning to PHM approaches emphasized that both population-based and individual-level initiatives for social determinants of health and improving health equity were important components of these systems³. System redesign to incorporate and support social services were identified in several of the systems studied. An equity-oriented approach is needed.
3. Governance: There is consensus that clearly outlined governance arrangements are a pre-requisite for successful implementation of PHM systems, as multiple organizations and actors are involved, each with their own processes and interests. Accountability, oversight, and distributed leadership considered within the local context are key to implementation of PHM initiatives⁵. In systems with lower degrees of administrative and organizational integration, some systems may implement shared governance mechanisms to offset this^{1, 6}.
4. Accountability-minded payment models and financing arrangements: While ongoing debates exist about the most appropriate payment model to support PHM systems, a key factor of payment models thus far has been the shifting of financial and clinical accountability from payers towards shared accountability in order to incentivize providers to implement a population health approach to care⁵.
5. Evaluation: One ongoing challenge of PHM systems has been the evaluation of such complex and context-dependent initiatives. Most systems have undertaken developmental or implementation evaluations during the “roll out” of PHM initiatives, followed by summative evaluation post-implementation. The creation of indicators and consideration of existing measures and indicators (such as quality of life measures and population mortality) have been incorporated into evaluation plans. It is common for PHM systems to be evaluated by the extent to which they contribute to the Triple Aim, which aims to improve quality of care, improve the health of the population, and reduce per capita costs (or cost growth)².

Context in Ontario: Ontario Health Teams

Ontario is Canada's most populous province, with a population of approximately 14.6 million ⁷. Canada's health system is a decentralized, publicly funded health system with universal coverage for medically necessary physician and hospital services, which are free at the point of care. Ontario's health care system is administered by the Ontario Ministry of Health and Long Term Care (MOHLTC) through the Ontario Health Insurance Plan (OHIP), which is financed from provincial and federal tax revenue⁸. In addition to physician and hospital services, OHIP covers prescription medications for seniors and those

on public financial assistance programs. A limited amount of home care is covered, and residential long-term care is financed subject to a resident co-pay for accommodation costs.

In 2019, the provincial government enacted the Connecting Care Act. This legislation launched a number of health system reforms, including the creation of Ontario Health Teams (OHTs). OHTs constitute voluntary collaborations between providers of hospital services, primary care, and community health services. Once established, OHTs are intended to comprise groups of providers and organizations that are clinically and fiscally accountable for delivering a full and coordinated continuum of care to a defined population. The OHT model is intended to encourage providers to improve the health of an entire population, reducing disparities among different population groups. As part of this approach, OHTs will be enabled to locally redesign care in ways that best meet the needs of the diverse communities they serve⁹. In effect, OHTs have a mandate to organize and deliver care using a PHM approach.

Purpose and Questions

Internationally, there are many examples of PHM initiatives that have been successfully implemented. Ontario is in the very early stages of transforming its model of health system organization and delivery toward a PHM approach, thus, it is well poised to integrate key components and learnings from the examples of others. This report aims to provide practical information to leaders, managers, and practitioners involved in the creation and implementation of OHTs using an array of examples of international PHM initiatives. Conditions for success and learnings from other systems are identified as they relate to OHTs. This report is guided by the following questions:

1. What are the descriptive and contextual characteristics of existing international PHM systems?
2. To what extent are international PHM systems effective?
3. What can be learned from the experiences of other jurisdictions implementing PHM?

Methods: Five Case Examples

To address these questions, five case examples of PHM systems were examined through the lens of the PHA analytic framework. The systems were selected for variability in geographic location, level of maturity, and political and health system context. The selection process involved a brief review of reports and PHM literature to identify potential case examples and iterative discussion with a panel of senior advisors with knowledge of integrated care and PHM to select case examples that were relevant while demonstrating variability. The selected case examples and preliminary outline of findings were presented to a larger advisory panel of experts in a webinar format. Webinar attendees included individuals with expertise in public and population health and individuals involved in the development of OHTs. The webinar format allowed for discussion and feedback on case selection and indicators examined within each case example. Through this, the case examples selected were refined and a distinct emphasis on social determinants in PHM approaches was recommended.

Of the five case examples examined, two examples are country-level (Netherlands and Singapore), demonstrating implementation of PHM systems initiated by governments. Three examples represent health systems within countries (Kaiser Permanente, Jönköping, Gesundes Kinzigtal). These examples demonstrate the implementation of PHM systems as a response to local needs.

Peer-reviewed articles and grey literature including health system reports, evaluations, and press releases were sourced by the study team to address the PHA framework components of each system.

Efforts were made to identify quantitative evaluative findings and qualitative analyses that described the development and context of each of the PHM systems.

The key insights regarding various steps of the PHA analytic framework that are most pronounced in each system are highlighted followed by a description of the context and organizational structure of each example. After exploring key contextual factors and PHM system characteristics, specific findings and experiences of the example systems were used to make recommendations for the use of PHM in OHTs.

Findings: International Approaches to Population Health Management

Country Level PHM: The Netherlands

What can be learned from Netherlands:

- An early focus on building trust between organizations and familiarizing all parties with relevant processes at respective organizations can help to facilitate building these relationships. Starting with small initiatives can help with this.
- Engaging the citizens of the community can help to address equity in the specific needs of certain groups in geographic areas.
- Financial risks and benefits must be regionalized to support accountability; ensuring certainty in payment for providers (e.g. hospitals) during transition to community-based care provides important stability
- Privacy legislation must be updated to support the shared information requirements of effective population health management but the biggest challenges are adaptive in changing the culture to share patient and provider information across a network of service providers
- Select performance indicators that reflect the stage of implementation you are in and the anticipated outcomes of that stage

Context

The Netherlands is a small, densely populated country in northwestern Europe with a population of approximately 17.2 million. Before 2006, the Dutch health system was a hybrid system based on social insurance, combined with a long-standing role for private insurance covering individuals of high socioeconomic status. Reforms in 2006 introduced three managed markets for universal health insurance, healthcare purchasing and provision. As of 2016, four insurer groups hold 90% of the insurance market share¹⁰. In addition, the reforms spurred a transformation of the Dutch government's role in the health system into one of setting health care priorities, introducing legislative changes when necessary, and monitoring access, quality, and costs¹¹. The Dutch health system is among the most expensive in Europe, yet it is also in the top five of best valued systems by its users in terms of quality¹⁰. Healthcare is largely financed through compulsory health insurance contributions from citizens with a small remainder financed through general taxation. Adults pay a community-rated premium to their insurer plus an income-dependent premium into a central fund that is redistributed amongst insurers on a risk-adjusted basis. The basic benefits package includes general practitioner care, maternity care, hospital care, home nursing care, pharmaceutical care and mental healthcare. Care that is not covered under the basic package can be insured via optional voluntary health insurance, such as prescriptions eye glasses and dental care¹⁰.

Organizational Structure

In 2013, the Netherlands Ministry of Health, Welfare and Sport designated nine regional innovation initiatives as pioneer sites in a nationwide effort to achieve better healthcare at lower cost¹². These sites serve more than 2 million people and represent partnerships among providers, insurers, and other stakeholders, and are currently implementing project plans to accomplish the Triple Aim (better health, improved quality and cost control) through the integration of clinical and community services¹². These regional health initiatives are in fact PHM initiatives. All sites share the same Triple Aim objectives; however, because they represent a move toward further decentralization, they have adopted different projects and strategies to achieve their objectives. There has also been a strong focus from the beginning on the importance of altering cooperative practices and organizational cultures, in addition to the achievement of healthcare improvement. The sites are networks, comprised of a steering group, one or more working groups, and sometimes an executive or management committee. The composition and responsibilities of the steering groups are varied and likely to change with maturity. According to a report published in 2014, the healthcare activities carried out by the sites up until that point had largely been reimbursed by insurance companies under the Health Insurance Act, with funding for certain projects, such as integrated mental health care, coming from additional government or research grants. Other strategies are also pursued to offset the additional costs of projects, such as requiring investments from the participating agencies¹².

Contextual Factors

In 2017, a qualitative study was published highlighting early decisions and learnings from these nine pioneer sites¹³. Findings were based on interviews that took place on a quarterly basis from January 2014 to July 2016 with 63 stakeholders (insurers, primary care groups, hospitals, municipalities, and community-based organizations, mostly representing patient organizations) and 9 program managers¹³. An overview of these findings is provided below to highlight the three key takeaways from the Dutch foray into PHM in its early stages.

1) Build trust by bridging gaps in organizational culture

The pioneer sites have thus far pursued small-scale interventions that foster collaboration between insurers, healthcare providers, community services, and community representatives with the aim of improving the underlying relationships amongst these different stakeholder groups. The implementation of these interventions put stakeholders in constant contact, which led to the creation of a common language, shared vision, and channels of communication. However, through this process, the importance of continuous, concerted effort to overcome cultural differences between organizations was also highlighted. For instance, some healthcare providers and insurers were frustrated by what they perceived as slow decision-making processes within municipalities. In certain instances, provider-payer contracts were misaligned with agreed-upon goals. It was found that these early stumbles challenged trust between different stakeholder groups, highlighting the importance of developing an early understanding of the culture and processes within participating agencies. The development of such an understanding is an important end in and of itself, but also lays the groundwork for the formulation of collaborative strategies to work around these differences¹³.

2) Fee-for-service payment and funding models inhibit integration

Fragmented payment systems that focus on the short term tend to put organizations' interests in conflict with the Triple Aim. As a result, new payment models and governance structures have emerged within the pioneer sites. For example, shared-savings contracts reward pharmacists, providers, and insurers for

increased prescribing rates of lower-cost generic drugs; long-term contracts between insurers and hospitals reduce income uncertainty when more patients are shifted from hospital-based to primary care; and new bundled-payment models (e.g., for mental health) provide a single payment for a range of related services, thereby encouraging integration. Some pioneer sites are working to integrate budgets and thereby eliminate funding silos between municipalities (which provide community services) and health insurers¹³.

3) Political support to increase transparency

The pioneer sites, like any PHM initiative, have significant information needs requiring the reorganization of governance structures. In the Netherlands, progress towards such reorganization has been hampered by concerns related to privacy, resources, and antitrust regulation rather than by technological challenges. Work is still required in this area¹³.

Moving forward, the pioneer sites are looking to build on their experience thus far and are now focusing on community engagement and regionalizing financial risks and benefits. Increasingly, the sites have recognized that direct engagement with communities is crucial for empowering them to take charge of their own population's health, for tailoring interventions to communities' needs and preferences, and for helping all stakeholder organizations look beyond their own interests to shared goals. In six of the nine sites, communities are represented in steering groups. Others engage in community outreach via surveys and online communities. In one of the sites, a new legal entity, owned by citizens, was formed, which has thus far negotiated a supplementary insurance package with the dominant insurers. Ascertaining models that enable the sharing of financial risk and benefit is also a focus in order to create a shared accountability structure amongst all participating agencies in the PHM initiatives¹³.

Evaluation

At this stage of the Netherlands's implementation of PHM initiatives, there is no data available (in English) on the impact of the initiatives on intended population health outcomes. Whether such evidence exists in Dutch is not known. It is important to keep in mind that a move toward PHM constitutes a system transformation and so impacts on health (physical, mental, and social) are not realized in the short term. Thus far, the initiatives have focused on relationship building and mitigating organizational challenges to the delivery of PHM. If anything, this reinforces that there are many stages to the implementation of PHM systems. It is critical that evaluation occurs at every stage, but it is equally critical to understand that the type of evaluation will be different at every stage and that any performance indicators must be chosen in relation to the aims of each stage.

Country Level PHM: Singapore

What can be learned from Singapore:

- Increased investment in primary and community care was necessary to ensure infrastructure and leadership were there to support collaboration.
- The general public may need education and support to transition to patient-oriented approaches to care.
- Innovations in funding and remuneration, such as bundled payments, are important to support integration across sectors and providers.

Context

Singapore is a nation state in south east Asia, with a total population of 5.6 million, covering an area of approximately 700km². Singapore's population is aging at a rapid rate. Additionally, the population has increased in the last decade as a result of immigration¹⁴. The public health system in Singapore is planned, built, and continues to be developed and maintained by Singapore's Ministry of Health¹⁵. Coverage is funded through general tax revenue, while private health insurance plans are available to supplement coverage. This combination of public and private funding is meant to ensure a balance between individual responsibility and social protection¹⁶. In this mixed delivery model, the public sector delivers approximately 80% of the national burden of acute care¹⁷. Primary care is largely provided by private, solo practice and general practitioners clinics, with just 20% of primary care services provided by publicly funded polyclinics¹⁸. Chronic long term care is largely delivered by acute and tertiary hospitals¹⁷. To see a physician specialist in the public system, a referral from primary care is expected; however, in most circumstances, primary care does not take on this gatekeeping role.

Organizational Structure

In 2008, the Singapore Ministry of Health created six Regional Health Systems (RHS) with the goal of delivering more comprehensive and integrated care. In this model, each of the RHSs was responsible for a specific geographic region, where the goal was to apply a PHM approach^{14, 19}. Each system was responsible for a large population; for example, the population residing in the Eastern RHS was approximately 1.3 million in June 2017²⁰. The RHSs were anchored by regional hospitals that were intended to work with primary, intermediate, community, and long term care supports in that region¹⁴, and were mandated to support and implement programs to provide healthcare beyond the hospital to the community. Each RHS had a dedicated strategic planning office and funding support.

The role of the Ministry of Health in the creation and management of the RHS system was significant, with the Ministry providing high level funding and oversight. Key priority areas were determined by the Ministry of Health with very little contribution from healthcare users or providers. Evaluations of the RHS indicate that this setup reflected an intention for top-down control while in practice each RHS needed considerable self-organization in the adaptation of mandated programs to meet the needs of their population¹⁹. Hospitals initially played a leading role in Singapore's RHSs, as leadership and funding was generally concentrated within the hospitals¹⁷. This was a challenge, as there were known financial and human resource constraints at the community level; primary and community care had less developed organization structures and practices, and have smaller operational budgets¹⁷. This imbalance made it difficult to collaborate across the hospital and primary and community care sectors.

In January 2017, Singapore's Ministry of Health announced another reorganization of the health care delivery system, from six RHSs into three systems, or integrated clusters: the National Healthcare Group (NHG), SingHealth, and the National University Health System (NUHS)¹⁸. This shift was intended to leverage the capabilities of different institutions within each system¹⁸.

Risk Stratification / Population Segmentation

Segmentation is used to group patients and healthy people into segments with relatively similar needs or characteristics and helps to facilitate the development of a population health programs²¹. In Singapore, the Ministry of Health proposed a consensus segmentation model which featured five complexity cohorts created by experts²¹. The cohorts included: mostly healthy; serious curable acute; stable chronic; complex chronic with and without acute hospitalizations; and end of life. The Eastern RHS applied an adaptation of the British Columbia Population Segmentation Framework²⁰, while SingHealth RHS validated the Ministry's proposed five segments, adapted to include two additional segments^{22, 23}. A focus of system leaders was on the identification of frequent and high cost users. Despite the interest in segmentation among Singapore's health regions, there continues to be a lack of consensus regarding the clinical application of segmentation approaches²¹.

Integrated Programs

To address the challenges with the public and private primary care clinics, the Ministry of Health introduced a Primary Care Network scheme to encourage private clinics to organize themselves into networks to optimize resources and deliver care in a team-based model. These networks were part of the Ministry's shift to build capacity in the community, with the Ministry providing funding and support for these networks²⁵. Another example of a program dedicated to a particular sub-population is the CARITAS integrated dementia care program in the northern RHS, which aims to improve integration of care for people with dementia through team based care, regular case conferencing, improving competency and capability of primary and community care providers, and empowering caregivers¹⁷.

Evaluation

There is a growing body of academic literature which reports on the performance of integrated care programs for sub-populations in Singapore, and on system level interventions, however, no sources have referred to internal or external evaluations of the system, nor have quality improvement initiatives been explicitly described. Performance measures, in the absence of comparators, offer only descriptive rather than evaluative information. Qualitative research that has evaluated Singapore's transition to integrated care has identified a disconnect in the expectations and perceptions of healthcare providers and users, with some users having difficulty understanding the need for team-based care and connections between health and social care. As a result of this, implementation and uptake of some integrated care programs was challenging, due to low acceptability and adherence^{17, 24}. This also points to a challenge in spreading top-down initiatives without sufficient local support.

Contextual Factors

Financing Arrangements

Singapore's RHSs faced challenges with respect to financing population health and integrated care programs. Services are typically charged to patients based on disease, service, and provider type, with direct reimbursement from health savings accounts, supplier subsidies, or out of pocket payments, with no mechanism by which public sector providers were able to pool funds across services and sectors¹⁷.

RHS evaluations advocated for the development of self-organized financing systems across the network or alternatives such as bundled payments, portable subsidies, or capitation models. The introduction of such funding innovations has been limited¹⁷.

Information Needs

A National Electronic Health Record (EHR) was created to be an integrated virtual and long-term healthcare record centered on the patient, accessible by all authorized healthcare professionals across settings and sectors. There have been concerns with the completeness of the documentation in the National EHR system. In addition, there have been difficulties using the system, resistance to the new technology, and challenges navigating regulations around the use of personal information¹⁷.

The Health Services and Outcomes Research department of the National Healthcare Group, one of the six RHSs, developed a database of linked healthcare utilization data from three RHS systems, with the goal of promoting the sharing of health information across independent healthcare organizations to ultimately improve management of population health¹⁹. Population segmentation approaches in Singapore drew on data from electronic health records and population level data from the Ministry of Health Singapore Division of Policy Research and Evaluation²⁰.

Local System: Kaiser Permanente Washington, United States (US)

What can be learned from Kaiser Permanente Washington:

- KPWA's Population Health Program is built on decades of experience of integrating population-based strategies into the health systems that serve its member population.
- Critical to its success in integrating care is substantial investment in e-health: it has been estimated that Kaiser Permanente financed a US \$4 billion electronic health record (EHR) system deployment over 10 years (HealthConnect). HealthConnect houses an EHR with interoperability across care settings, including inpatient, outpatient and clinical support, and connectivity to laboratory, pharmacology, and radiology systems; a web-based client portal for secure patient-provider messaging, as well as access to personal health records; and a system for messaging between providers, allowing care updates to be automatically added to patient records.
- Population segmentation plays a critical role in both the organization and delivery of KPWA's PHP.

Context

Healthcare in the US is covered by a mix of public funding and private insurance. The Centers for Medicare and Medicaid Services administers Medicare, a federal program covering adults 65 and older and some people with disabilities. The Centers for Medicare and Medicaid also works in partnership with state governments to administer both Medicaid and the Children's Health Insurance Program, a conglomeration of federal-state programs for certain low-income populations²⁶. Private insurance is regulated mostly at the state level. In 2015, 67.2% of US residents received health coverage through private voluntary health insurance: 55.7% received employer-provided insurance while 14.6% acquired coverage directly²⁶. As of 2018, approximately 8.5% of the population was uninsured²⁷.

Organizational Structure

Kaiser Permanente is one the US's largest not-for-profit private insurance networks, serving 12.2 million members. It consists of a consortium of three interdependent groups: Kaiser Foundation Health Plan, Kaiser Foundation Hospitals, and the Permanente Medical Groups. The medical groups are responsible for administration and care delivery²⁸. The health plans and hospitals receive federal not-for-profit tax status, while the medical groups operate on a for-profit or professional corporation basis. Kaiser is a virtually integrated system with providers remaining as distinct organizations with cooperation enabled through contracting. Together, these factors combine to create a very specific incentive structure that requires that value and member satisfaction be at the centre of everything they do. Since its inception, Kaiser Permanente has put integration at the core of its organizational ethos, adopting the following integrated care principles: 1) physician accountability; 2) a collaborative, multidisciplinary workforce; 3) cost-effectiveness; 4) e-health investment; and 5) integration of the patient's viewpoint²⁸. Kaiser Permanente has markets in nine states; the Washington division's PHM program is the focus of this section.

Risk Stratification / Population Segmentation

Kaiser Permanente's extensive, well-established model of care integration for all of its members is foundational to Kaiser Permanente Washington's (KPWA) recent foray into PHM. KPWA's PHM initiative, termed the Population Health Program (PHP), annually segments its entire member population into one of four intervention levels: 1) preventive care needs; 2) emerging health risk; 3) health safety concerns; and 4) multiple chronic conditions, using the previous year's data from claims, electronic medical records, health risk assessments, laboratories, immunization records, case management documentation systems, and the Emergency Department Information Exchange. These groups are further stratified to determine which programs within the PHP are best suited to their needs. The PHP currently includes five programs/services: 1) Clinical Quality Improvement Program; 2) Health Profile; 3) Complex Case Management Program; 4) Diabetes Care Program; and 5) Care Transitions Program. These five programs/services represent a suite of functions designed to work together to impact the health of populations. Members are informed about their eligibility for these programs and services via website, secure messaging, phone calls, or letters. A brief description of the PHP programs is provided below²⁹.

Citizens-centred Interventions

The *Health Profile* is an interactive health risk assessment on the KPWA secure member site that collects clinical information to produce an online personal health report for each member with customized recommendations for medical screening, chronic disease management, and health promotion. This report is automatically integrated into the EHR and for members receiving care in the Internal Delivery System (i.e., from providers within the KPWA Medical Group). The *Health Profile* generates an electronic alert to the member's care team if the member has poor control of a chronic condition or has trouble managing medications.

The *Complex Case Management Program* is designed for highly vulnerable members. In this program, registered nurses and licensed practical nurses carry a panel of members who have been identified as having complex needs via population segmentation, or who have chronic conditions such as asthma, COPD, or heart failure. Once enrolled in the program, members undergo a comprehensive assessment of physical and behavioural health, environment, psychosocial needs, safety, medications, and activities of

daily living. The case manager then works with the member to develop a self-management care plan informed by the member's goals, which is then implemented and supported by a nurse case manager. The care plan is developed on a digital platform and shared with the member, their primary care provider, and any other members of the care team.

The *Diabetes Care Program* is designed to support quality care for the diabetes population. The program team provides support to primary care in the form of education, training, and clinical consultation for nursing and medical staff. A focus of this support are nurses who create individual member care plans emphasizing self-management, with focused interventions to work towards goals, and treating the whole person.

The *Care Transitions Program* serves as a bridge and provides support services when members are discharged from the hospital. Upon discharge, members receive a post-discharge phone call from a nurse who reviews medication knowledge, the care plan, details of follow-up appointment, and knowledge of red flags/indications of when to reach out for help. These calls also serve as an identification point of members for other interventions described here or for Transition Management, which is for members who require assistance with coordination of care for a short-term period as a result of frailty, illness, lack of social supports or other psychosocial issues.

Evaluation

At present, there is no information available on the performance of KPWA's PHP; however, KPWA has planned for annual assessment of the program. A series of goals and objectives for each of the PHP programs were set *a priori*, and KPWA has specified that the PHP description will be revised and the overall individual program goals will be reviewed on an annual basis. Qualitative and quantitative analyses are planned to evaluate the efficacy of the PHP and to develop the coming year's targets. Kaiser Permanente has a long history of high performance. For example, between 2002 and 2005, in Northern California, Kaiser Permanente helped reduce prevalence of smoking among its members by 25%, compared with a 7.5% reduction across California as a whole³⁰.

Continuous Quality Improvement

The *Clinical Quality Improvement Program* provides health providers with clinical performance data and expert consultation to target outcomes within the many subsets of KPWA's member population. Quality Consultants work with both primary care and specialty providers and review quality dashboards, metrics, workflow, and reliability tools, and provide education on clinical best practices.

Equity

Another feature of Kaiser Permanente as a whole is its commitment to improving the health of the broader communities in which its sites operate and serve. For example, Kaiser Permanente provides financial support for food banks and other food assistance programmes and runs a range of educational theatre programs in schools and community centres to help educate children and adults about health and wellbeing³⁰. Kaiser Permanente has also established a range of Community Health Initiatives. Included among these initiatives is the sponsorship or co-founding of more than 40 Healthy Eating Active Living collaboratives which focus on: ensuring that health is considered in local government plans and policies; improving access to green spaces and community gardens; improving access to healthy food in schools, workplaces and deprived areas; promoting physical activity across the whole population; and utilising community assets to support and sustain initiatives³⁰.

Local System: Jönköping County Council, Sweden

What can be learned from Jönköping County Council:

- A built-in quality improvement culture, structures, and processes are critical to long-term success. Coaches for implementation are drawn from front line providers and trained to implement quality improvement.
- Jönköping has focused on 4 priority populations within which many essential components of PHM are exemplified, particularly in their older adults population as made famous as the “Esther project” (where integrating care was the foundation for the JCC PHM program).
- Selection of quality and effectiveness indicators should be tailored to specific long- and short-term goals. These indicators should be hosted on platforms that promote transparency between stakeholders (i.e., clinicians, decision-makers, politicians) and provide ease of access for review.

Context

Sweden's population of 10.3 million people is divided geographically into 21 county councils and 290 municipalities³¹. Eleven percent of Sweden's GDP can be attributed to health care³¹. Health care in Sweden is almost entirely publicly funded through taxation, with private health insurance accounting for only 1% of expenditures³². The majority of out-of-pocket spending for health care is due to medication costs. In 2014, 16% of all health expenditures were private. The Health and Medical Services Act of 1982 is the piece of legislation most central to the Sweden's care system. The Act states Sweden's mission of achieving universal care through three basic principles: human dignity; need and solidarity; and cost-effectiveness³³. However, county councils are responsible for regulating pricing of both public and private fees, eliminating the potential for competition through costs³². Each county council is elected and serves a regionally defined population for which they coordinate and fund health care services³⁰. Nationally, the Ministry of Health and Social Affairs governs healthcare in concert with eight collaborating agencies³³. Sweden's history of prioritizing and implementing integrated care models paved the way for the PHM approaches of today.

Organizational Structure

The Jönköping County Council (JCC) healthcare delivery system integrates public health, primary care, hospital care, and social care to address the population within its regional boundaries³. JCC serves a population of 340 000 in southern Sweden³⁰. The system contains three hospitals, each with an emergency department, that serve as the central points of organization for three geographically defined medical areas³⁴. There are a total of 44 health centres for primary and outpatient care in Jönköping county – 30 are owned by the county and 14 are privately owned, but all have the same assignments, rules, and fees due to the government's close regulation and price-fixing legislation³⁵.

Risk Stratification / Population Segmentation

Although JCC is responsible for the entire population within its geographic bounds, they have developed 4 key populations of interest for a focused PHM approach: children and youth, older adults, people with

mental health conditions, and people living with drug and alcohol addiction. JCC's most exemplary population health management intervention is considered by most to be the "Esther Model of Care" for older adults. Esther is a fictional older woman whose hypothetical journey through the healthcare system was crafted and presented to illustrate the challenges that a person in a similar situation may face as they navigate visits to different health care providers in an emergency³⁶. Esther was first introduced in the late 1990s as a case study to spark discussions of quality improvement between older adults, health care providers, and decision makers³⁶. Today the Esther model has grown to include targeted risk stratification for this population, along with various coaches to assist with projects, quality improvement and implementation of new programming. Coaches are frontline health care workers that receive extra training in "problem analysis, quality improvement, and client focus" ³⁶. Esther Cafes are regular meetings held with Esther coaches, community members, and health care policy leaders to exchange knowledge and discuss outcomes and future plans for the model³⁶. Evaluating initiatives like the Esther model in concert with more broadly defined PHM approaches has required JCC to design and implement both county council-level and project-specific indicators.

Evaluation

In the late 1990s, JCC adopted the Balanced Scorecard approach to county council-level evaluation. The scorecard consists of indicators consistent with the system's overall aims and it provides a measure that can be compared annually to inform program planning and budgeting³⁷. To evaluate project-specific initiatives, a corporate dashboard displays providers near real-time updates on indicators. For example, a dashboard informing a quality improvement project on safe healthcare in hospital settings included chronological, hospital-level data such as 'adverse events per 100 patient days', 'staff compliance with basic hygiene protocol', and 'prevalence of hospital-acquired infections'. The variables were chosen to represent the pillars of the corresponding Safe Health Care initiative³⁸. JCC also designs evaluations based on whole system measures developed in partnership with the Institute for Healthcare Improvement. The whole system measures used by JCC can be grouped into six broad categories: knowledge-based/effectiveness, timeliness, safety, patient-centeredness and equity, and efficiency ^{39, 40}. Qualitative measures (e.g., semi-structured interviews with stakeholders, observation of health care sites) and quantitative measures derived from hospital data have been used to evaluate success ³⁸.

Continuous Quality Improvement

Through collaboration with the Baldrige Performance Excellence Program, a U.S.-based accelerator and organizational training program, the foundation for JCC's quality improvement focus was laid. Based on the Baldrige award, JCC formed the QUL strategy, translated from Swedish into 'Quality - Development – Leadership'. The adoption of the QUL strategy led to the development of Qulturum, JCC's in-house quality improvement arm⁴¹. Qulturum consists of an interdisciplinary group across the health, social care and education spectrum⁴². The embedded culture of quality improvement exists at all levels of JCC's system, with all staff, from decision-makers to frontline healthcare workers, being told they have two jobs: to do their job and to improve it⁴¹. In the early 2000s, JCC also began a collaboration with the Institute for Healthcare Improvement's Pursuing Perfection Program and undertook projects to improve scheduling on surgical units, streamline processes in orthopedic care, and improve collaboration between pediatric health care providers⁴³. Through internal systems like Qulturum and seeking collaboration with external health organizations, JCC has built itself up to a level of sustainability where it can now coordinate both large-scale PHM approaches and develop initiatives tailored to populations of interest.

Contextual Factors

JCC's journey into an exemplary PHM system was first made possible through federal-level governance supporting an integrated care approach³³. From there, seeking external input from organizations such as Baldrige⁴¹ and the Institute for Healthcare Improvement⁴³ enabled JCC to establish Qulturum and implement the organizational infrastructure to support a sustainable commitment to quality improvement. Next, building system and project-level indicators based on strategic improvement frameworks, such as the Balanced Scorecard and Corporate Dashboards, has allowed JCC to have a reliable system to evaluate their efforts both long-term and on a near real-time basis^{37, 38}. JCC's adoption of quality improvement as a central tenet of their PHM system approach provides the culture and resources to continue with the ongoing innovation and evaluation needed to effectively manage a population.

Local System: Gesundes Kinzigtal, Germany

What can be learned from Gesundes Kinzigtal:

- Germany's mandatory health insurance model, combined with legislation to allow contracts with physician associations, allowed for the creation of an integrated system.
- Shared savings contracts and provider shareholder agreements allow for shared accountability for outcomes, as well as reinvestment in the integrated care system.
- "Start-up funding" is needed to invest in implementation teams and in information technology infrastructure at the outset.
- Ongoing funding is needed for providers to support information technology infrastructure and activities related to case management and integration.
- Rigorous evaluation using the triple-aim framework was essential for the sustainment of the GK model.

Context

Germany is a central European country with a population of 83.8 million people⁴⁴. Germany's healthcare system is a mandatory insurance model. Citizens and permanent residents must have insurance either through competing, not-for-profit, nongovernmental health insurance funds ("sickness funds") in the statutory health insurance system, or through substitutive private health insurance. The statutory health insurance covers 85% of the population, while another 11% are covered by private health insurance⁴⁵. Most university hospitals are owned by states, while municipalities play a role in public health activities and own about half of hospital beds⁴⁶. Regulation of the healthcare system is delegated to self-governing associations within sickness funds and provider associations⁴⁶. This division of insurance remains a challenge for the German healthcare system and is said to lead to inequalities. In 2012, Germany invested 11.4% of its GDP in its healthcare system, which is considered one of the highest levels in the European Union⁴⁵.

Organizational Structure

In 2004, a health reform was introduced that allowed statutory health insurance funds to designate financial resources for contracting with providers or networks of providers⁶; this laid the foundation for the development of Gesundes Kinzigtal (GK), an integrated care system using a population health approach in the Kinzigtal region of southwestern Germany. GK was created in 2005 as a contract between two organizations, a regional physicians' network and Optimedis AG, which is a management company specializing in integrated care. Two statutory health insurers, Landwirtschaftliche Krankenkasse (LKK)

Baden-Wurttemberg and Allgemeine Ortskrankenkassen (AOK) Baden-Wurttemberg, were contracted as part of the model⁴⁷. GK targets the entire population of the region, a population of 71,000. However, the system had approximately 33,000 enrollees as of 2016³⁰.

As part of its PHM approach, GK coordinates with approximately 160 partners, consisting of office-based physicians, hospitals, nursing homes, home care services, and others. Members of the health insurers can choose to opt into the GK PHM system and retain their preferred primary care provider. They also have the option to opt out at the end of each quarter⁶.

Optimedis AG, the management company, oversees the budget for all statutory health insurance members of the two funds. They had startup funding of approximately four million euros to set up management, quality control, evaluation projects, and additional services⁶. Health care providers in Kinzigtal are directly reimbursed by the sickness funds for their services, but GK holds virtual accountability for the healthcare budget for those enrolled in the model. A shared savings contract exists between the sickness funds and Optimedis AG, where profits are derived from realized savings when compared to the average risk-adjusted cost of care⁶. When the sickness fund spends less on healthcare than the population budget, GK shares the benefits. Providers are directly reimbursed for services as under usual care with the addition of payments for programs and information technology infrastructure. Providers also have shareholder agreements where they also receive a share of the profit generated by GK. This additional profit share comprises 10-15% of providers' other income⁶. Other profits may be reinvested into additional preventive programs or health promotion facilities⁶.

Risk Stratification / Population Segmentation

Enrolment in GK is voluntary, but providers are encouraged to identify patients who are at risk for certain diseases and enroll them to the appropriate GK health programs in a form of inverted risk selection^{48, 49}. GK has developed targeted care management and prevention programmes for particular high risk population groups, such as older people, those living in nursing homes, people with specific conditions, and those with high BMI³⁰. Providers conducting medical examinations and health questionnaires may identify a patient with a certain diagnosis, such as osteoporosis. The patient may then be stratified into different groups depending on the severity of the diagnosis based on risk. For example, osteoporosis patients may be stratified into one of three risk groups, slightly elevated, elevated, or highly elevated risk of fracture due to osteoporosis⁴⁹.

GK also uses predictive modelling and data analytic techniques to identify high risk patients, however, these have limited uptake in clinical settings⁴⁹.

Citizens-centred interventions

GK supports a number of interventions targeted to specific sub-populations, including chronic disease self-management programs, nutritional and health counselling for diabetes and smoking cessation programs⁴⁹. GK also has contracts with several non-medical services to offer discounts on fitness classes and sports club membership fees⁴⁸.

In addition to the involvement of patients in setting goals of care, GK has a patient advisory board consisting of several members elected from and by the members of the program. The patient advisory board elects a patient ombudsman, who represents patient interests and mediates in case of conflicts⁴⁷.

Evaluation

External and internal evaluation have demonstrated improvements in health outcomes. Most notably, those enrolled in GK have lower mortality rates compared to those not enrolled. Improvements in efficiency and experience of care have also been demonstrated³⁰. With respect to costs, GK has

generated savings of 16% between 2006 and 2010 against the population budget of members of sickness funds, compared to members from a different region. Between 2005 and 2010, emergency hospital admissions increased by 10.2% for patients in Kinzigtal, compared with a 33.1% increase in the comparator group⁴⁸.

Quality Improvement

With respect to ongoing evaluation and quality improvement, GK collects data to measure quality and monitor performance, which then informs improvement efforts⁶.

Contextual Factors

GK and its contracted partners were guided by a policy framework during the development and implementation of the system. The framework included an overarching mission statement and strategy, which detailed the planning and design of the care model. In addition, a dedicated design and implementation team was used along with startup funding to support readiness⁶. This early focus on implementation support and readiness is noteworthy, as it has been shown that up to 70% of implementation efforts fail as a result of the implementation setting not being ready⁵⁰.

Information Needs

GK makes use of a system-wide electronic health record to facilitate communication between providers where the patient gives access to each provider they see³⁰.

Summary

The international case examples highlight varying strengths across local and national PHM programs. More of the six steps in the PHA analytical framework were observed and reported within the three local system summaries compared to the national policy initiatives. It appears that PHM can be more fully developed and implemented at the local level.

All 6 steps in the PHA analytic framework were represented in varying strengths across local and national PHM programs. Each had a specific population for their program for whom risk stratification and population segmentation approaches were applied. All included tailored interventions such as the many targeted programs at Kaiser in Washington, designed and delivered at the local level. Kaiser and Jonköping both demonstrate that evaluation and quality improvement supports are best delivered at the local level where providers can develop trusting relationships and work in close concert with quality improvement coaches and related supports. Gesundes Kinzigtal ensured provider involvement and codesign and provided dedicated implementation support. Additional enabling factors included an early focus on building trust (Netherlands), changes in funding and investment in primary and community care (Singapore), effective e-health and (Kaiser Washington), systematic quality improvement culture (Jönköping), and rigorous evaluation (Gesundes Kinzigtal). More components of PHA were observed and reported within the three local system summaries compared to the national policy initiatives.

This does not mean that there isn't value in national supports. Setting populations at a national level can ensure population inclusion and setting overarching goals for local systems that are aligned with national values, principles and aims. Singapore's experience suggests value in coordinating data infrastructure across local health systems as well as risk stratification and population segmentation approaches. Several countries are moving toward created shared financing arrangements. At times the national policy is to devolve to local health systems. For example the Netherlands' experience identified that

accountability for quality and financial performance needs to be devolved to local health systems to have meaningful impact.

Summary of Evaluative Findings

While evaluation is a key component of the PHA analytic framework, detailed evaluation results are not always available and some PHM systems are not mature enough to have final or impact evaluation results. For instance, in Singapore the shift from six to three integrated RHSs took place in 2017, thus, overall quantitative evaluations are not available. The Netherlands began its regional shifts toward PHM in 2013, while KPWA initiated its PHM program in 2018. However, academic literature describing the implementation of early integrated care programs contribute to an understanding of PHM system implementation. Qualitative evaluations have identified challenges with acceptability of the program for patients, and difficulties with rolling out integrated electronic medical records. *Gesundes Kinzigtal* can be considered a more mature PHM system that has moved from developmental to more summative evaluations. GK measures the following indicators at a system level: total cost per patient, patient and provider satisfaction, quality of life, percent of patients in the integrated care program within the region, emergency hospital admissions. External and internal evaluations have demonstrated a reduced mortality rate for those enrolled compared to those not enrolled³⁰. With respect to costs, GK reports generating a savings of 16.9% against the population budget, compared to members of sickness funds from different regions⁴⁸.

JCC has been designing and implementing directed PHM approaches for over 20 years, but recent evaluations of their quality improvement initiatives are not widely available. However, in 2010 JCC ranked first among Sweden's 20 county council health systems on an overall index score of system performance indicators³⁸. Over time, JCC has improved on quality measures in the following categories: patient trust, women's health, orthopedics, psychiatry, and surgical care. Specific clinical departments in JCC's largest hospital that saw improvement over a five-year period were pediatrics where admission rates for acute asthma had dropped, and intensive care where the sepsis mortality rate was reduced by almost half³⁸.

Applying Learnings to Ontario Health Teams

The recommendations in this section were collected from the international case examples discussed above. Recommendations are drawn from the key successes of each example as well as the specific challenges that some programs had continued to face that limited their success. Recommendations are drawn for action at the provincial level, at the local (OHT) level and for initiatives that would benefit from provincial support but can only be implemented at the local level.

At the provincial level, there is high value in ensuring that there are supports to enable clinical information sharing, by enabling or securing an inter-operable electronic health record. A single EHR was instituted at Kaiser Permanente and was leveraged at every step of their PHM implementation. It also represented a substantive investment. Integrating and supporting shared payment and accountability to a single local governance structure can be set as a provincial requirement for financing. For example, Singapore struggled with integrating care when payments were made only for activities that did not involve joint activities with other providers while the Netherlands pioneer integrated delivery systems are actively working to create shared budgets.

At the local OHT level, there is considerable engagement required amongst providers and amongst and with patients, family and citizen representatives. This ensures that population health needs are addressed and that providers and patients share in the identification of needs and the co-design and implementation of solutions. Beginning with small scale interventions activates partnerships and builds trust.

Regarding programs that would benefit from provincial support but can only be implemented at the local level, topmost is the support for quality improvement infrastructure such as that of the three local examples. In all three examples, coaches are deployed at the local level, in Jonkoping they are drawn

from front-line providers. However the back-bone, training and supports for these coaches would be more effective if supported by a central operational support program. Similarly, the examples support a central organization of data integration and common approaches to risk stratification and population segmentation. This would enable OHTs to consistently identify important opportunities for improvement and to measure and track performance against those goals with a uniform approach to measurement. This can further support common measurement for shared purposes of quality improvement, evaluation, and performance measurement and accountability.

Table 1: Recommendations for success of OHTs relevant at the provincial level

Information Technology	<p>Adequate initial investment in the creation of an integrated EHR, plus funding dedicated to maintain and update the integrated EHR.</p> <p>Ensure privacy legislation is compatible with integrated structure of OHT and shared information across EHR.</p> <p>The province must draw together and enable local access to demographic, epidemiological, and claims data at the level of the OHT for purposes of OHT planning, risk stratification, and evaluation.</p> <p>Build local capacity for data management and analysis.</p>
Innovative Funding Models for Shared Accountability	<p>Shared savings contracts between the funder and health and community organizations that are part of the OHT.</p> <p>Include individual providers (physician practices) in shared accountability structures, either through shareholder agreements or shared savings.</p> <p>A common budget that is distributed among partner organizations may facilitate shared savings contracts and allow for targeted re-investment of savings.</p> <p>Providers need financial stability during transitions, particularly in shifting care resources from one sector (e.g. hospital) to another (e.g. community).</p>

Table 2: Recommendations for success of OHTs relevant at the local (OHT) level

Early and Ongoing Community Engagement	<p>Using surveys, town halls, and other forms of outreach to help understand the needs of the community from the citizens' perspective.</p> <p>Creating a citizen advisory council to ensure involvement in OHT level decision making.</p> <p>Clear mechanisms for citizens to provide feedback and raise concerns (i.e.: patient ombudsman).</p> <p>For citizen readiness to change, develop communication and involvement plans as OHT activities ramp up.</p>
Build Trust by Starting with Small Initiatives	In developing OHT, begin with small-scale interventions to help foster collaboration between health providers, community services, and community representatives.
Implementation	Adaptive solutions are required to bring providers together in a shared culture of teamwork and shared purpose and clinical information sharing including care plans.
Innovative Funding Models for Shared Accountability	Shared savings contracts between the funder and amongst providers
Quality Improvement	<p>Coordinated quality improvement supports with coaching drawn from engaging front-line providers given advanced training in quality improvement methodology were essential success factors for all three local programs.</p> <p>Develop indicators for each program to monitor both long- and short-term goals. A priori indicators for OHT programs, and to address PHM related aims.</p> <p>Host indicators on platforms to promote transparency between stakeholders (clinicians, decision makers, politicians), and provide ease of access for review.</p> <p>Create a shared culture of quality improvement across organizations.</p>

Table 3: Recommendations for shared resources amongst OHTs with provincial support and local implementation

Implementation	Centralized supports for OHTs such as training for local quality improvement could be provincially coordinated and supported while coaching staff are drawn from local programs.
Population Measurement using Triple/Quadruple Aim	OHT achievements should be consistently measured against common goals and representing Triple (or Quadruple) Aims. Indicators developed to measure performance should analyze all Triple (or Quadruple) Aim dimensions in order to help to identify opportunities for interventions to meet the needs of the population and gauge the full impact of the OHT PHM initiatives.
Development of indicators to measure overall PHM goals	In addition to provincial indicators to monitor program outcomes, OHTs should develop indicators to evaluate implementation of local PHM interventions that align with program goals. These might include: degree of integration, progress on population segmentation, level of access to electronic health records.
Risk Stratification and Population Segmentation Tools	<p>PHM initiatives well-tailored to their populations require a thorough population segmentation approach, which is tied to access to readily available and wide-ranging data. Population segmentation should be data driven and use health assessment information that is comprehensive including demographic, socioeconomic, clinical registration data, as well as claims and epidemiological data and population surveys.</p> <p>Risk stratification and population segmentation approaches should be used to ensure needs-based services are available and coordinated at the point of care. Singapore and Gesundes Kinzigtal implemented risk assessment systems that were not well used locally. Kaiser Permanente's approach to segmentation and risk stratification should be closely studied.</p> <p>Population segmentation should consider transitions and individuals' status requires updating.</p>

Conclusion

This report reviews three different examples of local PHM systems and two examples of countries that are in the process of transitioning to PHM approaches and scaling up existing PHM programs. While there were many successes and benefits shared, it is clear that most organizations are continuing to re-evaluate and adjust their programs and processes to respond to evaluations, address setbacks and challenges, and adapt to meet the needs of the populations they serve.

A number of recommendations for OHTs are made as the implementation of integrated delivery systems will be ramping up in Ontario. Some recommendations provide guidance for the development and evaluation of OHTs, while others highlight a need for early and concerted upfront investment in relationship building between different OHT stakeholder groups and in community engagement.

There is a growing list of health systems and organizations taking a PHM approach around the world. To our knowledge, there are no PHM systems in Canada to date. This is significant, as the implementation of integrated systems taking a PHM in Ontario approach may help inform the creation of similar models in other Canadian jurisdictions. Local groups of providers need to begin to build or develop strong relationships and trust, accelerating, scaling and spreading existing initiatives and initiating new interventions with shared values, purpose and aims. Policymakers can support these initiatives by organizing populations within local health systems, investing in shared and interoperable information technology, and leveraging funding models that support and enable redistribution of resources to maximize population health and equity. Triple (or Quadruple) Aim goals for local health systems, risk stratification and population segmentation alongside supports for evaluation and quality improvement will facilitate and accelerate shared learning and ultimately support an end goal of improved health outcomes for the population and a more equitable distribution of such outcomes.

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Appendix

Supplementary Table 1: Comparison of PHM systems by contextual and organizational characteristics

	Country-Level Initiatives		System-Level Initiatives		
	Netherlands	Singapore	Kaiser Permanente Washington	Jonkoping County	Gesundes Kinzigtal
Population of country	17.20 million	5.54 million (2014)	321.2 million	10.3 million (2019)	81.2 million (2014)
Health Financing model of country	Statutory health insurance	Public and private health insurance, Government uses general tax income to subsidize services.	Mostly private insurance with some public financing	County Councils are publicly funded through tax income.	Statutory health insurance, private health insurance subsidizes the rest.
Number of people covered by PHM system	~2 million	5.54 million	12.2 million	340,000	33,000
Integrated Care System Governance	The PHM pioneer sites are networks, comprised of a steering group, one or more working groups, and sometimes an executive or management committee. The composition and responsibilities of the steering groups are varied and likely to change with maturity.	Top down, from Singapore Ministry of Health.	Yes – Kaiser has a system of clinical governance where medical leadership has a major role in the delivery and planning of population care	Jonkoping county coordinates integrated care within their geographic bounds under the direction of a politically affiliated regional director.	GK, which is a partnership between networks of providers, and a health management company, manages network and coordinates integrated care activities. These contract with sickness funds, and also with providers including physicians, pharmacies, hospitals ⁴⁹ .
Integrated Care System Financing	Up until 2014, the healthcare activities carried out by the PHM pioneer sites had largely been reimbursed by insurance companies under the Health Insurance Act, with funding for certain projects, such as	Services are charged to patients based on disease, service, and provider type, with direct reimbursement from health savings accounts, supplier subsidies, or out of pocket payments ¹⁷ .	Yes – Kaiser's reimbursement scheme is a blended salary and pay-for-performance model	A fixed-pricing system for fee-for-service costs standardizes and regulates pricing for services across the county council.	Shared savings contract; health care providers are directly reimbursed for their services, GK holds virtual accountability for health care budget. GmbH is a for-profit company ⁶ . Healthcare cost savings are distributed between the contractual partners.

	integrated mental health care, coming from additional government or research grants. Other strategies are also pursued to offset the additional costs of projects, such as requiring investments from the participating agencies. Sites are currently exploring models that enable the sharing of financial risk and benefit.				Savings are calculated as the difference between the actual costs, and the funds provided to the statutory health insurers to ensure service coverage; the savings is based on all insureds, not only those in ICM ⁴⁷ . Providers are paid via fee for service model by sickness funds, however, GK includes add-on payments to encourage coordination ⁴⁹ .
Information Sharing	Specific information not available. While it seems to be the case that the technological infrastructure exists to enable information sharing, progress toward the reorganization of governance structures to allow for information sharing has been hampered by concerns related to privacy, resources, and antitrust regulation.	Common information system, the National Electronic Medical Record, an integrated and virtual long-term health care record centered on the patient, accessible to all authorized health professionals ¹⁷ .	Yes – patient database known as HealthConnect houses an EHR with interoperability across care settings, including inpatient, outpatient and clinical support, and connectivity to laboratory, pharmacology, and radiology systems; a web-based client portal for secure patient-provider messaging, as well as access to personal health records; and a system for messaging between providers.	There is a single electronic patient record used across critical and perioperative care settings for the three hospitals in the county ⁵¹ . Each county council controls what aspects of EHRs their patients can access. Jonkoping County patients can access medical notes, diagnoses and immunization records ⁵² . It is unclear whether EHRs are synchronized across all care settings from acute care to outpatient clinics and pharmacies.	System-wide electronic patient record: partner providers of GK Integrated Care may have access to electronic records. This information is stored in a highly encrypted manner and is then delivered to each provider whom a key card has been offered by the patient ⁴⁸ .

Supplementary Table 2: Comparison of PHM systems by PHA analytical framework

	Country-Level Initiatives		System-Level Initiatives		
	Netherlands	Singapore	Kaiser Permanente Washington	Jonkoping County	Gesundes Kinzigtal
Population Identification/Assignment Approach Geographical boundaries? Those registered to certain insurance companies?	Specific information not available. Based on maps of the pioneer sites, it seems that population identification happens according to regional geographical boundaries.	Geographic boundaries set by the Singapore Ministry of Health, surrounding areas of large tertiary hospitals.	All members of the KP insurance market.	All residents within the geographic bounds of Jonkoping County	People who reside in the Kinzigtal Valley geographic boundaries, are registered to specific insurance company, they opt into the GK model.
Triple Aim/Health Assessment The efforts to assess the health of the population, and how goals of the population, quality and access of existing care are measured?	Upon their inception, the PHM pioneer sites had a mandate to achieve better healthcare at lower costs. The initiatives currently being implemented are designed with Triple Aim accountability in mind.	A number of evaluations to understand the health of the population have been reported, it is unclear if these included considerations of access and quality.	KP's quality vision is aligned with the Triple Aim framework. Annual analysis of its member population is performed to inform segmentation with this Triple Aim accountability in mind.	Jonkoping county's mission is aligned with the Triple Aim framework. Population-level data is used to inform service and program planning	GK performs regular analysis of health record and claims data using predictive modelling to understand the population ⁶ . GK's performance measures are based on the Triple Aim ⁵³ .
Risk Stratification Method of risk stratification/population segmentation	Information not available.	The Singapore Ministry of Health suggested a , which has been adapted and validated. The British Columbia Population Segmentation Framework has also been validated.	Population segmentation is performed, though no details are available on the method of segmentation.	There is evidence in the literature for validated risk stratification tools used for the older adult population to assess factors such as nutrition, oral health, fall risk and pressure ulcer risk ⁵⁴ .	At the clinical level physicians refer patients to appropriate programs based on diagnosis. GK is reported to conduct predictive modelling for segmentation, but these are not used clinically.
Citizens-centered Intervention(s) a) Tailored interventions for predefined subpopulations	In six of the nine PHM pioneer sites, communities are represented in steering groups.	a. Programs exist for populations with chronic disease, such as dementia. Many programs	a. Diabetes Care Program: ideal candidates for enrollment in the Diabetes Care Program	a. Target populations: 1) children and youth 2) older adults 3) people with mental health conditions	a. Interventions include a chronic disease self-management program, nutritional and health counselling for

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<p>b) Interventions aimed to realize or improve the prerequisites for PHM (e.g., the development of a data warehouse, aligned incentives between providers, etc.)</p>	<p>Others engage in community outreach via surveys and online communities. In one of the sites, a new legal entity, owned by citizens, was formed, which has thus far negotiated a supplementary insurance package with the dominant insurers</p>	<p>focus on needs of older adults. b. Investments in primary care, through creation of primary care networks. Implementation of integrated electronic health records, testing and validation of segmentation approaches, efforts to invest in community care outside of hospitals.</p>	<p>with a registered nurse are member of the diabetes population who have symptoms and concerns, multiple comorbid conditions, or a HbA1c and/or blood pressure above target. However, all KPWA members in the internal delivery system who have diabetes with a HbA1c over 8%, or require focused interventions to work towards goals, regardless of HbA1c, are eligible. Population care nurses create individual member care plans that emphasize self-management, focused interventions to work towards goals, and treating the whole person. b. Significant investment in e-health, creation of collaborative, multidisciplinary workforce, and a blended salary and pay-for-performance model for providers to help align incentives.</p>	<p>4) people living with drug and alcohol addiction b.Co-learning opportunities focused on knowledge exchange between different stakeholder groups take place to facilitate knowledge exchange that will inform program evaluation and development⁵⁵. The "Esther Café" program is a knowledge exchange event between care patient advisors, primary care professionals, and policy makers to address the needs of the older population specifically</p>	<p>diabetes, smoking cessation. Patients are involved in the development of individual treatment/prevention plans and goal setting. b.GK uses a system wide EHR and has implemented multidisciplinary care teams, as well case managers to help navigate and coordinate care. Patient advisory board, which elects a patient ombudsman; this person represents patient interests and mediates in cases.</p>
<p>Impact Evaluation a) How are they measuring overarching goals of PM for total population? b) How are they measuring impact of interventions</p>	<p>Specific information not available. However, it is likely impact evaluations will occur, given the qualitative evaluation work that</p>	<p>Specific evaluations not available. However, academic literature demonstrates population level analyses and</p>	<p>KPWA has planned for annual evaluation of the programs that make up its PHM program. Overall and individual program goals will be reviewed based on the</p>	<p>Annually, the Balanced Scorecard report is used to assess progress on overarching PHM goals. The scorecards are</p>	<p>An external quality institution audits GK annually, and GK implements changes every two to three years based on audit results. Performance</p>

applied to specific subpopulations?	has emerged from the pioneer sites thus far ^{13, 56} .	evaluations on interventions for sub-populations.	previous year's performance. Qualitative and quantitative analysis are planned for to evaluate the efficacy of the program and to develop the next year's targets. No further details on the evaluation of program impact are available.	<p>compared each year to inform future program planning and budgeting³⁷.</p> <p>To assess targeted PHM goals, corporate dashboard displays with indicators relevant to the specific initiative are used. Dashboards provide near real-time feedback on selected variables. The variables are chosen in accordance with the community-level or site-specific goals of a targeted PHM intervention³⁸.</p>	measures for PHM include total cost per patient, patient and provider satisfaction, quality of life, percent of patients in integrated care (Alexander Pimperl et al., 2017). For specific programs and sub-populations, different measures exist such as percent of people with fractures among those with osteoarthritis, and mortality rates by subgroup.
Quality Improvement Processes Are there quality improvement processes?	Information not available.	Information not available.	Continuous quality improvement is planned for and outlined as a means of directly impacting the health of KP's member population, but specific details of quality improvement processes are not available.	Qulturum is JCC's in-house quality improvement hub. Qulturum members are not involved in health care system administrative duties or clinical work. However, Qulturum members leverage connections with senior management and frontline caregivers to enact change informed by both perspectives ⁴² .	As a performance accountability mechanism, physicians receive feedback reports every quarter. Tracks metrics using electronic health record patient survey data, business intelligence, and claims data(Alexander Pimperl et al., 2017). Reports are also discussed in quality circles and annual meetings with the GK management ⁶ .