



# Team-Based Diabetes Care in Ontario and Hong Kong: a Comparative Review

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## Abstract

**Purpose of Review** There are gaps in implementing and accessing team-based diabetes care. We reviewed and compared how team-based diabetes care was implemented in the primary care contexts of Ontario and Hong Kong.

**Recent Findings** Ontario's Diabetes Education Programs (DEPs) were scaled-up incrementally. Hong Kong's Multidisciplinary Risk Assessment and Management Program for Diabetes Mellitus (RAMP-DM) evolved from a research-driven quality improvement program. Each jurisdiction had a mixture of non-team and team-based primary care with variable accessibility. Referral procedures, follow-up processes, and financing models varied. DEPs used a flexible approach, while the RAMP-DM used structured assessment for quality assurance. Each approach depended on adequate infrastructure, processes, and staff.

**Summary** Diabetes care is most accessible and functional when integrated team-based services are automatically initiated upon diabetes diagnosis within a strong primary care system, ideally linked to a register with supports including specialist care. Structured assessment and risk stratification are the basis of a well-studied, evidence-based approach for achieving the standards of team-based diabetes care, although flexibility in care delivery may be needed to meet the unique needs of some individuals. Policymakers and funders should ensure investment in skilled health professionals, infrastructure, and processes to improve care quality.

**Keywords** Diabetes · Team-based care · Models of care · Comparative analysis · Health policy · Ontario · Hong Kong

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## Introduction

*Team-based diabetes care* is defined as “a health systems-level, organizational intervention that incorporates a multidisciplinary team to help patients manage their diabetes” [1, 2]. The principles of team-based care include collaboration, integration, communication, and empowerment [3]. Multidisciplinary teams provide individualized psychosocial support and education about behavioral change, medications, and monitoring. Team members may include physicians, specialist nurses, dietitians, psychologists, and pharmacists. Team-based approaches have been shown to improve blood glucose, blood pressure, blood cholesterol levels, quality of life, and hospitalization risk [4–6].

However, there are substantial gaps in accessing such services [7], and some team-based programs have not materialized into the expected benefits [8]. A major barrier to establishing and expanding these services is the lack of research on how team-based diabetes care is optimally designed, implemented, and evaluated. While successful models in a single jurisdiction have been previously described [9], systematic comparisons of team-based diabetes care across multiple jurisdictions can highlight innovative solutions and provide practical lessons to guide policymaking [10]. To address this gap, we conducted a review comparing the evolution and implementation of team-based diabetes care in the primary care contexts of Ontario, Canada, and Hong Kong, China.

## Methods

### Settings

#### Ontario

Ontario has a multicultural population of 14.2 million. Ontario’s health system is publicly financed, privately delivered, and publicly regulated and governed by the Ministry of Health (MOH) [11–13]. Hospital and physician services are covered under the Ontario Health Insurance Plan for all residents. User fees are prohibited. Hospital- and home-based health services are administered under regional bodies known as Local Health Integration Networks [14, 15], which have recently been restructured as Ontario Health Teams [16].

Primary care is provided in non-team or interprofessional team settings (e.g., “Family Health Teams,” FHTs). Primary care physicians are remunerated by a variety of models including fee-for-service, capitation, and salary [17, 18]. A minority of primary care physicians work in Community Health Centres (CHCs) as salaried

staff alongside interprofessional team members to serve socioeconomically marginalized populations. CHCs are designed to provide a broad range of health services and may not necessarily be equipped to provide team-based diabetes care.

#### Hong Kong

Hong Kong is a densely-populated urban territory with a population of 7.5 million people mostly of Han Chinese ethnicity. Hong Kong’s universal public healthcare system is similar to the British National Health Service, with regulation, financing, and delivery all governed by the state [11]. Hong Kong has easy access to a mix of public and private healthcare options. Public hospitals, clinics, and doctors are governed under the Hong Kong Hospital Authority (HA). Up to 5% of hospital-based services are financed by user fees (HKD 50 [USD 6.4] per community-based outpatient visit, HKD 100 [USD 12.8] for a hospital-based specialist outpatient visit) [19, 20]. These fees are inclusive of medications, laboratory tests, and basic procedures and are waived for low-income or vulnerable patients [21]. There is also a vibrant private health service sector funded by private insurance and out-of-pocket sources [22]. Public sector physicians are salaried government employees. Private-sector physicians are mainly remunerated on a fee-for-service basis [23].

The HA provides public healthcare through 43 hospitals and institutions, 73 general outpatient clinics (GOPCs) providing primary care, and 49 specialist outpatient clinics (including diabetes centres), all organized within 7 geographical clusters [24]. The HA accounts for 90–95% of inpatient and 30% of outpatient services including primary care [23]. The minimally-regulated private sector [23] includes many primary care physicians managing episodic ailments (e.g., influenza) and specialists. To mitigate the fragmentation of care across the private and public sectors [25], private doctors can register for access to the HA’s territory-wide electronic medical record (EMR) to retrieve data for consenting patients [26]. Because patients can receive long-term medications through the HA for only a nominal fee (HKD 10 [USD 1.3] per item every 3 months), > 90% of people with diabetes attend either public GOPCs or specialist outpatient clinics [27]. Apart from the subsidization of otherwise costly medications, many patients perceive that HA clinics have more advanced equipment and better support from specialists [28].

### Data Sources and Search

We reviewed the peer-reviewed literature from January 1, 1992, to May 1, 2022, using the following search terms in the PubMed and Web of Knowledge databases: *diabetes*;

Ontario or Hong Kong; and team, multidisciplinary, inter-professional, self-management education, diabetes education program, diabetes education centre, JADE, RAMP-DM, RAMP or Risk Assessment and Management Programme. We supplemented these sources with grey literature from relevant governmental and non-governmental sources, and additional peer-reviewed publications guided by the feedback of reviewers.

## Comparative Analysis

We described how team-based diabetes care was implemented in each jurisdiction. We applied Starfield's "5C" framework to compare and analyze the impact of these programs [29]. This framework evaluates primary care quality based on its ability to deliver 5 key functions: *coordination, first-contact accessibility, continuity, comprehensiveness, and person-centred care* [29–33].

## Results

### Development of Team-Based Diabetes Care

#### Ontario

Team-based care programs were incrementally introduced by gradually expanding the number of Diabetes Education Programs (DEPs). The MOH first announced diabetes reform as a strategic priority in 1992. At that time, there were 50 hospital-based DEPs [34]. These DEPs housed "a team of educators... to teach diabetes patients skills that help them care for themselves" through individual or group sessions [34]. These teams included a nurse and a dietitian [34]. In 1996, the Diabetes Complication Prevention Strategy added or expanded 33 DEPs [35]. The MOH then established a new diabetes task force (2003) [36] and launched the Ontario Diabetes Strategy (2008) "to expand services and improve the health of Ontarians with diabetes" [37]. From 2010 to 2011, 101 new DEPs were created in hospitals, community health centres, and FHTs, increasing the total number to 322 [37, 38]. In 2013, the administration of the DEPs was transferred from the Ministry to the Local Health Integration Networks, except for those under FHTs and not-for-profit organizations [39].

#### Hong Kong

The Chinese University of Hong Kong (CUHK) and Prince of Wales Hospital Specialist Diabetes Research and Care Team [40] pioneered a local research-driven quality improvement program for diabetes in 1995 [41]. This innovative program involved redesigning the clinical setting,

hiring more nurses and healthcare assistants, creating a new workflow featuring a structured protocol and standardized forms to collect important clinical data (eye, feet, blood, and urine examination), and establishing the Hong Kong Diabetes Register (HKDR) for quality assurance, risk stratification, and decision making [41]. HKDR data were analyzed using algorithms to assess risk factor management, determine complication risk, and display targets within a personalized report to empower self-management and inform timely medical intervention. In 2000, the protocol was incorporated into the HA EMR, and career paths were created for nurses to provide dedicated diabetes services and to serve as a liaison between endocrinologists and other care teams. In 2007, the CUHK research team designed the web-based Joint Asia Diabetes Evaluation (JADE) program to digitalize the HKDR protocol with built-in templates to guide data collection for risk stratification based on HKDR algorithms to issue individualized reports. These reports provided risk stratification, cardiometabolic risk factor trends and targets, and risk-based decision support to promote shared decision-making [41]. In 2009, the JADE risk stratification model was adopted by the HA as the RAMP-DM "to meet rising service demand, ... [and] enhance primary care and chronic disease management." [42, 43]. The RAMP-DM was piloted in 2009 in the Hong Kong East and New Territories East clusters, expanding to all clusters in 2011 [44].

### Comparing Key Functions of Diabetes Teams

The main findings of this comparison are described below and summarized in Table 1.

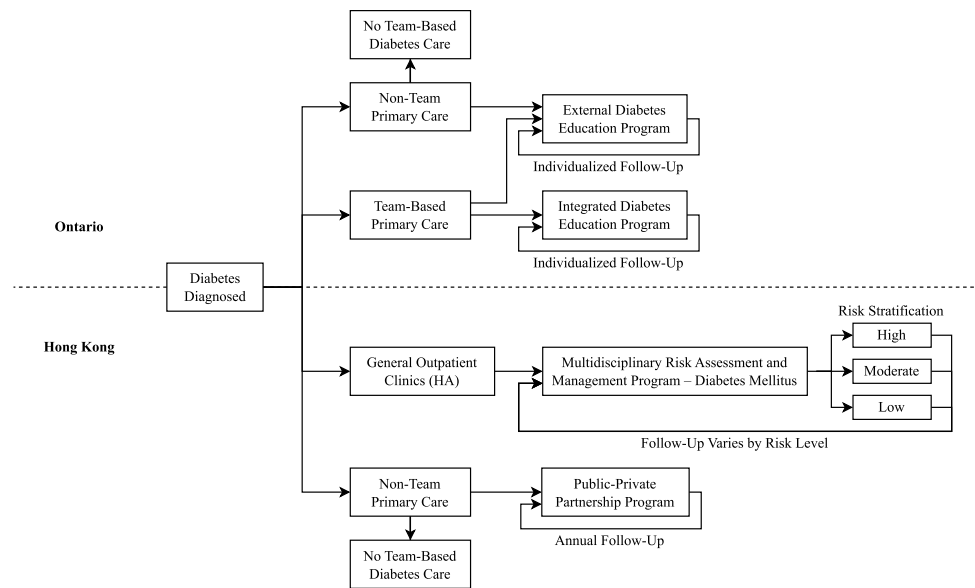
#### Coordination

There was a mixture of non-team and team-based primary care in Ontario and Hong Kong, but these services were coordinated differently (Fig. 1). In Ontario, patients accessed primary care in team-based settings such as CHCs and FHTs and non-team settings such as solo physician practices. In general, primary care providers were responsible for overseeing the care and initiating referrals to other team members, including nurses and dietitians with the expertise to provide specialized diabetes education, as well as diabetes specialists (e.g., endocrinologists) if deemed medically necessary. However, not all team-based primary care settings were equipped to provide specialized diabetes education. In such cases, patients may have been referred to a DEP to receive team-based diabetes care and education [46, 47]. These DEPs were sometimes integrated on-site at the CHC or FHT, while others were externally located in the community or in hospitals. Patients reported that coordination of care was most effective at on-site DEPs, which provided convenience and continuity [46, 48]. In non-team primary

**Table 1** Summary comparing team-based diabetes care in Ontario and Hong Kong according to the key functions of the “5C” framework [29]

Function	Ontario	Hong Kong
Coordination	<p>Mixture of non-team and team-based primary care</p> <p><i>Non-team settings:</i> team-based diabetes care available by referral to external diabetes education programs (DEPs)</p> <p><i>Team-based primary care settings:</i> team-based diabetes care available by integrated (on-site) or external DEPs [46, 47]; on-site services preferred by patients [46, 48]</p> <p>Uneven geographic distribution of DEPs and large variations in patient volumes [49]</p>	<p>Mixture of non-team (private) and team-based (public) primary care</p> <p><i>Non-team primary care settings:</i> no team-based diabetes care [31], except by referral to Public–Private Partnership program on self-funded basis [45]</p> <p><i>Team-based care settings:</i> Multidisciplinary Risk Assessment and Management Program for Diabetes Mellitus (RAMP-DM) provided seamless coordination with general outpatient clinics [40]</p> <p>Even geographic distribution of RAMP-DM across districts</p>
First-Contact Accessibility	DEPs required physicians to initiate a referral [50]; self-referral was underutilized or not permitted [51, 52]	Virtually all eligible diabetes patients in General Outpatient Clinic were automatically referred to RAMP-DM [27]
Continuity	<p>Less than half of family physicians routinely referred patients with diabetes to DEPs [46]; only 1 in 5 patients attended DEP within 6 months of diagnosis [8]</p> <p>Significant barriers to attending DEP follow-up appointments included forgetfulness, mental health issues, social marginalization [53]</p> <p>Continuity of care generally maintained for patients with a primary care physician, as patients usually followed longitudinally by the same physician [18]</p>	<p>Physician- or self-referral required for PPP [45]</p> <p>Significant barriers to RAMP-DM attendance included forgetfulness, lack of time, perception that appointments were useless, especially among patients aged &gt; 60 years with low education [54]</p> <p>Limited public sector resources compelled patients to seek private care for acute issues [28]</p>
Comprehensiveness	<p>DEP services focused on education and counseling; information provided about how to access ancillary (foot, eye care) services not available on-site</p> <p>Medications dispensed externally; costs not universally covered; resulting in disparities in adherence and outcomes [55, 56]</p> <p>Population-based administrative health data enabled monitoring to evaluate and improve quality of care [57]</p>	<p>Suboptimal continuity of care in private sector driven by high medication costs</p> <p>RAMP-DM services highly comprehensive and streamlined: nurse case managers provided education and directly connected patients with ancillary services within the same institution [40]</p> <p>Medications dispensed on-site directly from private physician (high out-of-pocket costs) or HA (costs covered); coverage of drug costs by HA strongly motivated patients to attend appointments [28]</p> <p>Comprehensive territory-wide electronic health record enabled powerful studies to evaluate and improve quality of care [58]</p>
Person-Centred Care	<p>Open-ended, flexible, person-centred approach: considerable variability in content of counseling, no standard risk stratification; appropriate use of shared decision-making [48, 53]</p> <p>Nurses and dietitians in DEPs often certified through standard process [59], though quality of education was perceived to be variable [37]</p>	<p>Systematic and structured approach in RAMP-DM and PPP: standardized protocols dictated the frequency and types of follow-up appointments, according to standardized risk stratification [27]</p> <p>Dedicated nurses served as case managers, but individualized support and counseling sometimes limited by overburdening of staff [45]</p>

**Fig. 1** Processes of team-based diabetes care referral and follow-up in Ontario and Hong Kong. Abbreviations: HA, Hong Kong Hospital Authority, <sup>1</sup>Model developed using Rose’s method [60]



care settings, team-based diabetes care was generally only available by referral to an external DEP.

By contrast, Hong Kong had a mix of public and private services for people with diabetes. In the public sector, primary care was coordinated by physicians working in the GPOCs. These clinics also included trained nurses, whose role was to perform protocol-driven assessment and education using the RAMP-DM module embedded within the HA EMR [40]. As the program evolved, automated reminders were added to remind physicians to book RAMP-DM reassessments every 2 years. Primary care physicians could also initiate referrals to public specialist diabetes care clinics in the HA for ongoing care and follow-up as required. Coordination of care and communication were facilitated by a shared EMR across all HA institutions. In the private sector, primary care was generally provided in non-team settings with no public sector integration [31], although team-based diabetes care could be accessed through a unique public–private partnership (PPP) program [45] using the JADE program developed by CUHK [41]. In this model, the CUHK operated a non-profit, nurse-run diabetes centre which provided self-funded assessment and education services to complement medical care [45]. Referrals to the PPP could be initiated by physicians or patients. The structured assessment generated a personalized report for patients accompanied by nurse-led education, with a copy of the report provided to referring physicians to support care coordination. Unlike the public sector, visits to private diabetes specialists did not require a referral.

**First-Contact Accessibility**

In Hong Kong, referrals to RAMP-DM were automatically triggered for virtually all GPOC patients with diabetes

[27]. By contrast, referrals to DEPs were not automated. It was estimated that only 1 in 5 Ontarians attended a DEP within 6 months of diagnosis, with even lower attendance among older recent immigrants [8]. The MOH stated that referrals to DEPs may be from patients or physicians [50]. However, self-referral is otherwise uncommon in Ontario’s healthcare system. It was unclear whether patients were aware of self-referral processes, and physician-initiated referrals were still required by some DEPs [51, 52]. In a population-based study, receiving regular primary care was the strongest predictor of DEP attendance [61]. Despite the importance of primary care providers in facilitating DEP attendance, a survey found that less than half of family physicians routinely referred all people with diabetes to DEPs [46]. Even in FHTs where DEPs were well-integrated on-site with access to the same space and EMR, some people with diabetes were not referred [53]. Diabetes educators expressed that they needed to “remind the doctors that [they were] there” [53]. Some physicians felt that diabetes education was unnecessary [53]. Other factors hindering physician referrals included time constraints and referral forms which were perceived as complicated [46]. Patient perceptions that DEP services were unnecessary or inconvenient further reduced the likelihood of DEP attendance [46]. In Hong Kong’s PPP program, either physician- or self-initiated referrals were allowed [45].

Geographically, RAMP-DM sites were evenly distributed by the HA across districts, whereas DEPs were unevenly distributed and had large variations in patient volumes [49]. For example, “[one] significantly underutilized DEP was located in a rural area that also had four other DEPs covering the same catchment area,” leading to “competition among DEPs for diabetes patients” [37].



## Continuity

Barriers to maintaining continuity of care existed across both jurisdictions. In some Hong Kong districts, a quarter of patients failed to attend RAMP-DM follow-up appointments, and the majority of these patients were aged > 60 years with low levels of education [54]. Reasons for non-attendance included perceptions that screening procedures were useless or unimportant, time constraints, and forgetfulness. It was suggested that better communication with an individualized, shared decision-making approach might improve attendance [54]. Similar challenges to scheduling follow-up at DEPs have also been reported, with cancellations and absenteeism related to forgetfulness, mental health issues, or social marginalization [53].

Differences in the availability and supply of physicians may have also affected team-based diabetes care continuity. In Hong Kong, around 45% of physicians work in the HA, which manages 90% of people with diabetes [45]. This heavy workload led to shortened consultation times and suboptimal doctor-patient relationships, with some patients utilizing both private and public diabetes care services. Although GOPCs were primarily staffed by family medicine trainees and their instructors [33], cost constraints in the context of Hong Kong's low taxation system required GOPCs to have fixed daily quotas of patient appointments, and same-day appointments were nearly impossible to obtain [31]. This situation compelled many people with diabetes to attend private clinics to address acute issues [28]. The constant turnover of trainees in the GOPCs also limited the continuity of care [31]. However, one Hong Kong study noted that receiving continuity of care from multiple GPC physicians from a single team was associated with reduced cardiovascular risk among people with diabetes [62]. Continuity of care was often suboptimal in the private sector, although some patients benefitted from more personalized services from private physicians [63]. While the PPP may enhance continuity of care, improve efficiency, and provide choices for patients, the PPP model has yet to be scaled up. In Ontario, people with a primary care physician usually remained on the roster of the same physician, thus facilitating a longitudinal doctor-patient relationship that can persist even if team-based diabetes care is provided off-site [18].

## Comprehensiveness

The RAMP-DM approach integrated nurse-led structured assessments, education, and referrals when necessary for detailed eye or foot assessments by optometrists and podiatrists respectively [40]. These streamlined services were enabled by the HA's dual role as the funder and operator. By contrast, DEPs were more focused on education and counseling by dietitians and nurses. These educators instructed

patients on the need to obtain other services such as foot and eye assessments, which were typically not provided on-site, except at some centres [50, 51]. Nevertheless, attendance at DEPs increased the rate of retinopathy screening, and around 70% of people aged  $\geq 65$  years received retinopathy screening after attending DEPs [52]. In the RAMP-DM, retinopathy screening among attendees increased from zero in 2009 to 40.6% in 2013 [64].

Medications are a critical element of comprehensive diabetes care. In Ontario, medications were dispensed by pharmacists working at retail pharmacies external to the primary care team. The costs of these medications were covered under publicly-funded drug programs for people aged > 65 years, people aged < 25 years (since 2017), low-income individuals, and people receiving disability benefits [65]. All other people relied on private insurance often linked to employment or out-of-pocket payment. By contrast, people in Hong Kong obtained their medications on-site in both the public and private settings. While drug costs were mainly covered in the HA [66], drugs purchased from private physicians were more expensive due to a lack of purchasing power. Obtaining free medications strongly motivated > 90% of people with diabetes to attend public clinics in Hong Kong, and some people with diabetes referred to the GPC as "the place for 'getting medicine'" rather than for 'consultation'" [28]. However, it is unclear whether all patients received sufficient counseling to ensure optimal medication adherence. In Ontario, disparities in drug coverage reduced adherence [55] and worsened diabetes outcomes [56].

Another aspect of comprehensive care is ongoing monitoring to evaluate and improve the quality of care [32]. In Ontario, population-based monitoring of care patterns and diabetes outcomes was facilitated by linking physician billing codes with other data such as laboratory tests and hospitalizations. However, DEP attendance is not routinely tracked, except for a study that occurred in 2006 [67]. In Hong Kong, the HA has an extensive register of patients with diabetes and territory-wide EMR including clinical encounter codes, laboratory tests, prescriptions, and risk assessments. These data enabled powerful studies to examine team-based care approaches in both the public and private settings [58, 68, 69]. In Ontario, attendance at DEPs was associated with improved processes of care such as retinopathy screening and laboratory testing among people aged > 65 years, but these improvements did not reduce the diabetes complications or mortality [57]. Attendance at on-site DEPs was also associated with improved blood glucose [70], increased appointment attendance, and increased foot examinations [71]. In Hong Kong, the RAMP-DM was estimated to reduce cardiovascular disease, microvascular complications, and mortality by 48–57%, 12–32%, and 55–66%, respectively [58, 68], with the more personalized

JADE-assisted PPP model showing additional benefits [69]. Statistics on outcomes were difficult to directly compare across jurisdictions because the RAMP-DM encompasses a broader spectrum of clinical care compared to DEPs. Nevertheless, the HA has found the RAMP-DM to be cost-effective [72]—a finding which strongly motivated the program's expansion across Hong Kong.

### Person-Centred Care

While DEPs applied an open-ended and flexible approach to person-centred care, the RAMP-DM adopted a more systematic and structured approach. Highly standardized RAMP-DM protocols adapted from the specialist-designed JADE program dictated the frequency and types of follow-up appointments required with the team. Based on the risk assessment report, people with a higher risk of cardiovascular complications received more intense interventions and specialist referral as needed [27]. Ontario had no standardized risk stratification process, and DEPs were encouraged to provide education that is tailored to local cultural contexts [73]. Thus, the content of individual or group counseling was not strictly standardized. Although individual patient experiences vary, qualitative studies reported that patients perceive DEP services to be person-centred and comfortable [53], with appropriate use of shared decision-making and goal-setting [48]. Qualitative studies of the patient experience within the RAMP-DM have not been undertaken, but some GOPC physicians perceived a tension between adhering to protocols and a more individualized approach [74]:

“I always remember the incident of a 72-year-old patient with 20 years of well controlled uncomplicated diabetes mellitus nearly had a fall when he was ushered through the multi-station (multi-disciplinary) risk assessment of the RAMP-DM according to our clinic DM management protocol, although his major health problem was right hemiparesis from a previous spinal cord injury.” [74]

The success of a flexible versus structured approach to team-based diabetes care also depended on the skills, training, capacity, and availability of interprofessional team members in each setting. In Hong Kong, specially trained nurses [54] gathered and inputted data for risk assessments and provided education for each patient centred around a personalized report that facilitated goal-setting and self-management [45]. The RAMP-DM protocol also recommended referral to other professionals including endocrinologists for those with atypical features or high-risk phenotypes including young-onset diabetes and diabetic kidney disease [54]. However, many nurses were too overburdened to provide individualized education and only gathered clinical data without providing further support or counseling [45]. This

shortcoming was reportedly addressed in the CUHK-led PPP program [45]. In Ontario, DEPs typically employed nurses and dietitians who are qualified as Certified Diabetes Educators [37]. This designation required accumulating 800 h of experience in diabetes education over 3 years and successful completion of an examination [59]. However, it was not mandatory for all DEP staff to hold this designation [37]. While there were multiple studies reporting excellent person-centred diabetes care provided by both certified and non-certified diabetes educators at DEPs [47, 48, 53], a survey found that physicians perceived that the quality of education was highly variable across DEP providers [37]. Care quality may also have been affected by high staff turnover and inadequate training for new DEP staff [37]. Clear role definition, task delegation, and team communication were critical to improving patient outcomes in both jurisdictions.

### Conclusions

This review and comparative analysis revealed important lessons for establishing and improving team-based diabetes care programs. Ontario incrementally added DEPs across the province to provide access to team-based education and counseling services using a flexible and person-centred approach. Although these services were underutilized and had gaps in coordination, continuity was generally maintained through consistent primary care providers, especially when DEPs were integrated on-site. By contrast, Hong Kong scaled up an innovative multicomponent model integrating structured assessment, risk stratification, and education delivered by a doctor-nurse team, designed by academic specialists and shown to improve outcomes. The territory-wide implementation of the RAMP-DM in both primary and secondary care settings was funded and operated by the same institution. Although team-based care closed gaps and improved outcomes in the public setting, ensuring care continuity, sustainability, and fidelity in implementing protocol-driven assessment remained challenging. This comparison highlights that diabetes care is most accessible and functional when integrated team-based services are automatically initiated upon diabetes diagnosis within a strong primary care system, ideally linked to a register with supports including specialist care (Table 2). Structured assessment and risk stratification are the basis of a well-studied, evidence-based approach for achieving the standards of team-based diabetes care, although flexibility in care delivery may be needed to meet the unique needs of some individuals with diabetes. Policymakers must ensure sufficient investment in a skilled health professional workforce with adequate resources and infrastructure to improve care quality.

Team-based diabetes care programs should be integrated with primary care to maximize access, coordination, and

**Table 2** Key lessons about team-based diabetes care implementation for policymakers, healthcare providers, people with diabetes, researchers, and industry stakeholders

Stakeholder group	Key lessons
Policymakers	<ul style="list-style-type: none"> <li>• Diabetes care is most accessible and functional when integrated team-based services are automatically provided upon diabetes diagnosis within a strong primary care system, ideally linked to a register with supports including specialist care</li> <li>• Structured assessment and risk stratification are the basis of a well-studied, evidence-based approach for achieving the standards of team-based diabetes care, although flexibility in care delivery may be needed to meet the unique needs of some individuals with diabetes</li> <li>• Ensure sufficient investment in a skilled health professional workforce with adequate resources and infrastructure to support team-based diabetes care and improve quality</li> </ul>
Healthcare providers	<ul style="list-style-type: none"> <li>• Primary care providers play a critical role in coordinating comprehensive diabetes care and facilitating continuity across multiple health professionals within a multidisciplinary team</li> <li>• In settings where team-based care is not automatically integrated or provided, it is critical for primary care providers to routinely initiate appropriate referrals to initiate team-based care</li> </ul>
People with diabetes	<ul style="list-style-type: none"> <li>• It is important for teams of health professionals to provide you with support to manage your diabetes, but your ability to access these teams may depend on your primary care setting</li> <li>• A structured assessment may help ensure that you receive the most appropriate care and support to prevent complications</li> </ul>
Researchers	<ul style="list-style-type: none"> <li>• Multi-jurisdictional comparisons and population-based studies are needed to understand how to optimally design, implement, improve team-based diabetes care across diverse settings</li> <li>• An implementation science framework can guide the rigorous adaptation, implementation, and evaluation of a structured approach to team-based diabetes care to maximize public health impact</li> </ul>
Industry	<ul style="list-style-type: none"> <li>• Medication accessibility and adherence are strongly driven by comprehensive prescription drug coverage</li> </ul>

continuity supplemented by a supporting system including specialist care. This finding extends previous recommendations emphasizing the role of the primary care provider [1, 2, 75] in managing patients with diabetes and other comorbidities. Spatial integration, with on-site diabetes team members using the same EMR, is critical in promoting continuity of care. Engaging nurses in implementing an evidence-based risk assessment program can help support primary care by personalizing management and facilitating appropriate referrals to specialists and other health professionals (e.g., optometrists and chiropractors). Both the automatic enrolment procedures of the RAMP-DM protocol and self-referral to a nurse-run assessment and education centre eliminate the need for a physician referral, which is often a barrier [76]. Such automated protocols might be useful in settings such as Ontario's FHTs, where DEPs are often under-utilized, despite often being available on-site. In areas where primary care relies on non-team primary care providers without any practical possibility of integration with an on-site diabetes team, team-based diabetes care can be provided through an external site. This option may be less preferable due to a lack of continuity, although shared EMRs can help mitigate fragmentation or duplication of care.

Structured assessment and risk stratification can be effective tools to guide the provision of comprehensive and patient-centred care. This approach may be especially appreciated or well-accepted by patients in Hong Kong and other East Asian regions [77] where many people hold a risk-averse, long-term view of health that responds well to

personalized risk predictions [78], and have Confucian values that emphasize respecting the knowledge of health professionals and the ability of doctors to “offer” solutions [79, 80]. While a structured approach would also help transform team-based diabetes care in Canada and other regions, it would be important for this model to be flexibly adapted to suit local contexts and cultures in a manner that meets individual patient needs and facilitates shared decision-making, patient autonomy, and empowerment [81]. Well-established knowledge translation frameworks can guide the rigorous adaptation, implementation, and evaluation of a structured approach to team-based diabetes care for maximization of public health impact [82].

Ultimately, the success of team-based diabetes care depends on adequate investment in skilled health professionals. Effective implementation of structured care requires adequate resources to support intensive data gathering followed by counseling. The delivery of flexible, person-centred care requires a reliable supply of available, experienced, and highly-trained care providers. As teams increasingly include a wide variety of care providers—such as nurses, dietitians, pharmacists, and providers of psychological support [83]—it will be important to better integrate these roles within existing models of care to allow each team member to fully contribute their skills. Primary care providers play a critical role in coordinating comprehensive care across multiple health professionals and in initiating appropriate referrals to enable team-based care in settings where such care is not automatically available. Longitudinal provider-patient



relationships are invaluable to facilitating continuity of care and first-contact accessibility, especially when diabetes team members are located across different geographic sites.

Sufficient resources, especially medications and infrastructure for monitoring and sharing of information, are also critical to supporting team-based care. Comprehensive coverage of prescription drugs and bundled provision of free or heavily-subsidized medications may be a powerful financial incentive for appointment attendance. In Hong Kong's dual healthcare system, a PPP model combining subsidized medications with nurse-coordinated risk assessment and education could better leverage the participation of private sector physicians. Such private–public partnerships may help bridge care gaps in other settings with multi-payer health systems [84], especially among those with limited insurance coverage [85]. Finally, ongoing monitoring and surveillance are essential to continuously improving quality and ensuring value. In Ontario, the lack of a standard mechanism to track DEP attendance is a gap that must be addressed to enable ongoing evaluation and improvement of this publicly-funded program. The routine collection and use of population-based data, supplemented by more detailed clinical information captured in diabetes registers, can provide valuable insights to help improve processes of diabetes care.

This comparative analysis has many strengths, including the in-depth description of different care programs in two high-income jurisdictions with different financing models. Our application of a framework to assess the quality and function of primary care revealed lessons for other jurisdictions to enact, improve, or expand team-based diabetes care. However, some lessons from Hong Kong may be most applicable to other dense urban settings (e.g., Toronto) and to jurisdictions with both public and private funding for health services. As with any comparative analysis, we cannot prove causal relationships between policies and outcomes. Comparisons were also limited by differences in study design across jurisdictions.

Considering the differing wants and needs of the ever-increasing number of people affected by diabetes, novel approaches and better program implementation are necessary to make team-based diabetes prevention and care sustainable and accessible to all. Since the coronavirus disease 2019 (COVID-19) pandemic, the accessibility of team-based diabetes care has been increasingly supported by telemedicine [86]. As modalities of clinical care continue to evolve, further multi-jurisdictional comparisons and population-based evaluations will be needed to understand how to optimally design, implement, and improve team-based diabetes care across diverse settings. Given the unique risk profile of every individual with diabetes, the marked heterogeneity of risk factors and complications, as well as the need for biomedical, cognitive, psychological, and behavioral support, structured risk assessment is a powerful tool to enhance team-based care by enabling personalized management and

facilitating the establishment of data registers to monitor outcomes and to evaluate and improve quality of care [87].

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## Declarations

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