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Adherence to diabetes clinical practice guidelines to improve prevention and treatment of cardiovascular disease in Quebec: A retrospective cohort 2017-2020

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ARTICLE INFO

ABSTRACT

Objective Assess adherence to the Diabetes Clinical Practice Guidelines (CPG) for the Prevention and Treatment of Cardiovascular Disease (CVD) in Family Medicine Groups (FMG) in Quebec.
Methodology A retrospective cohort was used with patients with diabetes (PWD) and/or CVD, enrolled in a FMG and the Public Prescription Drug Plan (PPDP) between 2017 and 2020.
Results Six adjusted indicators (gender and age) for the management of CVD in PWD aged 50 and over and enrolled in a FMG and the PPDP were calculated. In 2019-2020, among PWD with CVD, 82.0% were taking a statin, 71.9% were taking an antiplatelet, 66.5% were taking an angiotensin receptor (ARB) blocker or angiotensin-converting enzyme (ACE) inhibitor, and 25.5% were taking cardiac-protection therapies [sodium/glucose cotransporter 2 (SGLT-2), Glucagon like peptide antagonist (GLP-1)]. Among PWD for 15 years, 50.4% take a statin, while in the absence of CVD, 36.1% take an antiplatelet.
Conclusion The prescriptions for statin, antiplatelet and ACE/ARB appear in accordance with the CPG and stable from 2017 to 2020. Prescription of antiplatelet in primary prevention was declining between and SGLT-2/GLP-1 were increasing from 2017 to 2020, which is consistent with the recommendations from Diabetes Canada CPG.[1]

1. Introduction

People with Diabetes (PWD) have a 4 to 10 times higher risk of cardiovascular disease (CVD) than their peers without diabetes [2] CVDs reduce quality of life, life expectancy and have substantial economic consequences for the health care system [3,4]. The management of CVDs rests on the ability to target high-risk individuals at an early stage and provide appropriate interventions [3]. In Quebec, PWD are cared for by Primary Care Health (PCH) with Family Medicine Groups (FMGs), in coordination with specialists providing care for complex cases and acute care in hospitals.
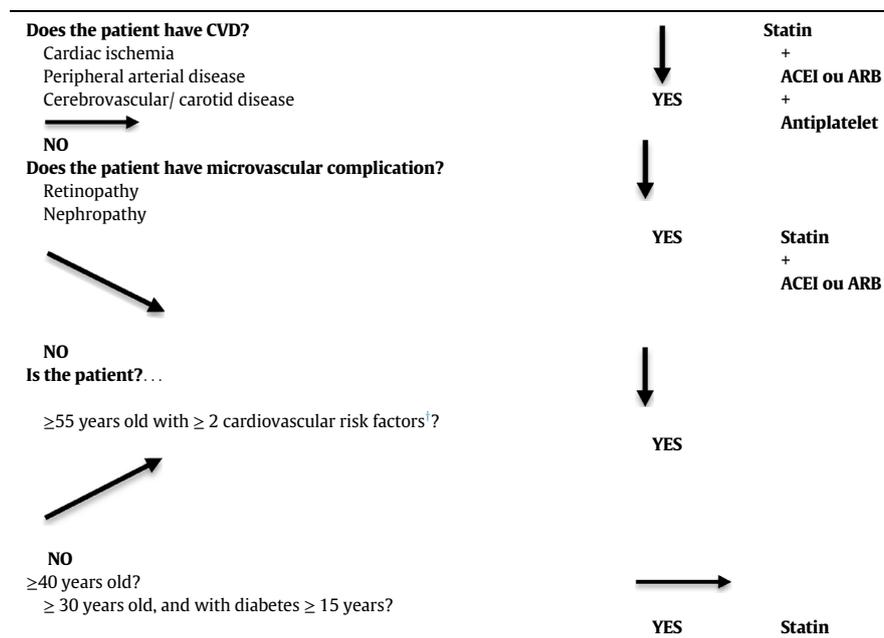
The proportion of patients meeting the three international guideline targets simultaneously [1,5], namely glycosylated hemoglobin (HbA$_{1c}$) ≤ 7%, blood pressure (BP) < 130/80 mmHg and low density lipoprotein levels (C-LDL) < 2 mmol/l, remains sub-optimal, ranging from 12 to 18 % [6−13]. In addition, a clinical intervention or therapeutic change in the presence of a missed target in diabetes management is offered in only 56% to 66% of cases, through a medical chart analysis [8,13,14].

Since 2017, the *Institut national d'excellence en santé et en services sociaux* (INESSS) in Quebec has been mandated to support regional health institutions in implementing a continuous quality improvement approach for chronic diseases, including diabetes. This is part of the provincial "Best Practices and Improvement in Care and Services Collaborative" (*CoMPAS+: Collectif pour les meilleures pratiques et l'amélioration des soins et services*) program [15] which offers

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Table 1
Clinical practice in cardiac and renal protection.

Does the patient have CVD?		**Statin**
Cardiac ischemia		+
Peripheral arterial disease		**ACEI ou ARB**
Cerebrovascular/ carotid disease	**YES**	+
		Antiplatelet
→ **NO**		
Does the patient have microvascular complication?		
Retinopathy		
Nephropathy		
	YES	**Statin**
		+
		ACEI ou ARB
NO		
Is the patient?...		
≥55 years old with ≥ 2 cardiovascular risk factors[†]?		
	YES	
NO		
≥40 years old?		
≥ 30 years old, and with diabetes ≥ 15 years?		
	YES	**Statin**

ACEI: Angiotensin converting enzyme inhibitor;
ARB: Angiotensin receptor blocker;
CVD: Cardiovascular disease;
Retinopathy or nephropathy or diabetic neuropathy
Adapted from Diabetes Canada,[1] 2020 Update
   [†] Cardiovascular risk factors: Dyslipidemia, hypertension, smoking, obesity microalbuminurie.

reflective practice workshops to PCH stakeholders [16]. Until now, CoMPAS+ has been using population indicators from clinico-administrative databases on population burden, service utilization and drug use [17]. However, additional data on clinical interventions could provide complementary information to clinicians and help improve the quality of care for patients with diabetes in PCH [18]

Integration of clinical intervention indicators would verify alignment of FMG physician prescriptions with recent Diabetes Canada [1] Clinical Practice Guidelines (CPG) to prevent and treat CVD in PWD (Table 1).

The first objective of this paper is to present the methodological basis for selecting quality indicators for diabetes care in the prevention and treatment of CVD. The second objective is to assess adherence to the diabetes CPG for the prevention and treatment of CVD in Quebec FMG between 2017 and 2020 using the indicators identified.

2. Methodology

2.1. Methodological basis for indicator development

2.1.1. Identification and selection of studies

A quick review of the scientific and grey literature was conducted [19] to identify: (1) studies citing quality indicators of diabetes care in a PCH context; and (2) the latest best practice guides for diabetes treatment to guide the process of selecting indicators against available best practices.

Research of the scientific literature was conducted in three databases: Pubmed, CINAHL and EBM Reviews. The bibliographic search strategy was developed in collaboration with a scientific information specialist. Regarding grey literature, the research has focused primarily on identifying good practice guides using the "Grey Matter" tool of the Canadian Agency for Drugs and Technologies in Health to access the websites of international government agencies, not-for-profit and evaluation organizations, and diabetology learned societies

[20]. Details of the literature search strategy used and the list of websites consulted are provided as supplementary materials.

The selection of studies based on pre-determined inclusion and exclusion criteria (Table 2) and the extraction of data from the selected studies were conducted by a member of the research team (H.M.) in consultation with the project team. Data extracted from the studies were compiled into an Excel file. The data essentially consists of the name of the indicator, its definition, the application context, supporting evidence, its operationalization parameters (numerator, denominator), its outcome and its reference. Only the quality of the good practice guides was assessed using the AGREE grid [21]. The first good practice guide was jointly evaluated by two team members from a standardization perspective, and the others were evaluated by the two evaluators independently (HM & KM). Cohen Kappa's coefficient (k) was calculated for inter-judicial fidelity [22] to compare the concordances and inconsistencies in the information extracted from the other guides by the two evaluators. An average k of 0.80 was

Table 2
Criteria for inclusion and exclusion of studies.

Inclusion	
Population	Adult people with diabetes
Intervention	Management CVD risk in people with diabetes
Context	Primary care health
Results	Indicators measuring the quality of care of adults with diabetes
Type of publication	Descriptive studies, controlled trials, systematic reviews, guides, frameworks and standards on quality-of-care measurement
Research period	2009-2019
Exclusion	
Population	Pediatric, pregnant
Context	Specialized Care Practices Countries of the Organisation for Economic Co-operation and Development
Type of publication	Conference abstracts, research protocol, editorial
Langue	Languages other than English and French

obtained, indicating strong agreement between the two evaluations [23].

The literature search identified 728 scientific publications and 75 good practice guides after duplicates were removed. Among these publications, 21 scientific studies and 13 good practice guides were selected to extract useful data to meet the objectives of this review. The flow diagram and exclusion reasons for each step of the selection process are presented in the additional material section.

An initial list of 43 indicators, based on criteria from the Chronic Disease Management Model [24], was presented to the Expert Panel. In this study, an indicator is "a meaningful measure, relative or otherwise, used to assess outcomes, resource utilization, progress or external context" [25]. In addition, indicators will be categorized according to the structure, process and outcome dimensions [26] related to diabetes management in a PCH context. Table 3 provides the criteria for defining a good indicator [25].

2.1.2. Selection of diabetes indicators

The selection of diabetes indicators was conducted by an advisory committee of twelve experts (five physicians, three academic researchers, a pharmacist, a FMG manager, a nurse, a INSPQ science advisor) and two patient partners who are involved in various other committees related to diabetes management. The process of selecting indicators by the advisory committee was conducted in two stages. Prior to the first step, patient partners were met to prepare them for their role in the indicator selection process. The first one-on-one meeting was held to inform all members of the expert panel of the CoMPAS+ approach and the nature of the indicators used to assess the quality of diabetes care and services. During this meeting, the expert panel reviewed the definition criteria for a good indicator and selected the relevance and feasibility criteria for the selection process. This step identified a preliminary list of indicators. Finally, a final list of quality indicators for diabetes care was selected through a consensus meeting with all committee members via video conference due to the Covid-19 pandemic.

Then, in collaboration with the members of the expert panel, thirty-two of the forty-three indicators were selected based on an assessment of relevance and feasibility. Eleven indicators were eliminated, including:

- Two descriptive indicators (proportion of patients with diabetes and number of deaths by age),

Table 3
Quality criteria used for the selection of relevant indicators.

Criteria	Definition
Importance	The indicator relates to a condition that represents a significant burden and an intervention for which there is a gap between current performance and best practices. The implementation of the indicator thus allows a measurable and significant improvement in clinical outcomes.
Relevance of care	The indicator is clinically relevant and represents best practices;
Evidence-based measurement	The indicator is based on evidence that confirms that the structure, process or outcome measured is associated with a desired state of health;
Measurement specifications	The indicator is measurable, available (accessible from medico-administrative databases) and produces accurate and valid information;
Feasibility and applicability	The indicator is easy to use by target customers and must be actionable.

(Beaulieu et al.)[25]

- An irrelevant indicator (screening for diabetic nephropathy by estimated glomerular filtration rate (eGFR) since microalbuminuria was selected)
- Eight indicators that are difficult to measure (persistence/adherence to antidiabetic treatments, prescription of hypolipidemic, antiplatelet, and nephroprotective agents).

The thirty-two indicators selected are grouped according to the nature of the concepts measured (supplementary material):

- Nine indicators pertaining to the population burden of diabetes,
- Six indicators assessing the quality of the care and service trajectory,
- Seventeen indicators assessing the technical quality of care, including:
  ○ Two indicators pertaining to clinical interventions related to preventive care,
  ○ Five indicators pertaining to the monitoring of clinical-biological parameters,
  ○ Three indicators on therapeutic targets
  ○ Seven drug utilization indicators (one for the treatment of diabetes with metformin and six for the prevention and treatment of CVD).

The six new indicators for the prevention and treatment of CVD were measured and analyzed in this study. These include prescriptions of statins, antiplatelets, angiotensin-converting enzyme (ACE) inhibitors, angiotensin receptor blockers (ARB), and of new cardiac protection therapies [Sodium/glucose cotransporter inhibitor 2 (SGLT-2), Glucagon receptor agonist like peptide (GLP-1)].

2.1.3. Establishment of the cohort

A retrospective cohort study from 2017 to 2020 was created from patients with diabetes and CVD enrolled in a FMG, and participating in Quebec's Public Prescription Drug Plan (PPDP) for a full year. The choice to calculate the indicators with those registered in a FMG was justified by the fact that the CoMPAS+ diabetes program was planned at the FMG level in 2020.

In Quebec, the majority of patients aged 65 and over are enrolled in the PPDP. A sensitivity analysis showed that among people with diabetes, the proportion that are insured year-round by PPDP in Quebec is 35.3% in the 40−49 year-olds, 43.1% in the 50−64 year-olds, 90.7% in the 65−74 year-olds, and 89.5% in the 75−84 year-olds. Given that the majority of patients aged 40 to 49 (64.7%) were not enrolled in PPDP, the age class of those over 50 years was used to calculate indicators of quality of diabetes care in the management of CVD in individuals enrolled in FMG and PPDP. Furthermore, some treatments such, as statins, are not recommended for PWD until age 40 or 30 if suffering from diabetes for at least 15 years (Table 1).

Patients were identified based on the presence of coded diabetes diagnoses during at least one medical visit and/or one hospital stay (supplementary material). Patients with CVD were identified using the operational definitions of acute myocardial infarction, percutaneous coronary intervention, and coronary artery bypass used by the National Institute of Excellence in Health and Social Services (INESSS) [27] and the *Institut national de santé publique du Québec (INSPQ)* [28]. The diagnostic codes used to identify these three conditions are detailed in the supplementary material. The individuals in the cohort must have both conditions -diabetes and CVD - during the study period. The data is from the *Régie de l'assurance maladie du Québec* (RAMQ) and the *Ministère de la Santé et des Services sociaux* (MSSS) databases. Access to these databases was made possible through a tripartite agreement between the MSSS, RAMQ and INESSS.

Table 4
Characteristics of the study population[‡].

In Quebec		2017/18	2018/19	2019/20
Number of patients	PWD with CVD	80,598	84,624	87,068
	PWD without CVD	286,119	302,484	312,808
	PWD for at least 15 years	128,992	126,637	121,909
	PWD with CVD	74.9	75.0	75.2
Average age, year	PWD without CVD	72.2	72.3	72.5
	PWD for at least 15 years	71.9	72.3	72.6
Proportion of female	PWD with CVD	36.3%	35.7%	35.4%
	PWD without CVD	47.1%	46.7%	46.5%
	PWD for at least 15 years	46.3%	46.1%	46.2%
Average number of years of diabetes	PWD with CVD	11.5	11.9	12.3
	PWD without CVD	10.5	10.9	11.2
	PWD for at least 15 years	17.3	18.3	19.2

CVD: Cardiovascular disease;
PWD: People with Diabetes.
[‡] People ≥50 year-olds of age followed in Family Medicine Groups and enrolled in the Public Prescription Drug Plan;

The indicators reviewed in this text relate to prescribing for FMG patients in Quebec between 2017/18, 2018/19 and 2019/20. This report presents the adjusted proportion of the indicator using the age and sex structure of the population aged 50 and over in Quebec as a reference using the direct standardization method (Proc Stdrate) using SAS software to make appropriate year-to-year comparisons [29]. Changes over time in results were explored by also observing the 95% confidence intervals of the indicators. The analyses were performed using the IBM SPSS® Quantitative Analysis Software, New York, US (version 25).

3. Results

3.1. Participants profile

The number of patients, aged 50 and over with diabetes and CVD followed in FMG enrolled in PPDP in 2019-20, represents 87,068 individuals, 34.4% of whom were women with an average age of 75.2 years and 12.3 years of diabetes. Patient characteristics appear similar in age, gender and duration of diabetes across the 2017/18, 2018/19 and 2019/20 cohorts (Table 4).

3.2. Results of the quality assessment of diabetes and CVD care

The results of the indicators adjusted for age and gender are presented in Fig. 1. The methodological sheets describing each of the six indicators are listed in the additional material.

Antiplatelet prescriptions: 72% of people over the age of 50 with diabetes and CVD were prescribed an antiplatelet in 2019-20 (secondary prevention) after adjusting for gender and age. The proportions are relatively stable from 2017 to 2020. In the group of diabetes patients without an identified CVD for which this treatment is not recommended for primary prevention, 36.1% were prescribed antiplatelet at least once in 2019-20. There is a decrease between 2017-18 (41.4%) and 2019-20 (36.1%), with 95% confidence intervals, initially mutually exclusive, that do not overlap.

ACE inhibitors or ARB prescriptions: The adjusted proportion (gender and age) of people over 50 years of age, with diabetes and CVD who take ACE inhibitors or ARB, was stable between 2017-18 and 2019-20. This percentage was 66.5% in 2019-20.

Prescription for SGLT-2 or GLP1: The use of SGLT-2 or GLP1 among people over 50 with diabetes and CVD has increased over the years,
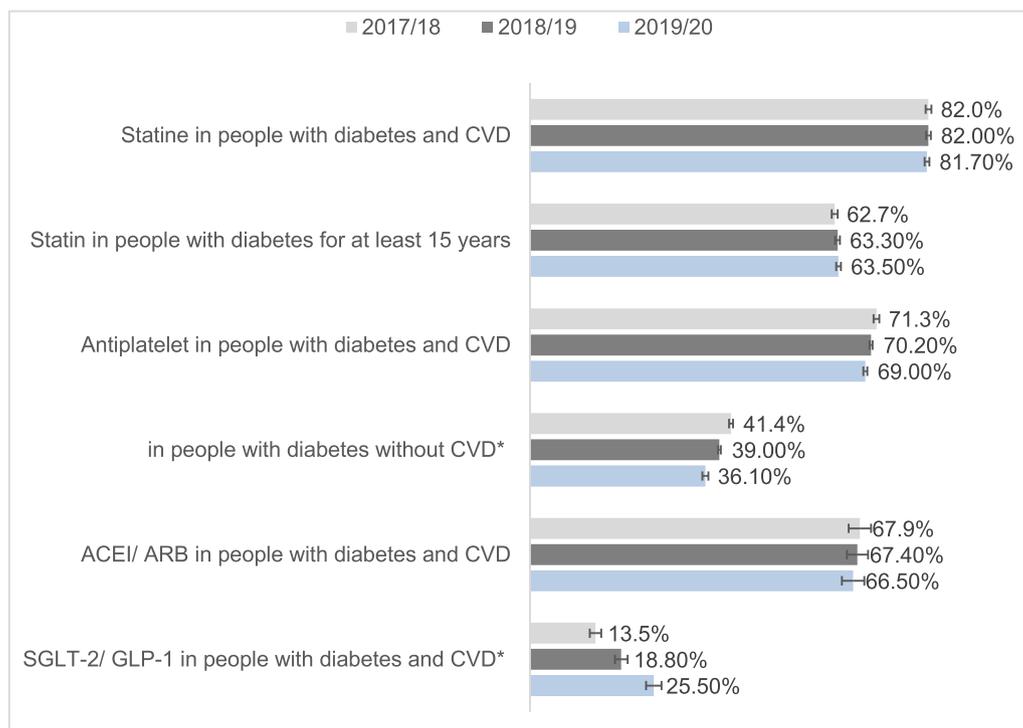

Fig. 1. Indicators of prevention and treatment of cardiovascular disease in diabetes management in Quebec, adjusted for age and sex with their 95% confidence intervals
People ≥50 year-olds of age followed in Family Medicine Groups and enrolled in the public prescription drug insurance plan;
* No overlap of confidence intervals indicators;
ACEI: Angiotensin converting enzyme inhibitor.
ARB: Angiotensin receptor blocker;
GLP1 receptor agonist: Glucagon like peptide;
SGLT-2 inhibitor: Sodium/glucose co-transporter 2.

from 13.5% in 2017-18 to 18.8% in 2018-19 and 25.5% in 2019-20 with 95% confidence intervals, at first glance mutually exclusive, which do not overlap.

4. Discussion

Using new quality indicators, this study examined the quality of diabetes care in CVD prevention and treatment in Quebec's PCHs. First, the selection of indicators followed a rigorous two-step process [30]: a quick review of the scientific and grey literature to identify a preliminary list of potential indicators and consultation with diabetology experts and patient partners to make a final selection. This led to the identification of six indicators that reflect the evolution of the most recent diabetes CPG. Subsequently, the selected indicators were measured in a retrospective cohort study to assess the quality of diabetes care management in the prevention and treatment of CVD in a PCH setting.

The results of this study would indicate that the CPG for prescribing a statin and/or antiplatelet (secondary prevention) are being followed as high and relatively stable proportions are observed from 2017 to 2020. These results show adequate management in PWD and CVD with a secondary prevention statin prescription of 82,0% in 2019-2020, which is above the 70% threshold that would likely be adequate as long as 5 to 29% of people treated with a statin had side effects [31] (e.g. myalgias) that promote a lack of adherence. The prescription of antiplatelet in secondary prevention is close to the target value of 80%, as reported in the literature [13,32,33]. These results for prescribing statins and antiplatelet drugs for secondary prevention are similar to data reported in studies in the United States, Portugal, Brazil and Canada [13,32−34]. However, the prescribing of antiplatelet medications is probably underestimated, since a non-prescription antiplatelet is available in Quebec. These data are not available in billing-based clinical and administrative databases.

Regarding the prescribing of antiplatelet medications in primary prevention in PWD without CVD, we see a decrease expected since the 2017-18 fiscal year. This suggests that the recommendation of not rescinding antiplatelet in primary prevention of CVD in diabetes management is starting to be implemented [1]. It is difficult to comment on a target value for this indicator, as other conditions may require the prescribing of antiplatelet medications in PWD without CVD. Furthermore, this indicator is rarely examined in the literature.

The prescription recommendation for ACEI or ARB in PWD and CVD also appears to be well followed and the prescription is stable from 2017/18 to 2019/20 (66.5%), indicating adequate management of CVD in people with diabetes, this is similar to literature data from Europe and Canada [13,33,35].

Recommendations for Prescribing New Cardiac Protection Therapies (SGLT-2/ GLP-1) for PWD and CVD [1] are starting to be tracked as the proportion of people receiving this treatment increased between 2017 and 2020. Treatment with a SGLT-2 inhibitor or GLP-1 receptor agonist is recommended for patients with sub-optimal equilibrium (Hba1c>7.0%), who are already treated with an anti-diabetic agent and have CVD and whose estimated glomerular filtration rate (eGFR) is greater than 30 mL/min/1.73 m2 [1]. However, the SGLT-2 inhibitor or GLP-1 receptor agonist molecules were listed as exception drugs in Quebec during the 2017 to 2020 study period [36]. Of the SGLT-2 inhibitors, only empagliflozine is reimbursed by the RAMQ for the treatment of type 2 diabetes, in combination with one or more antidiabetic agents, in people with CVD and whose HbA_{1c} is ≥ 7% [RAMQ, 2021]. This indicator could not be calculated taking into consideration clinical data including Hba1c and eGFR and taking into account RAMQ reimbursement criteria.

Our study has some other limitations. First, the definition of CVD is arguably restrictive, but it includes the most serious conditions. In addition, since individuals over the age of 50 were included in this cohort, some patients with type 1 and type 2 diabetes before the age

of 50 are not represented. It should be noted that only about half of people aged 50 to 64 in Quebec are enrolled in the PPDP, suggesting a potential selection bias. Finally, on a statistical level, we are aware that the 95% confidence intervals of the adjusted indicators are not sufficient to establish differences.

Methodologically, however, it is worth noting the quality of the study's approach to identifying and selecting indicators with a group of experts including patient partners. This approach has been inclusive, allowing for consideration of patient concerns, values and preferences [28].

5. Conclusion

The identification and selection of quality indicators for diabetes care is part of a quality improvement approach to care where these indicators can be mobilized to improve practices in PCH.

The prescriptions for statins, antiplatelet in secondary prevention and ACEI/ARB appear adequate and stable between 2017 and 2020. In contrast, the prescribing of antiplatelet medications in primary prevention is declining and the prescribing of new therapies (SGLT-2 /GLP-1) is increasing between 2017 and 2020, which is consistent with Diabetes Canada's 2018 CPG [1].

Ethical approval

Ethics approval was obtained from the Science and Health Research Ethics Board of the University of Montreal (Number: 20-040-D).

Consent to participate

Not applicable

Declarations of Competing Interest

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.deman.2022.100053.

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