Suboptimal DKA Awareness and Behavioural Gaps Supporting Non-invasive Ketone Monitoring in Elderly Care

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Abstract

Diabetic ketoacidosis (DKA) is a preventable yet life-threatening emergency of diabetes that can lead to multi-organ damage, and avoidable healthcare use when detection is delayed. In community elderly care settings, DKA awareness and ketone monitoring may be limited, while symptoms can remain non-specific or easily overlooked. This proceedings paper reports a pilot survey conducted in Hong Kong within an elderly diabetes community programme led by the School of Nursing and Health Sciences of Hong Kong Metropolitan University. The study recruited 53 older adults with diabetes; 52 completed the questionnaire, yielding a response rate of 98.1%. The questionnaire examined knowledge of DKA, DKA-related symptoms experienced in the prior month, responses to symptoms, and preferred tools for daily diabetes management. The survey showed that 67.3% of respondents had no prior knowledge of DKA. At the same time, 55.8% reported at least one DKA-related symptom, most commonly fatigue or weakness, extreme thirst, diarrhoea, loss of appetite, and nausea. Among those with symptoms, 65.5% neither sought professional support nor communicated with family members. Preference data suggested stronger acceptance of painless breath ketone testing among the younger elderly subgroup, with 70% of participants aged under 65 favouring breath testing. Taken together, the findings indicate a clinically relevant behavioural gap in elderly diabetes care: warning symptoms may be present, but awareness, help-seeking, and timely ketone checking remain insufficient. The paper suggests that education, routine symptom checks, clear guidance on prompt communication when symptoms arise, and non-invasive ketone monitoring deserve stronger integration into community-based elderly diabetes care.

Keywords: diabetic ketoacidosis, elderly care, ketone monitoring, non-invasive breath testing, gerontechnology, digital health, elderly diabetes care in Hong Kong

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Introduction

Diabetic ketoacidosis (DKA) is a life-threatening emergency in diabetes management, and early detection can save lives and reduce healthcare costs. However, DKA symptoms are often subtle or non-specific, making awareness of DKA risk essential to prevent delays in treatment. In addition, euglycemic DKA (EDKA) can occur even when glucose levels appear controlled, underscoring the importance of routine ketone monitoring in diabetes care.

Elderly diabetes management requires special attention, given the significant proportion of undiagnosed cases within this population and the practical challenges of recognising non-specific warning signs in community settings. In elderly care, non-specific symptoms such as fatigue, thirst, nausea, or reduced appetite may easily be overlooked, attributed to ageing, or not treated seriously in time. This creates a potential gap between physiological warning signs and timely recognition of risk.

In view of these challenges, we conducted a pilot survey within an elderly diabetes community program in Hong Kong to assess awareness of DKA risk and preferences for ketone testing. The survey also examined DKA-related symptoms experienced in the prior month and how older adults responded to those symptoms. The purpose was to identify current gaps in awareness, symptom recognition, help-seeking, and monitoring preference that may affect early detection and safer diabetes care in the elderly community.

This proceedings paper reports the findings of that pilot survey and discusses their implications for community-based elderly diabetes care. In particular, this paper suggests education, routine symptom enquiry, clear guidance on prompt communication with healthcare professionals and caregivers when warning symptoms arise, and non-invasive ketone monitoring may help address current behavioural and practical gaps and support more timely risk recognition in elderly care.

Methodology

Participants and Setting

The survey formed part of an elderly diabetes community project conducted in Hong Kong from April 2024 to May 2025 in collaboration with the School of Nursing and Health Sciences of Hong Kong Metropolitan University. Eligible participants were aged 60 years or above and had been diagnosed with diabetes. The programme recruited participants across five districts in Hong Kong: Ap Lei Chau, Aberdeen, Tseung Kwan O, Lok Fu, and Sheung Shui.

Fifty-three participants were recruited, and 52 completed the questionnaire, yielding a response rate of 98.1%. The median age was 70 years, with an age range of 60 to 90 years. The sample was predominantly female, comprising 79% women and 21% men (Table 1).

Survey Design

The questionnaire was designed around four. The first question addressed knowledge of DKA. The second focused on DKA-related symptoms experienced in the prior month. The third examined how participants responded when such symptoms were present, including whether they sought professional support or communicated with family members. The fourth explored preferred tools for daily diabetes management.

Table 1
Participant Profile

Characteristic	Value
Programme period	April 2024 to May 2025
Eligibility	Age 60 years or above; diagnosed diabetes
Recruited participants	53
Questionnaire completions	52
Response rate	98.1%
Districts represented	Ap Lei Chau, Aberdeen, Tseung Kwan O, Lok Fu, and Sheung Shui
Median age	70 years (range 60–90)
Sex distribution	21% male; 79% female

Results

The survey identified several significant gaps in DKA management in elderly community care. First, awareness of DKA was low. Although DKA is a life-threatening acute diabetic emergency, 67.3% of respondents had no prior knowledge of it. This indicates a substantial awareness gap in the elderly community and runs counter to the preventive care principle that early detection supports timely treatment.

Second, DKA-related symptoms were not uncommon. Over half of respondents (55.8%) reported experiencing at least one possible DKA-related symptom in the prior month. The most frequently reported symptoms were fatigue or weakness (32.7%), extreme thirst (26.9%), diarrhoea (19.2%), loss of appetite (17.3%), and nausea (7.7%). These findings suggest that non-specific symptoms occur with notable frequency in daily life, highlighting a critical gap between common assumptions that such warning signs are rare and the actual experiences of elderly individuals living with diabetes.

Third, warning symptoms often failed to prompt timely action. Among respondents who experienced symptoms in the previous month, 65.5% neither sought professional support nor communicated with family members. This finding reveals a clear behavioural gap between symptom experience and help-seeking behaviour. Even when possible warning signs are present, many older adults may not reach out for health support or communicate their concerns in a timely manner.

Fourth, non-invasive breath testing was favoured by younger elderly individuals. Among participants aged under 65, 70% preferred painless breath ketone testing over traditional methods. This suggests that the method of ketone testing may influence willingness to participate in screening. Breath-based, non-invasive approaches may therefore help overcome practical and psychological barriers, supporting more acceptable routine monitoring in elderly diabetes care.

Taken together, these findings point to a clinically relevant gap in elderly diabetes care. Possible warning symptoms are present, but awareness, help-seeking, and timely ketone checking remain insufficient.

Discussion

Recommendations

These findings support four practical recommendations to address the gap identified. First, DKA education should be strengthened for older adults, caregivers, and elderly-centre staff. Because DKA is a life-threatening emergency, limited awareness may delay recognition and timely treatment. Targeted education is therefore needed to improve understanding of DKA risk and to reinforce the importance of early detection in elderly diabetes care.

Second, routine symptom checks should be integrated into practice. The survey showed that DKA-related symptoms were not uncommon, even though they are often non-specific. Regular enquiry about symptoms such as fatigue, thirst, nausea, reduced appetite, or abdominal discomfort may therefore be valuable in routine elderly diabetes care. When these warning signs are present, timely ketone testing should be considered, especially because glucose monitoring alone may not be sufficient in cases such as EDKA.

Third, timely communication should be promoted. The finding that many symptomatic respondents neither sought professional support nor communicated with family suggests that warning symptoms often fail to prompt timely action. Elderly individuals with diabetes should therefore be encouraged to seek help promptly from caregivers and consult healthcare professionals when feeling unwell or experiencing possible warning symptoms.

Fourth, non-invasive screening should be adopted as part of routine care. The preference for painless breath ketone testing among younger elderly individuals suggests that the method of testing may influence willingness to participate in screening. Breath-based, non-invasive approaches may help overcome barriers that can discourage routine monitoring, enabling earlier risk detection.

Table 2
Summary of Key Survey Findings and Recommendations

	Statistics	Key findings	Recommendations
Knowledge of DKA?	67.3% had not heard of DKA	Awareness of DKA is low	Strengthen DKA education for elderly people, caregivers, and elderly-center staff
Any DKA-related symptoms in the past month?	55.8% reported symptoms	DKA-related symptoms were not uncommon	Integrate routine symptom checks and ketone testing into diabetes care
Sought help or discussed symptoms?	65.5% neither sought help nor told family	Warning symptoms are often overlooked and fail to prompt timely action	Encourage prompt contact with HCPs and caregivers when feeling unwell or symptomatic
Preferred daily monitoring tool?	70% of those aged < 65 preferred painless breath testing	Non-invasive breath testing is favored by younger elderly individuals	Painless, non-invasive ketone testing technology can be an invaluable tool to support routine elderly diabetes care management

Benefits of Non-invasive Ketone Testing for Diabetes Care

The benefits of non-invasive ketone testing extend beyond the individual patient. At the patient level, non-invasive ketone testing may enhance safety and quality of life while supporting timely escalation of care. At the caregiver level, it may reduce stress and workload through easier monitoring and support. At the community or elderly-centre level, it may strengthen response by enabling faster recognition and earlier action when warning symptoms arise. At the healthcare system level, it may help reduce late presentation, emergency burden, and avoidable deterioration. These benefits suggest that non-invasive ketone monitoring has practical value across multiple levels of elderly diabetes care.

Moving Forward

Looking ahead, this pilot study highlights important gaps in current diabetes care within the elderly community, and expanding the survey to a broader population may help uncover additional practical challenges that remain unaddressed. Such insights can provide a solid foundation for refining care routines and advancing new standards in elderly diabetes management. At the same time, the next step is not only to deepen understanding, but also to translate these findings into practice. This will require active engagement with healthcare providers, caregivers, community organisations, policy makers, and MedTech companies to explore how cutting-edge technologies can be meaningfully integrated into real-world elderly care settings.

With the advancement of new technologies, routine data being collected via digital platforms will enable respective stakeholders to conduct advanced analytics, generating novel metabolic insights, supporting the shift from prediction to prevention, and further contributing to the digital health transformation by enabling more tailored pathways to healthy longevity.

Finally, the findings from this pilot study underscore the importance of broad collaboration across healthcare, academic, community, policy, MedTech, and elderly-service sectors. Joint efforts that combine education, monitoring practices, effective communication, and the integration of new technologies can strengthen early recognition of metabolic risks and warning signs, enable timely responses, and ultimately help bring the best health outcomes for older people living with diabetes.

Figure 1

Application of Non-invasive Breath Ketone Testing in Elderly Community

Note. Fieldwork photo from the elderly diabetes community project conducted in collaboration with the School of Nursing and Health Sciences, Hong Kong Metropolitan University.

Conclusion

This pilot survey underscores persistent gaps in DKA awareness, symptom recognition, help-seeking, and ketone monitoring within elderly community care. Warning signs may be present, yet timely recognition and response remain insufficient. Addressing these gaps requires strengthening education, embedding routine symptom checks, and ensuring clear pathways for communication with caregivers and healthcare professionals. Integrating painless, non-invasive ketone testing into routine diabetes care may represent a feasible and scalable approach to improving early detection.

When embedded in elderly care pathways, such technology can empower older people living with diabetes, ease the burden on families and caregivers, and support healthcare professionals in delivering more timely and effective care. At a broader level, community adoption may facilitate earlier medical attention, help avoid prolonged hospitalizations through timely treatment, and generate long-term cost benefits for health systems. Notably, these benefits may also extend to older people with undiagnosed diabetes, enabling earlier detection and intervention. Beyond immediate clinical gains, such strategies contribute to a shift from reactive prediction to proactive prevention, fostering healthier longevity and reinforcing the collective responsibility of communities to safeguard the wellbeing of their aging populations.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The authors declare that OpenAI's ChatGPT and Microsoft Copilot were used to assist in organising, drafting, and refining the language of this manuscript based on author-provided study materials, including the approved conference presentation and accepted abstract. The use of AI was limited to structural drafting, language development, and editorial support. The authors reviewed, revised, and approved the final manuscript and take full responsibility for the study design, data, findings, interpretations, and conclusions.

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