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CADTH Reference List

Continuous Glucose Monitoring for People With Diabetes Receiving Dialysis or With Chronic Kidney Disease

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Summary of Abstracts

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Key Messages

- We found 7 non-randomized studies about the accuracy of continuous glucose monitoring systems versus arterial, venous, or capillary reference samples for people with diabetes who are receiving dialysis or who have chronic kidney disease.
- We did not find any studies on the clinical effectiveness of continuous glucose monitoring systems versus self-monitoring blood glucose for people with diabetes who are receiving dialysis or who have chronic kidney disease.
- We did not find any evidence-based guidelines about the use of continuous glucose monitoring systems for people with diabetes who are receiving dialysis or who have chronic kidney disease.

Research Questions

1. What is the accuracy of continuous glucose monitoring systems versus arterial, venous, or capillary reference samples for people with diabetes who are receiving dialysis or who have chronic kidney disease?
2. What is the clinical effectiveness of continuous glucose monitoring systems versus self-monitoring blood glucose for people with diabetes who are receiving dialysis or who have chronic kidney disease?
3. What are the evidence-based guidelines regarding the use of continuous glucose monitoring systems for people with diabetes who are receiving dialysis or who have chronic kidney disease?

Methods

Literature Search Methods

A limited literature search was conducted by an information specialist on key resources including MEDLINE, the Cochrane Database of Systematic Reviews, the International HTA Database, and the websites of Canadian and major international health technology agencies, as well as a focused internet search. The search strategy comprised both controlled vocabulary, such as the National Library of Medicine's MeSH (Medical Subject Headings), and keywords. The main search concepts were glucose monitoring, diabetes, dialysis, and chronic kidney disease. No search filters were applied to limit retrieval by study type. Where possible, retrieval was limited to the human population. The search was completed on August 10, 2022, and was limited to English-language documents published since January 1, 2017. Internet links were provided, where available.

Selection Criteria and Summary Methods

One reviewer screened literature search results (titles and abstracts) and selected publications according to the inclusion criteria presented in Table 1. Full texts of study publications were not reviewed. The Overall Summary of Findings was based on information available in the abstracts of selected publications. Open access full-text versions of evidence-based guidelines were reviewed when available, and relevant recommendations were summarized.

Table 1: Selection Criteria

Criteria	Description
Population	People with diabetes (e.g., type 1, type 2) who are receiving dialysis or who have chronic kidney disease
Intervention	Real-time or intermittently scanned continuous glucose monitoring systems
Comparator	Q1: Arterial, venous, or capillary reference samples assessed using any measurement device Q2: Self-monitoring blood glucose with a glucose meter Q3: Not applicable
Outcomes	Q1: Accuracy (e.g., mean absolute relative difference, Clarke error grid, Bland-Altman plots, or agreement with the accuracy standards of the International Organization for Standardization) Q2: Clinical effectiveness (e.g., hemoglobin A1C, quality of life, participant satisfaction, safety [e.g., hypoglycemia events, device-related adverse events]) Q3: Recommendations regarding best practices (e.g., blood glucose assessment protocols, special considerations for this population)
Study designs	Health technology assessments, systematic reviews, randomized controlled trials, non-randomized studies, evidence-based guidelines

Results

Seven non-randomized studies[1-7] were identified about the accuracy of continuous glucose monitoring (CGM) systems versus arterial, venous, or capillary reference samples for people with diabetes who are receiving dialysis or who have chronic kidney disease. No relevant health technology assessments, systematic reviews, randomized controlled trials, or evidence-based guidelines were identified.

Additional references of potential interest that did not meet the inclusion criteria are provided in Appendix 1.

Overall Summary of Findings

Seven non-randomized studies[1-7] were identified about the accuracy of CGM systems versus venous or capillary reference samples for people with diabetes who are receiving dialysis. The majority of the studies compared CGM[1,6,7] and/or flash glucose monitoring (FGM)[2-7] to self-monitoring blood glucose (SMBG) or capillary reference samples. One study[1] compared the accuracy of CGM to venous reference samples.

The results generally supported the accuracy of CGM or FGM devices compared to reference samples in people with diabetes who are receiving dialysis. Five studies[1,3,4,6,7] concluded that

CGM or FGM was reasonably accurate when compared to reference samples. The authors of 1 study[2] concluded that, compared to other populations, FGM was less accurate in people with diabetes undergoing hemodialysis. Another study[5] found that in people with type 2 diabetes undergoing hemodialysis, FGM had insufficient accuracy that deteriorated with greater usage when compared to SMBG.

Four studies[1-3,6] examined the use of CGM or FGM devices during hemodialysis. Of these, 3 studies[1,3,6] determined that CGM or FGM readings taken during dialysis were adequately accurate compared to reference samples. Two studies[2,6] found that there was less agreement between FGM and the reference during dialysis when compared to overall accuracy. Detailed summaries of included accuracy studies are provided in Table 2.

No relevant literature was found about the clinical effectiveness of CGM systems versus SMBG for people with diabetes who are receiving dialysis or who have chronic kidney disease. Additionally, no evidence-based guidelines were found about the use of CGM systems for people with diabetes who are receiving dialysis or who have chronic kidney disease; therefore, no summary can be provided.

Table 2: Summary of Included Accuracy Studies

Study citation	Study design, population	Intervention and comparator(s)	Relevant outcome(s)	Author's conclusions
Non-randomized studies				
Villard et al. (2022)[1]	**Study design**: Prospective cohort **Population**: People with diabetes on hemodialysis **N = 20**	**At home** Intervention: factory calibrated CGM Comparator: SMBG **During dialysis** Intervention: factory calibrated CGM Comparator: Venous blood glucose	MARD, Parkes error grid	CGM appeared reasonably accurate. The MARD was 13.8% and 98.7% of readings were in Parkes error grid zones A/B when compared to SMBG taken at home. CGM and venous blood glucose measurements taken during dialysis had a MARD of 14.4% and 100% of readings were in Parkes error grid zones A/B.
Genua et al. (2021)[2]	**Study design**: Prospective cohort **Population**: People with diabetes on hemodialysis **N = 16**	**Overall** Intervention: FGM (FreeStyle Libre) Comparator: Capillary glucose **During dialysis** Intervention: FGM (FreeStyle Libre) Comparator: Capillary glucose	MARD	The MARD between FGM and capillary glucose was 23%. During hemodialysis, this increased to 29%. FGM had lower accuracy in people with diabetes on hemodialysis compared to other populations, especially during dialysis sessions.

Study citation	Study design, population	Intervention and comparator(s)	Relevant outcome(s)	Author's conclusions
Hissa et al. (2021)[3]	**Study design**: Prospective cohort **Population**: People with T2DM on hemodialysis **N = 12**	**During dialysis** Intervention: FGM (FreeStyle Libre) Comparator: Capillary glucose	MARD, Clarke error grid, Parkes error grid	Most readings of FGM compared to capillary glucose were in either zone A or B. FGM use during dialysis was accurate enough to potentially inform clinical decision-making.
Mambelli et al. (2021)[4]	**Study design**: Prospective cohort **Population**: People with T2DM on hemodialysis **N = 20**	Intervention: FGM Comparator: SMBG	Clarke error grid	FGM showed good agreement with SMBG with 97% of readings in zones A and B.
Toyoda et al. (2021)[5]	**Study design**: Prospective cohort **Population**: People with T2DM on hemodialysis **N = 41**	Intervention: FGM (FreeStyle Libre) Comparator: Capillary glucose	MARD, mean absolute difference, Clarke error grid, consensus grid	FGM was considered insufficiently accurate, and accuracy deteriorated with days of usage. The MARD between FGM and capillary glucose was 23.4% with 99.0% to 99.7% of readings in zones A and B of the consensus and Clarke grid error analysis.
Matoba et al. (2020)[6]	**Study design**: Prospective cohort **Population**: People with T2DM on hemodialysis **N = 13**	**Overall** Intervention: FGM (FreeStyle Libre Pro); CGM (iPro2) Comparator: SMBG **During dialysis** Intervention: FGM (FreeStyle Libre Pro); CGM (iPro 2) Comparator: SMBG	MARD, Parkes error grid	FGM showed good clinical agreement with SMBG. Overall, the MARD for FGM was 18.2%. This increased to 22.8% during dialysis. The combined percent of readings in zones A and B decreased during dialysis. Overall, the MARD between CGM and SMBG was 11.2%. This increased to 15.0% during dialysis. The readings in zones A and B overall and during dialysis showed greater accuracy than FGM.
Yajima et al. (2020)[7]	**Study design**: Prospective cohort **Population**: People with T2DM on hemodialysis **N = 13**	Intervention: FGM (Freestyle Libre Pro); CGM (iPro2) Comparator: SMBG	MARD, Parkes error grid	The MARD between FGM and SMBG was 19.5% with all readings in zones A and B. FGM may be clinically acceptable. The MARD between CGM and SMBG was 8.1% with all readings in zones A and B.

CGM = continuous glucose monitoring; FGM = flash glucose monitoring; MARD = mean absolute relative difference; SMBG = self-monitoring blood glucose; T2DM = type 2 diabetes mellitus.

References

Health Technology Assessments

No literature identified.

Systematic Reviews

No literature identified.

Randomized Controlled Trials

No literature identified.

Non-Randomized Studies

1. Villard O, Breton MD, Rao S, et al. Accuracy of a factory-calibrated continuous glucose monitor in individuals with diabetes on hemodialysis. *Diabetes Care.* 2022 Jul 7; 45(7): 1666-1669. PubMed

2. Genua I, Sanchez-Hernandez J, Martinez MJ, et al. Accuracy of flash glucose monitoring in patients with diabetes mellitus on hemodialysis and its relationship with hydration status. *J Diabetes Sci Technol.* 2021 Nov; 15(6): 1308-1312. PubMed

3. Hissa MRN, Hissa PNG, Guimaraes SB, Hissa MN. Use of continuous glucose monitoring system in patients with type 2 mellitus diabetic during hemodialysis treatment. *Diabetol Metab Syndr.* 2021 Oct 9; 13(1): 104. PubMed

4. Mambelli E, Cristino S, Mosconi G, Gobl C, Tura A. Flash glucose monitoring to assess glycemic control and variability in hemodialysis patients: the GIOTTO study. *Front Med (Lausanne)*. 2021 Jul 30; 8: 617891. PubMed

5. Toyoda M, Murata T, Saito N, et al. Assessment of the accuracy of an intermittent-scanning continuous glucose monitoring device in patients with type 2 diabetes mellitus undergoing hemodialysis (AIDT2H) study. Therap Apher Dial. 2021 Oct; 25(5): 586-594. PubMed

6. Matoba K, Hayashi A, Shimizu N, Moriguchi I, Kobayashi N, Shichiri M. Comparison of accuracy between flash glucose monitoring and continuous glucose monitoring in patients with type 2 diabetes mellitus undergoing hemodialysis. J Diabetes Complications. 11 2020; 34(11): 107680. PubMed

7. Yajima T, Takahashi H, Yasuda K. Comparison of interstitial fluid glucose levels obtained by continuous glucose monitoring and flash glucose monitoring in patients with type 2 diabetes mellitus undergoing hemodialysis. *J Diabetes Sci Technol.* 2020 Nov; 14(6): 1088-1094. PubMed

Guidelines and Recommendations

No literature identified.

Appendix 1: References of Potential Interest

Note that this appendix has not been copy-edited.

Previous CADTH Reports

Flash glucose monitoring and continuous glucose monitoring for people with diabetes in acute care settings. *(CADTH reference list: summary of abstracts)*. Ottawa (ON): CADTH; 2021: https://www.cadth.ca/flash-glucose-monitoring-and-continuous-glucose-monitoring-people-diabetes-acute-care-settings Accessed 2022 Aug 29.

Flash glucose monitoring system for diabetes. *(CADTH horizon scan).* Ottawa (ON): CADTH; 2021: https://www.cadth.ca/flash-glucose-monitoring-system-diabetes Accessed 2022 Aug 29.

Continuous glucose monitoring for patients with all diabetes types: clinical effectiveness and guidelines. *(CADTH reference list: summary of abstracts).* Ottawa (ON): CADTH; 2018: https://www.cadth.ca/continuous-glucose-monitoring-patients-all-diabetes-types-clinical-effectiveness-and-guidelines Accessed 2022 Aug 29.

Systematic Reviews

Unclear Comparator

Gallieni M, De Salvo C, Lunati ME, et al. Continuous glucose monitoring in patients with type 2 diabetes on hemodialysis. *Acta Diabetol.* 2021 Aug; 58(8): 975-981. PubMed

Alternative Outcome – Correlation

Wang F, Wang D, Lyu XL, Sun XM, Duan BH. Continuous glucose monitoring in diabetes patients with chronic kidney disease on dialysis: a meta-analysis. Minerva Endocrinol. Dec 3. Online ahead of print.PubMed

Non-Randomized Studies

Mixed Population

Sweeney AT, Pena S, Sandeep J, et al. Use of a continuous glucose monitoring system in high-risk hospitalized noncritically ill patients with diabetes after cardiac surgery and during their transition of care from the intensive care unit during COVID-19: a pilot study. *Endocr Pract.* 2022 Jun; 28(6): 615-621. PubMed

Alternative Comparator – Samples Taken Less Than 4 Weeks Apart

Perlman JE, Gooley TA, McNulty B, Meyers J, Hirsch IB. HbA1c and glucose management indicator discordance: a real-world analysis. *Diabetes Technol Ther.* 2021 Apr; 23(4): 253-258. PubMed

Unclear Comparator

Hu K, Peng H, Ma Y, et al. Analysis of glycemic improvement in hemodialysis patients based on time in range, assessed by flash glucose monitoring. *Blood Purif.* 2021; 50(6): 883-890. PubMed

Review Articles

Bomholt T, Kofod D, Norgaard K, Rossing P, Feldt-Rasmussen B, Hornum M. Can the Use of continuous glucose monitoring improve glycemic control in patients with type 1 and 2 diabetes receiving dialysis? Nephron. 2022 Jul 13; 1-6. PubMed

Lamine F, Pruijm M, Bahon V, Zanchi A. What nephrologists should know about the use of continuous glucose monitoring in type 2 diabetes mellitus patients on chronic hemodialysis. Kidney Dial. 2022; 2(3): 459–473. https://www.mdpi.com/2673-8236/2/3/42 Accessed 2022 Aug 29.

Ling J, Ng JKC, Chan JCN, Chow E. Use of continuous glucose monitoring in the assessment and management of patients with diabetes and chronic kidney disease. *Front Endocrinol (Lausanne)*. 2022 Apr 22; 13: 869899. PubMed

Bomholt T, Adrian T, Norgaard K, et al. The use of HbA1c, glycated albumin and continuous glucose monitoring to assess glucose control in the chronic kidney disease population including dialysis. *Nephron.* 2021; 145(1): 14-19. PubMed