

Optimising glycaemic control in type 1 diabetes

Voting on published recommendations – Key Question 5: glucose metrics

ROUND 1: RESPONSES

Group members were asked to vote on the acceptability and implementability within NHS Scotland of 9 recommendations published in evidence-based guidelines on the topic of metrics used in glucose monitoring for people with type 1 diabetes. The threshold of 70% of respondents indicating acceptance was established a priori as the definition of formal consensus. Results are summarised in the table below. Further details about adaptations and actions are included in the accompanying report.

Recommendation	Acceptable (%)		Implementable (%)			Action
	Yes	No	Yes	Yes, with adaptation	No	
1	100.00%	0.00%	94.12%	5.88%	0.00%	Include
2	100.00%	0.00%	88.24%	11.76%	0.00%	Include
3	94.12%	5.88%	93.75%	6.25%	0.00%	Include
4	100.00%	0.00%	64.71%	35.29%	0.00%	Include
5	100.00%	0.00%	58.82%	41.18%	0.00%	Include
6	94.12%	5.88%	75.00%	25.00%	0.00%	Include
7	82.35%	17.65%	92.86%	7.14%	0.00%	Include
8	100.00%	0.00%	82.35%	17.65%	0.00%	Include
9	94.12%	5.88%	62.50%	37.50%	0.00%	Include

The following responses, potential adaptations and comments were returned.

Recommendation 1

Recommendation: Measure HbA1c levels every 3 to 6 months in adults with type 1 diabetes. [STRONG RECOMMENDATION]

Source guideline: National Institute for Health and Care Excellence (NICE). NG17 - Type 1 diabetes in adults: diagnosis and management (recommendation 1.6.1, page 17) (<https://www.nice.org.uk/guidance/ng17/resources/type-1-diabetes-in-adults-diagnosis-and-management-pdf-1837276469701>)

Country and date of publication: UK, 2015 (no updates warranted in 2019 surveillance)

Guideline quality rating: Rigour of development 98%, Editorial independence 100%, Stakeholder involvement 98%

Of 17 respondents:

17 voted this recommendation as acceptable (100%)

0 voted this recommendation as unacceptable (0%)

16 voted this recommendation as implementable (94.12%)

1 voted this recommendation as implementable with adaptations (5.88%)

0 voted this recommendation as not implementable (0%)

17 out of 17 (100%) respondents voted that this recommendation was acceptable so consensus has been reached. This recommendation will be included in the draft guideline. The glucose metrics subgroup will discuss the context in Scotland and any supporting information which may help with implementation.

Respondents' suggested adaptations and other comments are detailed in table 1:

Table 1: suggested adaptations and responses to recommendation 1

Respondent	Response and comments
6	ADAPTATION - The utility of and optimal frequency of measuring HbA1c should be reassessed in light of alternative measures of glycaemic control that are now available e.g. time in range, glucose variability. If the evidence base for alternative measures is strong enough, then we should consider tailoring this recommendation to take into account of the presence or absence of CGM/Flash monitoring.
3	COMMENT - May not be so relevant with the ability to use TIR.
4	COMMENT - The recommendation is reasonable but as more people use CGM then arguably annual HbA1c would be sufficient for many.
9	COMMENT - This would be in line with NICE guidance, only query is how feasible/realistic is it to offer HbA1c every 3 months - do clinics have capacity for this?
10	COMMENT - Consider whether use of technology negates the need to check HbA1c so frequently.
13	COMMENT - While HbA1c is the most recognised measure of an individual's glycaemic control and the basis for most outcome studies, there can be no doubt that Time in Range is more intuitive and widely accepted by people with type 1 diabetes. I feel strongly that this should be incorporated - with targets in any record of glycaemic control. Glycaemic variability is less well understood and there are a number of measures if this which adds to the confusion.
16	COMMENT - From a quality assured measuring device

Recommendation 2

Recommendation: Agree an individualised HbA1c target with each adult with type 1 diabetes. Take into account factors such as their daily activities, aspirations, likelihood of complications, comorbidities, occupation and history of hypoglycaemia.
[STRONG RECOMMENDATION]

Source guideline: National Institute for Health and Care Excellence (NICE). NG17 - Type 1 diabetes in adults: diagnosis and management (recommendation 1.6.7, page 18)
(<https://www.nice.org.uk/guidance/ng17/resources/type-1-diabetes-in-adults-diagnosis-and-management-pdf-1837276469701>)

Country and date of publication: UK, 2015 (no updates warranted in 2019 surveillance)

Guideline quality rating: Rigour of development 98%, Editorial independence 100%, Stakeholder involvement 98%

Of 17 respondents:

17 voted this recommendation as acceptable (100%)

0 voted this recommendation as unacceptable (0%)

15 voted this recommendation as implementable (88.24%)

2 voted this recommendation as implementable with adaptations (11.76%)

0 voted this recommendation as not implementable (0%)

17 out of 17 (100%) respondents voted that this recommendation was acceptable so consensus has been reached. This recommendation will be included in the draft guideline. The glucose metrics subgroup will discuss the context in Scotland and any supporting information which may help with implementation.

Respondents' suggested adaptations and other comments are detailed in table 2:

Table 2: suggested adaptations and responses to recommendation 2

Respondent	Response and comments
6	ADAPTATION - An individualised target will be appropriate for some. However, it would be desirable to have a nationally agreed HbA1c target that is applicable to the majority. It would also be desirable to agree on national targets for alternative measures of glycaemic control if the evidence base is deemed sufficient to use these as an alternative to HbA1c.
8	ADAPTATION - To fit the time available in consultations, give the priorities of the person with diabetes.
4	COMMENT - Individualised but should be <53 unless there is a clinical reason for a higher level.
9	COMMENT - Important to keep HbA1c target individualised
13	COMMENT - Yes but this approach is very limited and does not deal with the elderly and/ or those with co-morbidities. We need to provide more

	concrete examples for primary care. At the moment NICE refer only to lower targets in those who are younger but the American Geriatrics Society/ ADA for instance now clearly recommend a higher HbA1c target in the elderly. The American Geriatrics Society recommends a goal A1c of 7.5-8% in older patients with moderate comorbidities and life expectancy less than 10 years; the American Diabetes Association recommends a more relaxed goal of 8-8.5% for older patients with complex medical issues.
16	COMMENT - Consider goals setting tools within SCI-diabetes.

Recommendation 3

Recommendation: Ensure that aiming for an HbA1c target is not accompanied by problematic hypoglycaemia in adults with type 1 diabetes.
[STRONG RECOMMENDATION]

Source guideline: National Institute for Health and Care Excellence (NICE). NG17 - Type 1 diabetes in adults: diagnosis and management (recommendation 1.6.8, page 18)
(<https://www.nice.org.uk/guidance/ng17/resources/type-1-diabetes-in-adults-diagnosis-and-management-pdf-1837276469701>)

Country and date of publication: UK, 2015 (no updates warranted in 2019 surveillance)

Guideline quality rating: Rigour of development 98%, Editorial independence 100%, Stakeholder involvement 98%

Of 17 respondents:

16 voted this recommendation as acceptable (94.12%)

1 voted this recommendation as unacceptable (5.88%)

Of the 16 respondents who voted the recommendation as acceptable:

15 voted this recommendation as implementable (93.75%)

1 voted this recommendation as implementable with adaptations (6.25%)

0 voted this recommendation as not implementable (0%)

16 out of 17 (94.12%) respondents voted that this recommendation was acceptable so consensus has been reached. This recommendation will be included in the draft guideline. The glucose metrics subgroup will discuss the context in Scotland and any supporting information which may help with implementation.

Respondents' suggested adaptations and other comments are detailed in table 3:

Table 3: suggested adaptations and responses to recommendation 3

Respondent	Response and comments
3	ADAPTATION - To achieve this aspiration there should be an increase in the availability of HCL.
4	COMMENT - Fairly self-evident statement

8	COMMENT - Would have thought the wording should be "Attempt to ensure ..."
13	COMMENT - Yes, this approach is incorrect and sends the wrong message. There is now plenty of literature to show that hypoglycaemia frequency can be reduced through educational approaches, novel insulins and technologies without leading to an increase in HbA1c.
16	COMMENT - Recommended Time in range targets details would be useful for Level 1 and Level 2 hypoglycaemia.

Recommendation 4

Recommendation: The AGP may be utilized to assess glycemic status in persons with diabetes. [GRADE B]

Source guideline: Grunberger G, Sherr J, Allende M, Blevins T, Bode B, Handelsman Y, et al. American Association of Clinical Endocrinology Clinical Practice Guideline: The Use of Advanced Technology in the Management of Persons With Diabetes Mellitus. *Endocr Pract.* 2021 Jun;27(6):505-537. (recommendation 2.2.1, page 519)
<https://www.endocrinepractice.org/action/showPdf?pii=S1530-891X%2821%2900165-8>

Country and date of publication: USA, 2021

Guideline quality rating: Rigour of development 92%, Editorial independence 92%, Stakeholder involvement **43%**

Of 17 respondents:

17 voted this recommendation as acceptable (100%)

0 voted this recommendation as unacceptable (0%)

11 voted this recommendation as implementable (64.71%)

6 voted this recommendation as implementable with adaptations (35.29%)

0 voted this recommendation as not implementable (0%)

17 out of 17 (100%) respondents voted that this recommendation was acceptable so consensus has been reached. This recommendation will be included in the draft guideline. The glucose metrics subgroup will discuss the context in Scotland and any supporting information which may help with implementation.

Respondents' suggested adaptations and other comments are detailed in table 4:

Table 4: suggested adaptations and responses to recommendation 4

Respondent	Response and comments
5	ADAPTATION - Utilised in conjunction with other tools to assess status
6	ADAPTATION - I think we should aim to be more definitive in the use of AGP. Rather than saying it "may be utilised", it would be preferable to recommend that it "should be utilised" (if available, and if the evidence

	base is good enough), and to agree national targets for AGP, TIR, variability etc.
9	ADAPTATION - Using time in range together with HbA1c can be an effective way for your healthcare team to review your diabetes care to help you reduce your risk of long-term health problems - delighted SIGN considering additions to HbA1c to measure glucose.
10	ADAPTATION - Define what AGP is in a UK and Scotland context and in line with the available technology for consistency.
12	ADAPTATION - Should be more specific around diabetes - T1
19	ADAPTATION - Change mg to mmols
4	COMMENT - AGP is one tool to use in those on CGM (and is supplied with all current device platforms)
8	COMMENT - Subject to appropriate training/expertise
13	COMMENT - This is the current reality of practice. The widespread use of either iCGM or real time CGM mean that AGP metrics dominate clinical conversations. They are intuitive and widely accepted by people with type 1 diabetes.
15	COMMENT - need increased access to FGM & CGM

Recommendation 5

Recommendation: When using the AGP, a systematic approach to interpret CGM data is recommended:

1. Review overall glycemic status (eg, GMI, average glucose)
2. Check TBR, TIR, and TAR statistics, focusing on hypoglycaemia (TBR) first. If the TBR statistics are above the cut-point for the clinical scenario (ie, for most with T1D >4% <70 mg/dL; >1% <54 mg/dL), the visit should focus on this issue.

Otherwise, move on to the TIR and TAR statistics.

If the TBR statistics are above the cut-point for the clinical scenario (ie, for most with T1D >4% <70 mg/dL; >1% <54 mg/dL), the visit should focus on this issue. Otherwise, move on to the TIR and TAR statistics.

3. Review the 24-hour glucose profile to identify the time(s) and magnitude(s) of the problem identified.

4. Review treatment regimen and adjust as needed.

[GRADE B]

Source guideline: Grunberger G, Sherr J, Allende M, Blevins T, Bode B, Handelsman Y, et al. American Association of Clinical Endocrinology Clinical Practice Guideline: The Use of Advanced Technology in the Management of Persons With Diabetes Mellitus. *Endocr Pract.* 2021 Jun;27(6):505-537. (recommendation 2.2.2, page 519)

(<https://www.endocrinepractice.org/action/showPdf?pii=S1530-891X%2821%2900165-8>)

Country and date of publication: USA, 2021

Guideline quality rating: Rigour of development 92%, Editorial independence 92%, Stakeholder involvement **43%**

Of 17 respondents:

17 voted this recommendation as acceptable (100%)

0 voted this recommendation as unacceptable (0%)

10 voted this recommendation as implementable (58.82%)

7 voted this recommendation as implementable with adaptations (41.18%)

0 voted this recommendation as not implementable (0%)

17 out of 17 (100%) respondents voted that this recommendation was acceptable so consensus has been reached. This recommendation will be included in the draft guideline. The glucose metrics subgroup will discuss the context in Scotland and any supporting information which may help with implementation.

Respondents' suggested adaptations and other comments are detailed in table 5:

Table 5: suggested adaptations and responses to recommendation 5

Respondent	Response and comments
5	ADAPTATION - The visit should focus on any presenting difficulties that the patient highlights and, if appropriate, an exploration dialogue between patient and clinicians around issues highlighted in AGP.
6	ADAPTATION - GMI to be reported in mmol/mol and TBR/TIR/TAR reported in mmol/l
10	ADAPTATION - Needs to define the terminology in a UK/ Scotland context.
11	ADAPTATION - simple unit conversion
12	ADAPTATION - need to clarify abbreviations and ensure values reflect what we report on.
13	ADAPTATION - There would need to be an educational campaign. TiR, TBR and TAR are well understood, but GMI much less so. Also the evidence to support this is very limited not just because of the lack of any outcome trials (focused on micro- or macrovascular risk) but also because it is not clear yet what hypoglycaemia actually is when using CGM. The correlation between SMBG and CGM detected hypoglycaemia is not strong. The HypoMETRICS trial due to report this year will start to address this. That being said I am supportive of the overall approach.
19	ADAPTATION - Change mg to mmols
7	COMMENT - Point 4 is very doctor centric- shouldn't health professionals work collaboratively with the person with T1D rather than just adjusting their treatment for them. Shouldn't adjustments take account of other factors like life goals, lifestyle and competing priorities?

8	COMMENT - Subject to clinician's agreement as to the value/ need for training/ replacement of US units with UK ones
9	COMMENT - Delighted that TIR and TBR are being considered for inclusion in SIGN guidance
16	COMMENT - customise targets for circumstances... <ul style="list-style-type: none"> • for older people • pregnancy • multiple co-morbidities/ frailty and cognitive impairment
18	COMMENT - While the HbA1c result is useful, the data from AGP provides information that can be used to improve glycaemic control so having a systematic approach to considering this information at clinic will be beneficial.

Recommendation 6

Recommendation: Two metrics, % Time in Range (TIR) and % Time below Range (TBR), should be used as a starting point for the assessment of quality of glycaemic control and as the basis for therapy adjustment, with emphasis on reducing %TBR when the percentages of CGM values falling below 54 mg/dL or 70 mg/dL are close to or exceed targets.
[GRADE B]

Source guideline: Grunberger G, Sherr J, Allende M, Blevins T, Bode B, Handelsman Y, et al. American Association of Clinical Endocrinology Clinical Practice Guideline: The Use of Advanced Technology in the Management of Persons With Diabetes Mellitus. *Endocr Pract.* 2021 Jun;27(6):505-537. (recommendation 1.1.2, page 516-7)
(<https://www.endocrinepractice.org/action/showPdf?pii=S1530-891X%2821%2900165-8>)

Country and date of publication: USA, 2021

Guideline quality rating: Rigour of development 92%, Editorial independence 92%, Stakeholder involvement 43%

Of 17 respondents:

16 voted this recommendation as acceptable (94.12%)

1 voted this recommendation as unacceptable (5.88%)

Of the 16 who voted this recommendation as acceptable:

12 voted this recommendation as implementable (75%)

4 voted this recommendation as implementable with adaptations (25%)

0 voted this recommendation as not implementable (0%)

16 out of 17 (94.12%) respondents voted that this recommendation was acceptable so consensus has been reached. This recommendation will be included in the draft guideline.

The glucose metrics subgroup will discuss the context in Scotland and any supporting information which may help with implementation.

Respondents' suggested adaptations and other comments are detailed in table 6:

Table 6: suggested adaptations and responses to recommendation 6

Respondent	Response and comments
6	ADAPTATION - Use of mmol/l rather than mg/dl
11	ADAPTATION - unit conversion
13	ADAPTATION - The focus should not be just on therapy adjustment but on factors that might be leading to increased TBR, e.g. review of CHO counting, injection timing, exercise etc. As in previous comments the focus cannot be on just insulin dose adjustment
19	ADAPTATION - Change mg to mmols
4	COMMENT - Progress is being made to integrate all these metrics into SCI-D - which will make it easier to track progress here
6	COMMENT - This replicates recommendation 5
8	COMMENT - I'd defer to clinicians' views if my response differs from theirs
12	COMMENT - duplication of recommendation 5
16	COMMENT - as previous answer
18	COMMENT - This is making good use of CGM data. People with T1D can be encouraged to look at the data between clinics and either make adjustments independently or contact the diabetes team for advice.

The following recommendations relate to glucose metrics in children and young people with type 1 diabetes.

Recommendation 7

Recommendation: Measure HbA1c level 4 times a year in children and young people with type 1 diabetes. Think about more frequent testing if they are having difficulty with blood glucose management. [STRONG RECOMMENDATION]

Source guideline: National Institute for Health and Care Excellence (NICE). NG18 - Diabetes (type 1 and type 2) in children and young people.: diagnosis and management (recommendation 1.2.80, page 21)
<https://www.nice.org.uk/guidance/ng18/resources/diabetes-type-1-and-type-2-in-children-and-young-people-diagnosis-and-management-pdf-1837278149317>

Country and date of publication: UK, 2015 (no updates warranted in 2019 surveillance)

Guideline quality rating: Rigour of development 98%, Editorial independence 100%, Stakeholder involvement 98%

Of 17 respondents:

14 voted this recommendation as acceptable (82.35%)

3 voted this recommendation as unacceptable (17.65%)

Of the 14 who voted this recommendation as acceptable:

13 voted this recommendation as implementable (92.86%)

1 voted this recommendation as implementable with adaptations (7.14%)

0 voted this recommendation as not implementable (0%)

14 out of 17 (82.35%) respondents voted that this recommendation was acceptable so consensus has been reached. This recommendation will be included in the draft guideline. The glucose metrics subgroup will discuss the context in Scotland and any supporting information which may help with implementation.

Respondents' suggested adaptations and other comments are detailed in table 7:

Table 7: suggested adaptations and responses to recommendation 7

Respondent	Response and comments
3	ADAPTATION - May be less necessary with the availability of TIR from sensor/HCL technology.
6	COMMENT - Frequency and utility of HbA1c measurement should be reassessed in light of alternative measures of glycaemic control
13	COMMENT - If we are moving to a position where we use ADG more then there is simply no reason to measure HbA1c so frequently. The vast majority of children and young people are on CGM. We need to consider the stress of repeated hospital attendance, repeat blood sampling and HbA1c dominated clinical discussions.
16	COMMENT - not sure why this is required more often than 6 months, when we can get estimated HbA1c from continuous glucose monitoring data.
18	COMMENT - I would like to say that 'having difficulty with blood glucose management' is well worded, rather than words like 'failed to achieve good glucose control'. This is good.
19	COMMENT - Currently due to demands on healthcare in Scotland I am not sure how achievable this is, but this should not stop us from recommending it.

Recommendation 8

Recommendation: Agree an individualised lowest achievable HbA1c target with each child or young person with type 1 diabetes and their families or carers. Take into account factors such as their daily activities, individual life goals, complications, comorbidities and the risk of hypoglycaemia. [STRONG RECOMMENDATION]

Source guideline: National Institute for Health and Care Excellence (NICE). NG18 - Diabetes (type 1 and type 2) in children and young people: diagnosis and management (recommendation 1.2.78, page 21)
<https://www.nice.org.uk/guidance/ng18/resources/diabetes-type-1-and-type-2-in-children-and-young-people-diagnosis-and-management-pdf-1837278149317>

Country and date of publication: UK, 2015 (no updates warranted in 2019 surveillance)

Guideline quality rating: Rigour of development 98%, Editorial independence 100%, Stakeholder involvement 98%

Of 17 respondents:

17 voted this recommendation as acceptable (100%)

0 voted this recommendation as unacceptable (0%)

14 voted this recommendation as implementable (82.35%)

3 voted this recommendation as implementable with adaptations (17.65%)

0 voted this recommendation as not implementable (0%)

17 out of 17 (100%) respondents voted that this recommendation was acceptable so consensus has been reached. This recommendation will be included in the draft guideline. The glucose metrics subgroup will discuss the context in Scotland and any supporting information which may help with implementation.

Respondents' suggested adaptations and other comments are detailed in table 8:

Table 8: suggested adaptations and responses to recommendation 8

Respondent	Response and comments
3	ADAPTATION - Increase availability of HCL
6	ADAPTATION - If using alternative measures of glycaemic control (e.g. TBR/TIR/TAR), then recommendation should include these metrics as an alternative to HbA1c
14	ADAPTATION - This is only achievable with technology for AGP/pumps so you can really review data. Can we add a comment re use of these technologies to achieve a targeted goal?
8	COMMENT - Presumably target may need reviewing at least annually - not clear how frequently this is recommended
18	COMMENT - This is well worded, 'individualised lowest achievable'.

Recommendation 9

Recommendation: Continuous glucose monitoring metrics derived from continuous glucose monitor use over the most recent 14 days (or longer for patients with more glycaemic variability), including time in range (70–180 mg/dL), time below target (<70 and <54 mg/dL), and time above target (>180 mg/dL)], are recommended to be used in conjunction with A1C whenever possible. [EXPERT OPINION]

Source guideline: Draznin B, Aroda VR, Bakris G, Benson G, Brown FM, Freeman R, et al. American Diabetes Association Professional Practice Committee; 14. Children and Adolescents: Standards of Medical Care in Diabetes-2022. *Diabetes Care*. 2022 Jan 1;45(Supplement_1):S208-31. (recommendation 14.27, page s214) (https://diabetesjournals.org/care/article/45/Supplement_1/S208/138922/14-Children-and-Adolescents-Standards-of-Medical)

Country and date of publication: USA, 2022

Guideline quality rating: Rigour of development 79%, Editorial independence 92%, Stakeholder involvement **55%**

Of 17 respondents:

16 voted this recommendation as acceptable (94.12%)

1 voted this recommendation as unacceptable (5.88%)

Of the 16 who voted this recommendation as acceptable:

10 voted this recommendation as implementable (62.50%)

6 voted this recommendation as implementable with adaptations (37.50%)

0 voted this recommendation as not implementable (0%)

16 out of 17 (94.12%) respondents voted that this recommendation was acceptable so consensus has been reached. This recommendation will be included in the draft guideline. The glucose metrics subgroup will discuss the context in Scotland and any supporting information which may help with implementation.

Respondents' suggested adaptations and other comments are detailed in table 9:

Table 9: suggested adaptations and responses to recommendation 9

Respondent	Response and comments
6	ADAPTATION - Use of mmol/l rather mg/dl
8	ADAPTATION - Only relevant to people with access to CGM. US units need changing to UK units.
11	ADAPTATION - unit conversion
12	ADAPTATION - ensure values consistent with those reported
15	ADAPTATION - more funding would be needed
19	ADAPTATION - Change mg to mmols

9	COMMENT - as per previous comment using time in range together with HbA1c can be an effective way for HCPs to review diabetes care
14	COMMENT - This is sort of what I said in my previous response. I think this helps us to set achievable goals. So used in conjunction to help set achievable targets
16	COMMENT - as per previous unless there is a reason to suspect discrepancy , not sure the point of doing too many HbA1cs, 2 readings / year would suffice