Change of HbA_{1c} reporting to the new SI units

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ABSTRACT

- An international consensus statement recommends that dual reporting of haemoglobin A_{1c} (HbA_{1c}) levels — in the current units (percentage) and Système International (SI) units (mmol/mol) — be used as an interim measure for a 2-year transition period before progressing towards the use of SI units only.
- This recommendation is supported by the Australasian Association of Clinical Biochemists, the Australian Diabetes Educators Association, the Australian Diabetes Society and the Royal College of Pathologists of Australasia.
- The SI units are a true measure of HbA_{1c} and remove potential confusion between HbA_{1c} values and blood glucose values.

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Haemoglobin A_{1c} (HbA_{1c} — a term that is sometimes used interchangeably with "glycated haemoglobin") measurements are an indicator of time-averaged blood glucose levels (previous 2–3 months), and are used as the best marker of long-term diabetes control. A recent consensus statement on the worldwide standardisation of HbA_{1c} measurement[1] has updated previous international recommendations on the standardisation of HbA_{1c} measurement and reporting.[2] Here, we provide the rationale and guidance for implementation of HbA_{1c} reporting in the new Système International (SI) units in Australia. This article represents the views of the Australasian Association of Clinical Biochemists, the Australian Diabetes Educators Association, the Australian Diabetes Society and the Royal College of Pathologists of Australasia, and was prepared by a working party of representatives of these organisations.

The International HbA_{1c} Consensus Committee recommends that all HbA_{1c} levels be reported in SI units (mmol/mol, no decimal places) — with results directly traceable to the International Federation of Clinical Chemistry and Laboratory Medicine (IFCC) reference method — and in the currently used, National Glycohemoglobin Standardization Program (NGSP) units (percentage, one decimal place). We recommend that dual reporting in Australia begins in July 2011, and that reporting of percentages ceases 2 years later. In New Zealand, dual reporting commenced in August 2009.

The key reasons for implementing this recommendation in Australia are that:

- the SI units relate to a scientifically valid measure of HbA_{1c};
- the SI units remove potential confusion between HbA_{1c} values as a percentage and blood glucose values in mmol/L;
- the change is in keeping with the international consensus statement;[1] and
- the change has already been initiated in New Zealand and a number of countries in the European Union.

Until now, all HbA_{1c} measurements performed in Australia have been reported as percentages (HbA_{1c} as a percentage of total haemoglobin) that are aligned with those produced in the Diabetes Control and Complications Trial.[3] These units and this standardisation have been promoted by the NGSP in the United States, and the activities of this organisation have produced marked improvement in the accuracy of HbA_{1c} results worldwide. More recently, the IFCC has developed a reference method that is more specific for HbA_{1c} and more analytically robust.[4] The IFCC method is now used as the reference system by the NGSP and for all routine methods for measurement of HbA_{1c}, although a numerical conversion is required during the calibration process. The changes recommended here will provide results that are directly aligned with the IFCC method. As the IFCC method is more specific for HbA_{1c}, not measuring several other haemoglobin–sugar complexes, the results are 10% to 40% lower than those from the NGSP system, depending on HbA_{1c} concentration. Because reporting these results as percentages may lead to confusion (eg, producing a result of 5.3% rather than 7.0%), the units are changed to mmol/mol (millimoles HbA_{1c} per mole of total haemoglobin [53 mmol/mol in the previous example]), which is consistent with the SI units recommended for use in Australia.

There is a linear relationship between results from the two methods, and the "master equation" is used to convert results between the two methods: HbA_{1c} SI unit (mmol/mol) = 10.93 × HbA_{1c} NGSP unit (%) – 23.50.[5]

To make the conversion easier for clinicians, it is important to translate current treatment advice to the new units. A general conversion table for clinical use is provided in Box 1. The general HbA_{1c} target of ⩽ 7.0% for patients with type 1 and type 2 diabetes mellitus equates to ⩽ 53 mmol/mol, although these values need to be individualised for patients. The recently updated diabetes treatment guidelines are shown with SI units in Box 2 and Box 3,[6] and recommendations for reporting HbA_{1c} levels in Australia are summarised in Box 4. In addition, supporting material for doctors and patients will be presented in SI units in the future.

The routine reporting of an estimated average glucose (eAG) value may be useful for consultations with individual patients. However, the working party strongly agrees with the revised consensus statement that routine reporting of eAG with all requests for HbA_{1c} analysis is not appropriate.[1] The reasons for this include variability in the methods used to measure eAG, the risk of confusing a measure of long-term glycaemia (eAG) with a measure of short-term blood glucose control (actual blood glucose level), and its lack of applicability in the majority of patients with type 2 diabetes (in whom blood glucose levels are not measured at frequent intervals).[7] Nonetheless, eAG values will be used as an educa-

1 Conversion table for haemoglobin A_{1c} (HbA_{1c}) values

HbA_{1c} as percentage (old units)	HbA_{1c} in mmol/mol (new units)
5.0	31
6.0	42
6.5	48
7.0	53
8.0	64
9.0	75
10.0	86
11.0	97
12.0	108

2 Recommended haemoglobin A_{1c} (HbA_{1c}) target ranges for patients with type 1 diabetes[6]

	HbA_{1c} target
General target	⩽ 53 mmol/mol, ⩽ 7.0%*
Specific clinical situations	
Pregnancy or planning pregnancy	⩽ 53 mmol/mol, ⩽ 7.0%*†
Children and adolescents	⩽ 58 mmol/mol, ⩽ 7.5%*
Recurrent severe hypoglycaemia or hypoglycaemia unawareness	⩽ 64 mmol/mol, ⩽ 8.0%
Patients with major comorbidities likely to limit life expectancy	Symptomatic therapy of hyperglycaemia‡ and avoidance of ketosis

* Achievement of HbA_{1c} targets must be balanced against risk of severe hypoglycaemia. † An HbA_{1c} level of ⩽ 42 mmol/mol (⩽ 6.0%) is desirable if it can be achieved safely. ‡ Where practical, suggest blood glucose target level < 15 mmol/L to help minimise risk of infection. ◆

3 Recommended haemoglobin A_{1c} (HbA_{1c}) target ranges for patients with type 2 diabetes[6]

	HbA_{1c} target
General target	⩽ 53 mmol/mol, ⩽ 7.0%*
Specific clinical situations	
Diabetes of short duration† and no clinical cardiovascular disease	
Requiring lifestyle modification ± metformin	⩽ 42 mmol/mol, ⩽ 6.0%*
Requiring any antidiabetic agents other than metformin or insulin	⩽ 48 mmol/mol, ⩽ 6.5%*
Requiring insulin	⩽ 53 mmol/mol, ⩽ 7.0%*
Pregnancy or planning pregnancy	⩽ 42 mmol/mol, ⩽ 6.0%*
Children and adolescents	⩽ 53 mmol/mol, ⩽ 7.0%*
Diabetes of longer duration† or clinical cardiovascular disease (any therapy)	⩽ 53 mmol/mol, ⩽ 7.0%*
Recurrent severe hypoglycaemia or hypoglycaemia unawareness (any therapy)	⩽ 64 mmol/mol, ⩽ 8.0%
Patients with major comorbidities likely to limit life expectancy‡ (any therapy)	Symptomatic therapy of hyperglycaemia§

* Achievement of HbA_{1c} targets must be balanced against risk of severe hypoglycaemia, especially among older people. † In an older adult, long duration might be considered to be > 10–20 years, but for a person who develops type 2 diabetes at a young age, it might be considerably longer. ‡ Examples of major comorbidities include chronic medical conditions, such as chronic kidney disease stages 4 or 5; heart failure stages III or IV (New York Heart Association grading); incurable malignancy; and moderate to severe dementia. § Where practical, suggest blood glucose target level < 15 mmol/L to help minimise risk of infection. ◆

4 Recommendations for reporting haemoglobin A_{1c} (HbA_{1c}) levels in Australia

- From July 2011, HbA_{1c} levels should be reported in both National Glycohemoglobin Standardization Program units (percentage) and the Système International (SI) units (mmol/mol) by all pathology laboratories and, where possible, from point-of-care devices.
- The period of dual reporting will be 2 years, after which only the SI units will be used.
- These recommendations are consistent with international tional tool at the discretion of individual clinicians, who can assist patients to understand the significance and limitations of the result.

Competing interests

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