Glycohemoglobin A1C and the Estimated Average Glucose Simplified with WAM™!

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What is Glycosylated Hemoglobin or Hemoglobin A1C?

• The A1c is a blood test, done in a lab that shows what your average blood sugar has been for the past 3 to 4 months.

• Other names for this test are:
  – glycosylated hemoglobin
  – glycohemoglobin
  – hemoglobin A1c
  – HbA1c
When is Glycohemoglobin A1C testing performed

• Glycohemoglobin A1C testing is generally performed on patients with a history of diabetes who are performing daily monitoring of their blood glucose levels.

• Testing is not limited to diabetes monitoring, it is also performed on those keeping an eye on their general health.

• It is also used for screening for diabetes.

• Glycohemoglobin A1C testing is usually performed every 2 months for the monitoring of diabetes.

• For those patients that have good control of their blood glucose, testing may be performed every 3-4 months, since this is the span of a RBC is 120 days.
Why is glycohemoglobin A1C testing performed?

- Glycohemoglobin is a blood test that checks the amount of glucose bound to hemoglobin in the Red Blood Cell.
- Normally, only a small percentage of hemoglobin in the blood (4% to 6%) has glucose bound to it.
- People who have diabetes or other conditions that increase their blood glucose levels have more glycohemoglobin than normal.
- The glycohemoglobin A1c can be used to diagnose diabetes.
- The glycohemoglobin A1c test checks the long-term control of blood glucose levels in people with diabetes. Most doctors think the glycohemoglobin A1c level is the best way to check how well a person is controlling his or her diabetes.
How is the body affected by elevated Glycohemoglobin A1C levels?

- Research shows that keeping blood sugar levels close to normal can greatly reduce the chance of problems related to diabetes.
- Studies show that any decrease in A1C will help to decrease and prevent the long term problems from diabetes.
- By keeping the A1C below 7%, the risk for the following problems is greatly reduced.
  - Retinopathy (eye damage).
  - Nephropathy (kidney disease).
  - Neuropathy (nerve problems).
  - Cardiovascular disorders (heart disease and stroke)
- Stabilizing the Hemoglobin A1C levels will help to keep one in better health!
Measuring Hemoglobin A1C

• The glucose that the body doesn’t store or use for energy stays in the blood and attaches to red blood cells which live in the bloodstream for about 4 months.

• The glycohemoglobin A1C measures the amount of glucose attached to the red blood cells over the last 3 to 4 months. It is not affected by recent change in diet, exercise or medicine.

• Home blood glucose tests measures the level of blood glucose only at that moment. Blood glucose levels change during the day because of diet, exercise, and the level of insulin in the blood.

• Blood glucose levels may not truly reflect the daily blood glucose level.

• Since the A1C is a stable measurement, it shows the physician how well the patient is managing their diabetes.
How does the Estimated Average Glucose (eAG) fit in?

- Glycohemoglobin levels are measured as a percentage of total hemoglobin. The average person has between 4-6% glycosylated hemoglobin.

- The American Diabetes Association (ADA) is recommending the use of a new term in diabetes management, estimated average glucose, or eAG.

- The relationship between A1C and eAG is described by the formula  
  \[ \text{eAG} = (28.7 \times \text{A1C}) - 46.7 \]

- Health care providers can now report A1C results to patients using the same units (mg/dl) that patients see routinely in blood glucose measurements.

- The eAG allows patients and physicians to correlate their A1C values with their daily blood glucose values and gives them a better understanding of the A1C value.
WAM’s Role in Reporting Glycohemoglobin A1Cs and Estimated Average Glucose (eAG)

- There are a number of ways that HbA1c can be measured,
  - Immunoassay
  - Enzymatic
  - Capillary electrophoresis
  - Point of care technologies
  - HPLC (high performance liquid chromatography) which continues to be the leading technology

- HbA1c uses EDTA samples, these tubes can go on an automated hematology line to simplify and minimize tube handling and to allow walk away testing.

- We use the BioRad VARIANT™II TURBO Link for HbA1c which is compatible with the Sysmex HST line.

- With the combination of the Bio-Rad, HST line and WAM ™ the majority of the HbA1C s and eAGs are being auto-validated resulting in immediate reporting and better TAT for Dynacare Laboratories.
Reporting and using WAM

- WAM™ middleware allows you to create your own rules so that you can simplify and standardize the review and reporting of your results.

- WAM™ allows you to autoverify, removing the need to review normal results before reporting them.

- WAM™ auto calculates the eAG so that you don’t have to use a conversion wheel, table or perform a manual calculation.

- The A1C value is given as a percentage, The American Diabetes Association (ADA) feels that it may be more helpful to translate this A1C value into an average glucose value (eAG), Sysmex and WAM™ have made this possible for us.
## Estimated Average Glucose/ Hemoglobin A1C in WAM™

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- **4.0% to 4.6% A+ (Excellent)**
- **4.7% to 4.9% A (Excellent)**
- **5.0% to 5.2% B (O.K.)**
- **5.3% to 5.4% C (Bad)**
- **5.5% to 5.9% C- (Bad)**
- **6.0% to 6.4% D (Very Bad)**
- **6.5% to 6.9% D- (Very Bad)**
- **7.0% or more F (Failure)**

### Result Status

- Pending
- To be Validated
- Validated/No LIS
Glycohemoglobin A1C and Estimated Average Glucose in our LIS
If you don’t use WAM™ you can use a A1C/eAG Conversion Chart

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Estimated Average Glucose (eAG) Simplified with WAM™

- The new WAM™ software allows the laboratory to calculate and report the Estimated Average Glucose (eAG) along with all Hemoglobin A1C (Glycohemoglobin) testing.

- These values are autoverified in almost all testing which is a time saver.

- The eAG is a calculated result based on the actual Hemoglobin A1C level. The units of measure for eAG are reported in mg/dL.

- The American Diabetes Association (ADA) introduced the Estimated Average Glucose (eAG) to translate the Hemoglobin A1C test results into numbers that more closely represent the daily blood glucose meter readings.

- The eAG translates the A1C, long term glycemic indicator, into a daily average blood glucose value. This will assist patients and clinicians in the monitoring of Diabetes.
Implementing the Estimated Average Glucose (eAG)

- Implementing the eAG was rather simple on our end.
- We filled out a SYSMEX WAM™ REQUEST FORM
- This Request Form is used to document Sysmex WAM™ requests from the customer.
  - Sysmex WAM Rules changes
  - Software enhancement requests
  - Miscellaneous change requests
- Sysmex processed this request and developed the calculation in WAM.
- Our IT department prepared our Laboratory Information System for the eAG while Sysmex was developing the calculation on their end.
- It was completed rather quickly and was available when we upgraded to WAM 4.1.1
- We implemented the calculation when we went live 9/15/13 with out any troubles and are very happy with it. This has allowed us to provide the physicians and patients with information that is more helpful for both diagnosing and monitoring diabetes, without creating any extra effort on our part.