LET THE INDICES DIRECT YOU

My hemoglobin and hematocrit (H&H) don’t match, what should I do? It really depends on the indices. For example, if the mean corpuscular volume (MCV) and mean corpuscular hemoglobin concentration (MCHC) are both decreased, it is likely due to a microcytic, hypochromic anemia, in which case you would document that you are unable to match the H&H and follow your laboratory’s guidelines for viewing the peripheral smear. Another scenario could be where the MCV is decreased while the MCHC is in the normal range. Here you would want to consider whether the patient may have a hemoglobinopathy, in which case you would want to view the peripheral smear assessing the RBC morphology.

You might encounter a situation where the MCV is normal or high accompanied by a low MCHC. Here you should consider one of several things. For example, the patient could have a high sodium, a high glucose\(^1\) or a WBC greater than 100 x 10\(^3\)/uL. To ensure an accurate test result, you would perform a 1:5 dilution using the same diluent that is used by your analyzer or using normal saline. Let the dilution equilibrate at room temperature for 10 minutes then run the assay in the manual mode\(^2\). Multiply the Hgb result you by 5, to determine the corrected Hgb. Check your dilution accuracy by multiplying the RBC on the diluted sample by 5 and then compare this result to the original RBC count. The diluted count should match within 0.10 x 10\(^6\)/uL of the original count. For example, if the original RBC is 5 x 10\(^6\)/uL, the count on your dilution should be between 4.9 and 5.1 x 10\(^6\)/uL. Take the original RBC and HCT results and the corrected Hgb and correct the mean corpuscular hemoglobin (MCH) and MCHC using the following formulas:

\(^1\)sometimes on the Sysmex analyzer some of the parameters will --- out when a patient has a high glucose

\(^2\)When using a Sysmex analyzer DO NOT run in Capillary Mode, Suspect flags will not show up when run in Capillary Mode
MCH = corrected Hgb /original RBC x 10  

MCHC = corrected Hgb/original HCT x 100

Where the MCV is normal or high with a low MCHC and the Sodium, Glucose or WBC are not high, check the age of the sample and have it recollected where necessary.

You could encounter an increased MCHC. Check the specimen for RBC agglutinins that may be visible to the naked eye. Confirm the existence of agglutinins by making a peripheral smear staining it according to your laboratory’s procedures. If the specimen contains RBC agglutinins, the RBC and HCT will be falsely decreased while Hgb, MCH, MCV and MCHC will be falsely increased. Where this occurs, warm the specimen at 37°C for 15-30 minutes, mix by inversion 10 times, and re-analyze the warmed sample. The results obtained may be reported so long as the H&H match. Make a smear from the warmed specimen in order to accurately grade RBC morphology and perform WBC and PLT estimates. Be sure to grade the RBC agglutinins from the original peripheral smear. It may be necessary to perform a warmed plasma replacement by warming the diluent at 37°C for 15 minutes. Spin an aliquot of the patient specimen down and replace the plasma with the warmed diluent. Be careful not to disturb the WBC and PLT layers (buffy coat) marking the areas where you are going to remove the plasma, with a permanent marker or grease pencil. Add the diluent to the upper line (plasma to air barrier), cap the tube, mix by inversion until well mixed and warm this mixture 15 minutes at 37°C. Mix by inversion 10 times then re-analyze. This result may be reported providing the H&H matches.

In the event that a warm reacting antibody is the cause for the RBC agglutinin, you will need to perform a room temperature plasma replacement as warming the sample will cause agglutination. In this case you will need to substitute a room

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3 In my experience, an MCHC > 37 g/dL may be abnormal. Check your laboratory ranges as the H&H may not match when the MCHC is above 37 g/dL.

4 The marks should be between where the cells separate from the plasma and the plasma separates from the air.
temperature plasma replacement for the warmed plasma replacement. Results may be reported out, again being conscious that the H&H match. If the H&H still does not match and the indicies are still high, result out the WBC and PLT from the original run, along with a microhematocrit (spun HCT). Put a comment in the result fields, that you were unable to determine, stating unable to determine due to the presence of RBC agglutinins.

When the MCHC is >37 g/dL and the specimen does not appear to be agglutinated, perform a spun HCT. Look for an icteric, lipemic and/or hemolyzed plasma. If specimen is hemolyzed, have it recollected. If the recollected specimen is hemolyzed, consider whether or not the hemolysis is occurring in vivo, in which case you would need to run a plasma blank performed by running the plasma through the analyzer to obtain a plasma Hgb, then calculating a Cellular Hgb according to the following equation:

\[
\text{Cellular Hgb} = \text{Total Hgb} - [(1 - \text{HCT}/100) \times \text{Plasma Hgb}] 
\]

Use the original Hgb as the total Hgb and the original HCT as the HCT in the formula. Recalculate the indices (MCH and MCHC) using the cellular Hgb value you obtained.

Where the specimen is not hemolyzed but it is icteric or lipemic, perform a plasma replacement or perform a 1:5 dilution of the specimen in order to obtain an accurate Hgb. Recalculate the Hgb, MCH and MCHC, using the original, i.e., the initial test result, RBC and HCT. Should the patient have an abnormal osmolality, you would also perform a spun HCT and correct the MCV along with the MCHC. To correct the MCV use the following equation:

\[
\text{MCV} = \text{spun HCT}/\text{RBC} \times 10
\]

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5 Run the room temperature plasma replacement immediately after substituting the plasma with the diluent.

6 Make certain that the reported result notes which of the two techniques was used (warmed or room temperature) prior to releasing that result(s).
In contrast to before, where the patient’s Sodium is low, perform a 1:5 dilution, analyze, and recalculate the Hgb, MCH and MCHC. You may need to use the spun HCT here as well in which case you would need to correct the MCV also.

Where the patient’s Sodium is normal and the specimen is not lipemic, icteric, or hemolyzed, consider hereditary spherocytosis or severe poikilocytosis the confirmation of which would necessitate viewing the peripheral smear for RBC morphology.

Finally, another cause of a falsely increased Hgb or decreased HCT could be the presence of abnormal plasma proteins, in which case you would perform a plasma replacement according to the procedure outlined earlier.

As you can see, there are many reasons that an H&H may not match. Looking at the indices, and allowing them to guide your steps, should enable you to identify the basis for the discrepancy and allow for the reporting of credible test results.