

Public Comment Proposal

Guidance for ABO Subtyping Organ Donors for Blood Groups A and AB

OPTN/UNOS Operations and Safety Committee

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Guidance for ABO Subtyping Organ Donors for Blood Groups A and AB

Affected Policies: N/A
Sponsoring Committee: Operations and Safety
Public Comment Period: January 22, 2018 –March 23, 2018

Executive Summary

The OPTN/UNOS Operations and Safety Committee (the Committee) has updated the Guidance for ABO Subtyping Organ Donors for Blood Groups A and AB, originally developed by the Committee and approved by the OPTN/UNOS Board of Directors in June 2011.

Since the original publication, the Committee sponsored major revisions to ABO policies that were approved by the OPTN/UNOS Board of Directors and implemented in June 2016. During that process, the Committee identified the need to revise the subtyping guidance, as many questions emerged related to subtyping. Questions and identified issues include lab result nomenclature, results interpretation, and incomplete knowledge of policy requirements.

In addition, the revised Kidney Allocation System (KAS) went into effect in December 2014. It eliminated variances (including subtyping variances). KAS put use of subtyped deceased donors into policy to help promote greater access to kidneys for blood type B candidates. Allocation of kidneys using subtyped donors has increased. Pre-KAS there were 19 transplants (0.2% of all kidney transplants) using subtyped donors for blood type B candidates. Post-KAS (year 2) that number had risen to 168 (1.4% of all kidney transplants).

The revised guidance document is also part of efforts to assist members with subtyping. Nearly a quarter of OPOs had a subtyping issue cited on their last site survey. Instructional Innovations developed a subtyping e-learning module in response to these concerns. The guidance document is cited as a resource. It needs to be updated to complement the efforts aimed at improving compliant subtyping practices and reporting.

Changes made to the guidance document include:

- Updated OPTN Policy references
- Amended information about special considerations such as neonates
- Updated additional complementary resources
- Revised structure and addition of key points
- Modified language to read more as a plain language document

Is the sponsoring Committee requesting specific feedback or input about this resource?

The Committee changed the section that covers special considerations in subtyping including neonates and history of red blood cell transfusion. The Committee seeks feedback whether this guidance is sufficient or if more detail or policy is desired.

The Committee also wants to know if there are related concerns not addressed in the guidance.

What problem will this resource address?

Guidance for ABO Subtyping Organ Donors for Blood Groups A and AB was developed and approved by the Board of Directors in June 2011. Since the original publication, the Committee sponsored major revisions to ABO policies that were approved by the OPTN/UNOS Board of Directors and implemented in June 2016. During that process, the Committee identified the need to revise the subtyping guidance, as many questions emerged related to subtyping. Questions and identified issues include lab result nomenclature, results interpretation, and incomplete knowledge of policy requirements.

In addition, the revised Kidney Allocation System (KAS) went into effect in December 2014. It eliminated variances (including subtyping variances). KAS put use of subtyped deceased donors into policy to help promote greater access to kidneys for blood type B candidates. Allocation of kidneys using subtyped donors has increased. Pre-KAS there were 19 transplants (0.2% of all kidney transplants) using subtyped donors for blood type B candidates. Post-KAS (year 2) that number had risen to 168 (1.4% of all kidney transplants).

The guidance document is still a valuable and requested resource. Members and UNOS staff identify subtyping issues. These issues include lab result nomenclature, results interpretation, and incomplete knowledge of policy requirements. Nearly a quarter of OPOs had a subtyping issue cited on their last site survey. Instructional Innovations developed a subtyping e-learning module in response to these concerns and the guidance document is cited as a resource in the module. It needs to be updated to support efforts to promote compliant subtyping practices and reporting.

The revisions also address questions that have recently been asked regarding other special circumstances such as subtyping neonates.

Why should you support this resource?

This resource is being revised to address identified transplant community needs. It needs to be updated to remain relevant to the community. It was developed in consultation with relevant subject matter experts, stakeholders, and internal staff. It is a free resource available along with others to assist members with subtyping education and practices. The revised guidance is one tool that can assist with answering questions, reducing confusion, and promoting effective practices regarding subtyping requirements. The revised guidance also supports other efforts to increase subtyping and availability of organs to candidates with traditionally less access due to blood types. This resource augments other policy initiatives and resources such as ABO policy modifications, KAS, UNOSConnect e-learning modules, and the most recently approved Guidance for Transplant Program Participation in the Transplantation of Non-A1/Non-A1B (A2/A2B) Donor Kidneys into Blood Group B Candidates.

How was this resource developed?

In 2008, a kidney donated from a living donor, whose ABO subtyping completed prior to the donation was reported as non-A₁ (e.g. A₂), was transplanted into a blood type O recipient resulting in immediate graft rejection and organ failure. Repeat subtype testing of the donor indicated the actual subtype to be A₁. In response to this event, the Membership and Professional Standards Committee (MPSC) requested that the Operations and Safety Committee (OSC) examine current OPTN policies to evaluate whether they are adequate to ensure that subtyping of both deceased and living donors is accurately determined and verified.

In April 2010, after data review and discussion, the OSC requested that a group of experts in the field of ABO typing and subtyping be formed to assist the committee in its task. The ABO Subtyping Work Group was created and included representation from American Association of Blood Banks (AABB), a histocompatibility laboratory supervisor, a blood bank medical director, the OPTN/UNOS Histocompatibility Committee, representatives from OSC, and other transplant center and OPO personnel familiar with processes related to allocation of organs based on ABO subtyping. The OSC requested the work group to assist the committee with understanding the current practice of laboratories performing subtype testing and centers requesting completion of such tests. They were also asked to assist in

proposing requirements that would be consistent with current laboratory and transplant community practice for ABO subtype testing.

This group developed the guidance as part of their overall work on subtyping issues to address community education needs. Their work also resulted in a policy proposal approved by the OPTN/UNOS Board of Directors in November 2011. Policy changes were made to require two separate specimens and tests for subtyping as well as requiring two-person verification of results prior to reporting results to the OPTN Contractor.

The revised guidance was developed by a work group including members of the Operations and Safety Committee. The revision efforts also included three additional subject matter experts: two members who have served on the Histocompatibility Committee and are currently lab directors, as well as one member who is a blood bank expert. The work group met monthly to review the current guidance, research content, discuss current issues, and review new developments in the field.

Support staff to the Operations and Safety Committee contributed to the review. Member Quality staff provided updated feedback on issues that they might still uncover during site surveys such as the need to emphasize that two out of three subtyping results cannot be reported or used for allocation. All tests must indicate the same result in order for use in allocation; otherwise, the donor must be allocated on primary blood type. Other internal support staff reviewed the document and made suggestions to incorporate more plain language.

The workgroup solicited pre-public comment feedback from the Minority Affairs, Kidney, and Organ Procurement Organization (OPO) Committees. The Kidney Committee provided suggestions to improve readability and organization. As a result, the key points are listed at the beginning of the document for those that might not read the entire guidance. The guidance was presented to the Minority Affairs Committee. No suggestions were made at their monthly call. OPO leadership received an advance copy but did not have pre-public comment feedback. The Operations and Safety Committee will continue to consult with these stakeholders during the public comment process as needed. A revised document was developed and submitted for full Committee consideration. The Operations and Safety Committee voted at their November 2017 monthly conference call to send the revised guidance document for January 2018 public comment consideration.

How well does this resource address the problem statement?

This resource addresses the issues identified in the problem statement by doing the following:

1. Updated OPTN Policy references

The revised guidance removes language on kidney variance policy that is no longer in effect following the implementation of the new KAS. It also references organ-specific policies (e.g. kidney, kidney-paired donation, and liver). It also cites specific requirements from revised ABO policies that were amended for clarity.

2. Amended information about special considerations such as neonates

Questions have arisen about special yet rare circumstances. For example, members have asked how far back in time does the rule apply requiring a pre-red blood cell transfusion specimen. The Committee has discussed this question but has decided not to specify a timeline in policy or guidance but the guidance offers information on the red blood cell life cycle. It also raises other considerations such as subtyping in neonates. Neonates do not immediately express red blood cell antigens. Members are encouraged to develop relationships and consult with their blood bank. When there is concern that subtyping cannot be accurately conducted, then the reasons must be documented and allocation based on primary blood type. Other issues known from site surveys are highlighted such as not using two out of three results to determine subtype.

3. Updated additional complementary resources

In 2011, this guidance was the sole OPTN resource. Since then, two UNOSConnect modules that include significant interactive content on subtyping requirements have been developed and released. These are referenced as well as the recently approved guidance for transplant programs on managing the candidate side of titer monitoring.

4. Revised structure and addition of key points

The guidance has been reformatted to put the most important information first and move the more technical information towards the back. All key points are put in a summary statement up front. This is done to capture those who may have limited time or ability to read the entire document.

5. Modified language to read more as a plain language document

Concerns were expressed that of the information might be more technical than helpful to assist one of the intended audiences of front line OPO staff. Efforts were put in to make the language simpler. Both work group members as well as communication and policy staff reviewed and revised the content to incorporate plain language wherever possible.

The updates, additional guidance, plain language, and reformatting should benefit the transplant community and help increase compliance with subtyping policies as well as promote effective practices. This resource, along with others discussed, should help answer community questions and ultimately help promote application of allocation subtyping policies that aim to increase organ access for certain blood type candidates.

Which populations are impacted by this resource?

This guidance document augments existing efforts to promote sound subtyping practices that can widen organ offer access to some blood type B and blood type O candidates.

How does this resource impact the OPTN Strategic Plan?

1. *Increase the number of transplants:* There is no impact to this goal.
2. *Improve equity in access to transplants:* There is no impact to this goal.
3. *Improve waitlisted patient, living donor, and transplant recipient outcomes:* There is no impact to this goal.
4. *Promote living donor and transplant recipient safety:* This guidance document originally developed and published in 2011 helps the transplant community understand the fundamentals of subtyping practices and terminology. The revisions will improve the transplant community's abilities to understand the importance of subtyping and to avoid incorrect results reporting.
5. *Promote the efficient management of the OPTN:* The revised guidance could help decrease questions and therefore decrease member and staff efforts involved in answering questions.

How will the OPTN implement this resource?

This proposal will not require programming in UNetSM.

Instructional Innovations will monitor this proposal for educational needs. The impact to members suggests that an educational offering may not be necessary.

Updated guidance will be posted on the OPTN website.

How will members implement this resource?

The overall fiscal impact will be minimal to all member types as this is a guidance document that might be used for staff training.

Transplant Hospitals

The fiscal impact to transplant hospitals will be minimal. They might use the updated tool as part of staff training.

OPOs

The fiscal impact to OPOs will be minimal. They might use the updated tool as part of staff training.

Histocompatibility Laboratories

The fiscal impact to histocompatibility laboratories will be minimal. They might use the updated tool as part of staff training.

Will this resource require members to submit additional data?

No, this proposal is a guidance document and does not require additional data collection.

How will members be evaluated for compliance with this resource?

This proposal is a guidance document does not require evaluation for compliance.

How will the sponsoring Committee evaluate whether this resource was successful post implementation?

Although the Committee will not formally monitor this guidance document, support staff will be queried regarding the frequency and type of observed subtyping questions and issues among members. Staff will also review data from the subtyping course available on UNOS Connect as well as monitor website hits accessing the guidance. This will help determine whether the existing resources are being used, whether they are helpful, or whether additional steps need to be taken to assist with subtyping requirements and promotion of increasing access to disadvantaged blood type candidates.

Guidance Document

All the language in the guidance document below is proposed new language; underlines have been omitted for easier reading.

Guidance for ABO Subtyping Organ Donors for Blood Groups A and AB

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26 Summary

27 Key Points

- 28 • Persons who are in blood groups A and AB (meaning that their primary blood type is A or AB,
29 respectively) can be further tested to determine a more specific subtype (also known as a
30 subtype).
- 31 • Subtypes for blood type A include A₁, A₂, A_x, A_{int} and others, but the most common is A₁.
- 32 • If the donor is **not** subtype A₁, it means they have less A antigen on their red blood cells (RBCs)
33 and organs, which allows them to donate to recipients outside of their primary blood type.
- 34 • OPTN policies refer to all subtypes that are not A₁ as non-A₁. Therefore, a donor who is primary
35 blood type A and subtyping results show that the donor does not have the A₁ subtype is referred
36 to as having blood type A, non-A₁.
- 37 • Perform subgroup typing before the donor receives RBC products or transfusions.
- 38 • **Any** blood transfusion can affect the accuracy of the results despite the donor's hemodilution
39 status.
- 40 • OPOs and transplant hospitals should consult with their blood banks to consider special issues
41 (such as RBC transfusion and neonates) and follow their recommendations.
- 42 • It is never acceptable to use two out of three results for a subtype determination. If there are any
43 discrepant results, then only primary type can be used for allocation.
- 44 • There are no standards for how laboratories should report ABO subtypes. The International
45 Society for Blood Transfusion Committee on Terminology for Red Cell Surface Antigens has
46 created a standardized numerical format for reporting red cell subtypes, but this is not suitable for
47 everyday communication. Popular terminology often uses terms: A₁, A₂, A₁B, and A₂B. OPTN
48 policies use the term non-A₁ for any subtype that is not A₁.
- 49 • You must not use subtype results for organ allocation when:
 - 50 • The results do not match or indicate the same result. It is never acceptable to use two out of
51 three results. If one result is different, then only primary type must be reported and used for
52 allocation.
 - 53 • Pre-RBC transfusion specimens are not available for initial and/or confirmatory testing of
54 subtyping.
 - 55 • Testing determines the presence or absence of the A₁ antigen only. It does not determine the
56 actual sub-group. Typing is either positive for A₁ or negative for A₁ – hence the subgroup
57 labeled A, non-A₁.
- 58 • Patients should not be labeled A₂- absence of A₁ as it does not equal A₂ due to the existence of
59 multiple subgroups.

60

61 What is required by OPTN Policy?

62 The OPTN has several policies that allow the transplantation of donors who have a non-A₁ subtype into
63 blood type B candidates. These policies include:

- 64 • *Policy 9.7.B: Points Assigned by Blood Type*
- 65 • *Policy 8.5.D: Allocation of Kidneys by Blood Type*
- 66 • *Policy 13.7: OPTN KPD Screening Criteria*

67 Requirements for Blood Type Determination

68 Clinical policies and information about how to perform these transplants are determined by the transplant
69 program. When these types of transplants are planned, the OPTN has policies about how to determine a
70 subtype for a deceased donor (*Policy 2.6.B: Deceased Donor Blood Subtype Determination*) or a living
71 donor (*Policy 14.5.B: Living Donor Blood Subtype Determination*). OPTN policies mandate that all
72 deceased and living donors, as well as candidates, be blood typed on two separate occasions, and these
73 rules apply to subtyping as well. By definition, this means the blood must:

- 74 1. Be drawn on two separate occasions
- 75 2. Have different collection times
- 76 3. Be submitted as separate samples
- 77 4. Have results indicating the same blood type

78 Requirements for Blood Subtype Determination

79 If testing determines that a deceased donor's primary blood type is A, then you must also subtype that
80 donor. The only exception to this rule is when no blood samples are available before the donor is given
81 red blood cell (RBC) products. Subtyping is optional for living donors and blood type AB deceased
82 donors. If the donor is found to be blood type A, non-A₁ a second subtype must be drawn (different draw
83 time, different draw occasion) for confirmation. It is important to note that:

84 *All subtyping for deceased or living donors must be completed before the donor receives any red blood*
85 *cell transfusions.*

86 What is a Subtype?

87 We are all familiar with the blood types (also called blood groups) A, B, O and AB.

88 Enzymes that add sugars to form either the group A or the group B antigens determine the blood type.
89 Individuals who are blood type O lack the enzyme to add those sugars and have an H precursor
90 substance that gives them their O blood type. You can find blood group antigens on many cells, including
91 RBCs and cells inside blood vessels of all vascular organs that are routinely transplanted. The reason
92 these blood group antigens are clinically important in transplantation and blood transfusion is that
93 individuals have naturally occurring antibodies to blood group antigens they do not have. Those
94 antibodies are termed isoagglutinins. Isoagglutinins are antibodies that can react with the blood group
95 antigens on the cells of the organ being transplanted. For instance, blood type O individuals have A and B
96 isoagglutinins, blood type B individuals have A, blood type A individuals have B, and blood type AB
97 individuals have no isoagglutinins.

98 When an incompatible transplantation takes place, such as transplanting a blood type B organ into a
99 blood type O individual, that organ would likely be rejected immediately. The rejection occurs because the
100 B isoagglutinins in the blood type O patient react with the B antigens on the vessels of the transplanted
101 organ.

102 Eighty percent of blood group A and AB persons are subtype A₁ and A₁B, respectively. The other 20% of
103 these blood groups are subtype A- non-A₁. Most often the subtype is A₂ (or A₂B), but occasionally it may
104 be a more rare subtype like A₃, A_{int}, etc. Blood group A, non-A₁ individuals express only about 20% of the
105 normal level of group A antigen on their RBCs and organs. A₁ subtyping is not routinely performed in
106 compatibility testing; however, some patients and donors may be identified as A, non-A₁ or AB, non-A₁B

107 in the course of routine blood bank typing because they have anti-A₁ antibody in their plasma (1-8% of
108 group, non-A₁, 25% of group “AB, non-A₁B” persons¹.

109 **Key Points:**

- 110 • Persons who are in blood groups A and AB (meaning that their primary blood type is A or AB,
111 respectively) can be further tested to determine a more specific subtype (also known as a subtype).
- 112 • Subtypes (or subtypes) for blood type A include A₁, A₂, A_x, A_{int} and others, but the most common is
113 A₁.
- 114 • If the donor is **not** subtype A₁, it means they have less A antigen on their RBCs and organs, which
115 allows them to donate to recipients outside of their primary blood type.
- 116 • OPTN policies refer to all subtypes that are not A₁ as non-A₁. Therefore, a donor who is primary blood
117 type A and subtyping results show that the donor does not have the A₁ subtype is referred to as
118 having blood type A, non-A₁.

119 **Why does it matter?**

120 An ABO subgroup (A₁ vs. A, non-A₁) allows organs to be allocated to additional recipients for both
121 deceased and living donor transplants. A person who is primary blood type A normally could not donate
122 their organ to a candidate who is blood type B. If the person who is blood type A also has a non-A₁¹
123 subtype, then they could possibly donate a kidney to a person who is primary blood type B (or O)
124 depending on other factors.

125 **When should we use and not use subtyping results for allocation?**

126 Subtyping results can only be used when both samples were obtained before any RBC transfusions, and
127 subtype testing results (both initial and confirmatory) are clear, valid, and match each other. You must not
128 use subtype testing if you question the validity or interrelation of the ABO subgroup testing results or if
129 pre-transfusion specimens are not available for both initial and confirmatory subtyping testing. In these
130 situations, the safest approach is to allocate the organs based on the donor’s primary blood type only. It is
131 against OPTN policy to use two out of three results if even one of the results does not indicate the same
132 subtype.

133 **What can interfere with test results?**

134 If a donor recently received an RBC transfusion, the A₁ subtyping result may be inaccurate and therefore
135 you should obtain all subtyping samples before RBC transfusions occur. Plasma and platelet transfusions
136 do not affect RBC typing results.

137 For example, if you gave an organ donor an emergency blood group O RBC transfusion before you
138 collected the subtyping specimen, then the A₁ typing could be inaccurate. Experiments with *in-vitro*
139 mixtures of blood group O and A₁ RBCs suggest that A₁ typing could become falsely negative if more
140 than 75% of the RBCs are group O². Since it is difficult to estimate precisely how many units of group O
141 RBCs need to be given to effect the efficacy of the test (as this depends on the patient’s size, amount and
142 rate of blood loss, timing of the transfusions and intravascular volume status) you must obtain all samples
143 before RBC transfusion.

144 In the event that the potential donor received a RBC transfusion in the past (as opposed to the current
145 hospitalization), then OPOs and transplant hospitals must determine the time, if any, since transfusion
146 that they consider safe to perform subgroup testing. Currently no data identifies how many group A RBC
147 transfusions it may take to change the subtyping result from non-A₁ (A₁ negative) to A₁. Transfused RBCs
148 have a half-life of 30 days and the “youngest” RBCs in the blood bag would circulate for up to 120 days.

¹ John Roback et al., eds., AABB Technical Manual 17th edition (Bethesda, MD: AABB, 2008).

² Glenn Ramsey et al., “Abstract Presentations from the AABB Annual Meeting and CTTXPO, Baltimore, MD, October 9-12, 2010,”
Transfusion 50 (2010): 168A.

149 **Infants and Neonates**

150 Neonates and infants do not fully express their ABO antigens. Manufacturers of anti-A₁ lectin also have
 151 varying warnings in their package inserts such as “results should be interpreted with caution in infants
 152 less than one year of age.” Umbilical cord blood is another consideration for neonates and it is generally
 153 recommended that you not use cord blood cells to determine primary ABO or subtype. OPO and
 154 transplant programs should consult with their blood banks to consider this issue and adjust practices
 155 accordingly.

156 **Key Points:**

- 157 • Perform subgroup typing before the donor receives RBC products or transfusions.
- 158 • **Any** blood transfusion can affect the accuracy of the results despite the donor’s hemodilution status.
- 159 • OPOs and transplant hospitals should consult with their blood banks to consider special issues (such
 160 as RBC transfusion and neonates) and follow their recommendations.
- 161 • It is never acceptable to use two out of three results for a subtype determination. If there are any
 162 discrepant results, then only primary type can be used for allocation.

163 **What do the results say?**

164 The wide range of terminologies used by blood banks and manufacturers to describe subtyping results is
 165 confusing. It is particularly confusing when transplant programs or OPOs need to identify the accurate
 166 subtyping for transplant compatibility. As we mentioned earlier, the actual subtype test looks for whether a
 167 blood group A or AB donor’s RBCs react with anti-A₁ lectin. The following tables provide subtype
 168 terminology used by the OPTN, along with synonymous terms that you may also see on typing results.

169 **Blood Group A Subtype Reporting Terminology:**

OPTN	A ₁	A, non-A ₁
Other terms used	A ₁ positive	A ₁ negative
	A ₁ reactive	Non A ₁
	-	A ₂

170 **Blood Group AB Subtype Reporting Terminology:**

OPTN	A ₁ B	AB- non-A ₁ B
Other terms used	AB-A ₁ positive	AB- A ₁ negative
	AB-A ₁ reactive	AB- A ₁ non-reactive
		A ₂ B

172 **Key Points:**

- 174 • There are no standards for how laboratories should report ABO subtypes. The International Society
 175 for Blood Transfusion Committee on Terminology for Red Cell Surface Antigens has created a
 176 standardized numerical format for reporting red cell subtypes, but this is not suitable for everyday
 177 communication. Popular terminology often uses terms: A₁, A₂, A₁B, and A₂B. OPTN policies use the
 178 term non-A₁ for any subtype that is not A₁.
- 179 • You must not use subtype results for organ allocation when:
 180

- 181 1. The results do not match or indicate the same result. It is never acceptable to use two out of three
182 results. If one result is different, then only primary type must be reported and used for allocation.
183 2. Pre-RBC transfusion specimens are not available for initial and/or confirmatory testing of
184 subtyping.
185

186 Common issues in subtype reporting:

- 187 • Unclear or discordant subtyping results.
188 • You do not know the time of the last transfusion.

189 What should I do when I am not sure how to report results?

190 A patient's age, transfusion status, and testing methods of the laboratory can all affect the efficacy of the
191 test. If you have questions about how to interpret subtyping results or whether testing was performed
192 accurately, your safest approach is to report and allocate the organs based on the donor's primary blood
193 type and not to consider subtyping. For all blood type A donors, the host OPO must document either that
194 subtyping was completed or the reason it could not be completed.

195 More technical information about subtyping

196 Determination of a donor's A₁ RBC subtype is performed with Anti-A₁ lectin, an FDA- approved test
197 reagent. Lectins are non-antibody proteins, which bind with high specificity to a particular carbohydrate
198 structure. Anti-A₁ lectin is extracted from the lentil-like seeds of the plant *Dolichus biflorus* (horse gram).
199 Anti-A₁ lectin binds to the A₁ carbohydrate and agglutinates A₁ or A₁B RBCs in a suspension. When group
200 A or AB RBCs are not agglutinated by anti-A₁ lectin, the RBCs are negative for A₁.

201 Strictly speaking, there is no (non-DNA) test for the A₂ antigen— only a test for whether the A₁ antigen is
202 present or not. Therefore, when a blood group A donor does not test positive for A₁ it is called an A, non-
203 A₁. Other group A variants exist. One group A variant called A_{int} (intermediate) is partway between A₁ and
204 A₂ in strength and can give weak reactions in A₁ typing. A_{int} is found most often in blood group A African-
205 Americans (5-8%). All of the other group A variants, such as A₃, A_{end}, and A_x, are rarely seen (<1:1000
206 group A persons) and are much weaker in expression overall than group A-non-A₁, and therefore
207 presumably would be equivalent to A₂ for organ-transplant purposes. Laboratories using anti-A₁ lectin
208 should follow the manufacturer's directions carefully.

209 From the perspective of transplant safety when using A, non-A₁ organs, any RBC reaction with anti-A₁
210 lectin, when performed according to the manufacturer's directions, should be regarded as A₁-reactive by
211 the transplant program, unless proven otherwise.

212 Key Points:

- 213 • Testing determines the presence or absence of the A₁ antigen only. It does not determine the actual
214 sub-group. Typing is either positive for A₁ or negative for A₁ – hence the subgroup labeled A, non-A₁.
215 • Patients should not be labeled A₂- absence of A₁ as it does not equal A₂ due to the existence of
216 multiple subgroups.

217 Who can help?

218 Your local blood bank is a great resource. OPOs and transplant programs should establish a relationship
219 with them as they can advise on protocol development and answer questions. Other national groups such
220 as the American Association of Blood Banks (AABB) (<http://www.aabb.org/Pages/default.aspx>) have
221 additional resources.

222 Resources to learn more

- 223 • UNOS Connect, the location for all your transplant education materials, is available at:
224 <https://unosconnect.unos.org/>

- 225 Two courses are available on UNOS Connect that relate to subtyping:
- 226 1. ABO Subtyping (SFT 116)
- 227 2. ABO Typing and Subtyping (SYS104)
- 228 • OPTN/UNOS “Guidance for Transplant Program Participation in the Transplantation of Non-
- 229 A1/Non-A1B (A2/A2B) Donor Kidneys into Blood Group B Candidates” is available at:
- 230 <https://optn.transplant.hrsa.gov/resources/guidance/>
- 231 • You can also find resources organized by specific organ types:
- 232 • Kidney and pancreas
 - 233 • Liver and intestine
 - 234 • Heart and lung
 - 235 • Vascularized composite allograft
- 236 #
- 237