The XML import file is composed of four unique parts: patientList, runList, PatientXML and RunXML. The <patientList> element contains multiple elements that represent patients and those patient elements are displayed as <PatientXML>. <PatientXML> contains <runList> which contains multiple elements that represent runs. The run element is named as <RunXML>.

The basic structure of the xml file looks like this:

Image no: 1.1

In image 1.1, we have a patient list that contains three patients or three <PatientXML> elements, where the third patient counting from top contains the element <runList> which itself contains two runs or two <RunXML> elements. A patient can have multiple runs.

The <RunXML> is the element where we store data about each Run. All sections are present from editing the Run in the Registry Application, including sections like RunInfo, Pre ECLS Assessment, Infections, Diagnoses, etc.

Before a user starts adding data about a Run and the sections of a run, the user needs to include some information for Patient, which is the parent element of the <runList> element. This image illustrates the structure.

Image no: 1.2

Image 1.2 shows <PatientXML> with patient fields including: UniqueId, Apgar1, Delivery, MaternalAge, etc. There is also a list with runs for that patient which is represented by the

<runList> element. The patient in this example has only one run. This example shows only a few of the patient elements. The most important field for a patient is the <UniqueId> element which is used for tracking this patient.

To create a new patient using the XML import process, all required fields must be included. These include: UniqueId, Birthdate, Sex, TimeOn, SupportType, Mode, and RunNo. For a new patient creation, only UniqueId, Birthdate, and Sex are required. Image 1.3 shows <PatientXML> with those three fields.

```
 1    <?xml version='1.0'?>
 2    <patientList>
 3    <PatientXML>
 4        <UniqueId>test12344435</UniqueId>
 5        <Birthdate>2002-09-24 13:40</Birthdate>
 6        <Sex>4</Sex>
 7        <runList>
 8            <RunXML>
65        </runList>
66    </PatientXML>
67    </patientList>
```

Image no: 1.3

Other fields that are not displayed in this image (image 1.3) include TimeOn, SupportType, Mode and RunNo. These fields are Run fields so they are not displayed with the Patient. These fields are included in the <RunXML> element.

```
23    <RunInfo>
24        <RunNo>1</RunNo>
25        <SupportType>1</SupportType>
26        <WeightUnknown>0</WeightUnknown>
27        <AdmissionWeight>97.8</AdmissionWeight>
28        <COVID19>1</COVID19>
29        <MisC>1</MisC>
30        <AdmissionHeight>80</AdmissionHeight>
31        <Intubation>1</Intubation>
32        <IntubationDate>2003-10-15 10:50</IntubationDate>
33        <InvasiveVentilation>1</InvasiveVentilation>
34        <InvasiveVentilationDT>2003-10-15 12:23</InvasiveVentilationDT>
35    </RunInfo>
36    <PreECLSAssessment>
76    <PreECLSSupport>
96    <ECLSAssessment>
143   <Modes>
144       <ConcurrentMode>
145           <Mode>
146               <StartTime desc="TimeOn">2004-09-30 10:50</StartTime>
147               <EndTime>2005-06-24 05;13</EndTime>
148               <ECLSMode>1</ECLSMode>
149           </Mode>
150       </ConcurrentMode>
151   </Modes>
```

Image no: 1.4

The <RunXML> element contains run sections such as RunInfo and Modes from the Registry Application and those sections contain the appropriate fields (image 1.4). <RunNo> and <SupportType> can be found in <RunInfo> section (marked with red rectangle). As we know, those fields in the Registry Application can be found in the same section called RunInfo. In order to add the <SupportType> and <RunNo> elements, the <RunInfo> element must be created.

The other fields in RunInfo are not required for the Patient and Run creation through XML but should be included if you have them.

TimeOn and Mode are other two fields that are required for Patient and Run creation. Those fields are present in the <Modes> element section (marked with red rectangle). The StartTime of the Initial Mode is TimeOn for the run (that is why TimeOn is marked as <StartTime> here), while the Mode is marked as <ECLSMode>. The value for <ECLSMode> is the number that will represent that Mode. The element <EndTime> is not required field for Patient and Run creation so we can easily create <Mode> element without that element, but bear in mind that <EndTime> of last or only Mode is TimeOff for run which is required for run to be submitted.

With only those fields completed, a Patient and Run can be created if the validation for BirthDate, TimeOn and UniqueId are acceptable. Other elements that were not included in the XML file will have NULL or default value. This is the minimum data required to create a patient and/or run but all of the other data should be entered as well just as if the Registry Application was being used to enter the data.

To update the data for this patient, include the UniqueId XML element <UniqueId> and include the other field elements that need to be changed.

```
1   <?xml version='1.0'?>
2   <patientList>
3   <PatientXML>
4       <UniqueId>test12344435</UniqueId>
5       <Sex>3</Sex>
6   </PatientXML>
7   </patientList>
```

Image no: 1.5

For example, to change patient Sex, add the <PatientXML> element with <Sex> and <UniqueId> elements in the <patientList> element, as you can see in Image 1.5. Other fields that were not included in this XML example such as <Birthdate>, <TimeOn>, <Mode> and other run data will stay the same and will not be updated.

If the wrong value is entered in the Sex field for example, where a letter is inserted instead of a number, a warning will be shown displaying that patient with the UniqueId that shows the wrong value for Sex (Image 1.6).
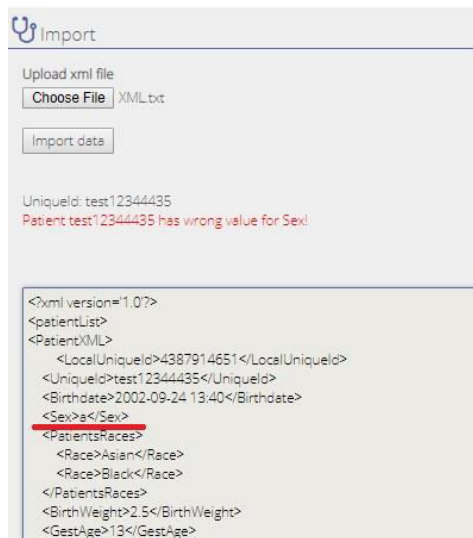
Image no: 1.6

The screen that displays warnings will also display warnings about min/max, hard/soft limits, and date validations.

If an element needs to be reset to NULL value, set that element to empty value like this: <BirthWeight></BirthWeight>.

If the race for existing patient needs to be updated from White to Asian and Black, the element <PatientsRaces> with new races needs to be included (image 1.7).

Image no: 1.7

After the patient is updated, all races that were previously included for this patient will be DELETED first, and the new races will be the only ones included. This process is the same for all elements that can contain multiple repeated elements such as: Diagnoses, Procedures, Infections, etc. If one <Diagnosis> is added in <Diagnoses> element, and the run already included three diagnoses in database, those three diagnoses will be deleted and only the new diagnosis will be saved, leaving the run with only one diagnosis.

The values for each element vary (some can be whole numbers and some can be decimal numbers). If a decimal number is included for a fielde that can only accept whole numbers, an error message will be generated stating that the value has the wrong input and it needs to be fixed before importing again. For date/time elements, acceptable formats include: YYYY-MM-DD HH:MM AM/PM or YYYY-MM-DD HH:MM, in other words 12h or 24h format. For example, both of these are acceptable: 2002-09-24 13:40 or 2002-09-24 1:40 PM. It is possible to import date fields in other formats also, but the most common one is used in the example.

Some fields can accept values in two different units, for example <PO2> from the <ECLSAssessment> section can be measured in both mmHg or kPa. Before importing data please check the settings for "Unit System" which are located in the upper right corner of the Registry Application screen, simply by clicking on the "blue gear" icon. The settings where "Unit System" dropdown can be adjusted there..
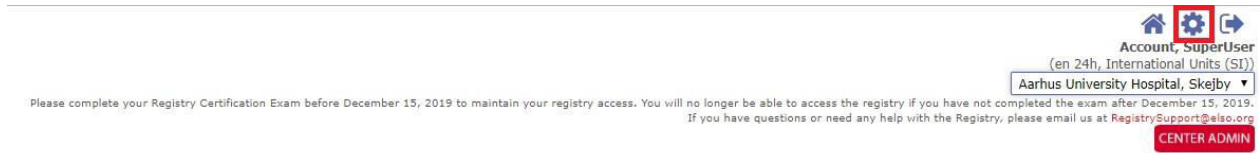

Image no: 1.8

Image no: 1.9

If International Units (SI) system is selected <PO2> is measured in kPa. That means it will have different hard/soft min/max limits from United States Units (US) system, when its validated. If, for example, the a user has International Units (SI) system selected and <PO2> is imported in mmHg, the user will receive soft/hard error if value is not in range for kPa which is measure unit from International Units (SI) system.

The XML import system has advanced error tracking. When the imported file has a valid structure, and patient/run data is validated, any applicable error messages will be displayed on the screen. Errors can contain information about a field or XML section element where the error is located. The error will show the Patient UniqueId, RunNo and section name of the issue. If the user enables display of import XML file, the user is then able to see the imported file in the application and there will be colored XML elements that correspond to the error messages. To enable the display of the imported file, the user can select "Yes" for "Display content of XML import file" (image 1.10).

Image no: 1.10

The first error that is underlined with the red line is a green error (soft error) for <RunInfo> or RunDemographics section. It is colored in green and the element is displayed in the box bellow that contains the imported file (image 1.10).

Other errors that are red (hard error) can also be seen in the same box (image no: 1. 11).

Image no: 1.11

An error can also be clicked on, and if "Display content of XML import file" is set to "Yes", the screen will scroll right to that error in the box where the file is displayed. This scroll will only work if the user completed the<UniqueId> and <RunNo> fields. If there is an XML tag that is not valid in the import file, the user will receive a red error message that will explain where to find that element or even provide the element name when the whole XML element tag is missing (image 1.12).
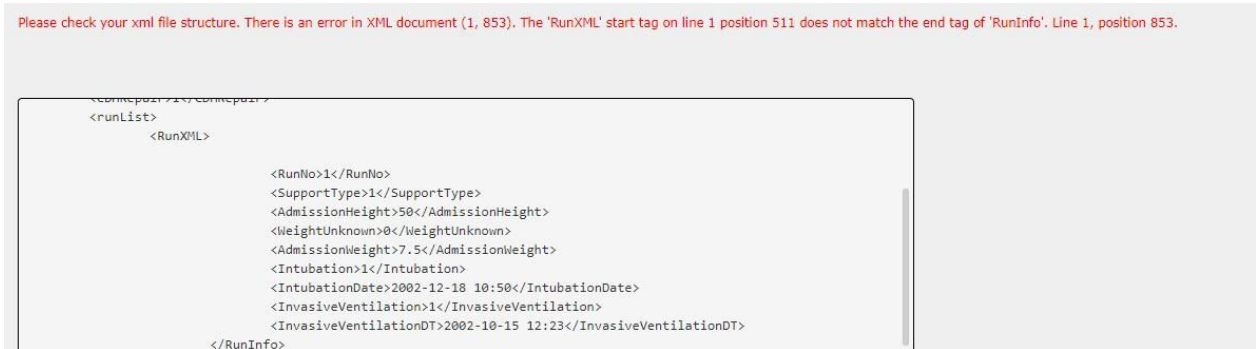
Image no: 1.12

On this image (image 1.12), there is a closing tag </RunInfo>, but the opening tag for the <RunInfo> section is missing. In this case, the system notifies the user that the imported file is missing the opening tag.

When a user is importing a patient for the first time and that patient doesn't already exist in the Registry database, that patient will be labeled as "--This patient is new" to denote that new data is being added instead of updating existing data (image 1.13).

Image no: 1.13

When updating an existing patient or existing runs, the Patient and each of the Runs will be labeled as: "--This patient was previously imported and will be updated" or "--This run was previously imported and will be updated for this patient". This will denote that a patient or run is being updated in the database (image 1.14).

UniqueId: test1231231231 --This patient was previously imported and will be updated.
  RunNo: 1 -- This run was previously imported and will be updated for this patient.
    RunDemographics > You can leave Date/Time of Intubation Date as is, but it is unusual for this date to be more than a month before the time on ECMO date December 18, 2003 10:50.
    RunECLSAssessment > You can leave the data in the system as is, but these are fields outside the usual data range for FiO2 (21 and 100). Current value for FiO2 is 12.
    RunPreECLSAssessment > You can leave the data in the system as is, but these are fields outside the usual data range for FiO2 (21 and 100). Current value for FiO2 is 11.

Send me an email for import result status: ☐
The patients and runs above will be added/updated when you press the Confirm button: [Confirm]

Image no: 1.14

If an existing patient is being updated, the hard/soft errors even for the fields not included with the new import file, but previously imported, will be displayed. For example: if a run has CardiacAddenda, but the new import update file does not include CardiacAddenda, the hard/soft errors for CardiacAddenda will be displayed. To reset values from the CardiacAddenda section, just send the empty element <CardiacAddenda></CardiacAddenda>.

When the XML import file is validating, there are two options with checkboxes that can send those validations or XML import results via email. Check one or both boxes and an email will be sent accordingly (image 1.15).
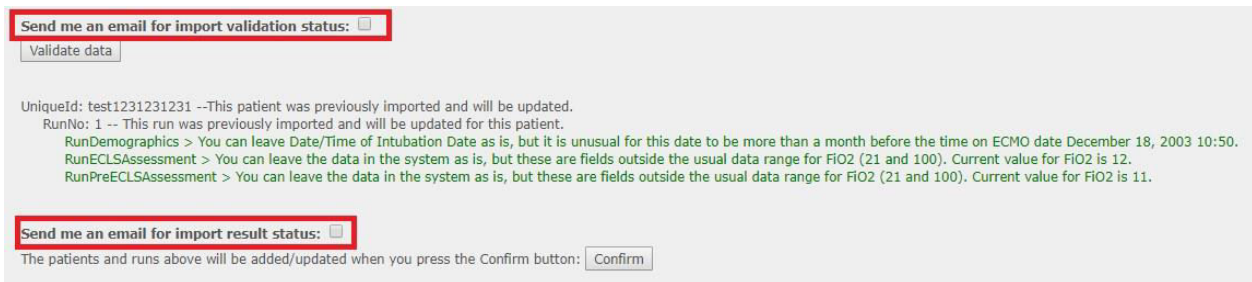

Send me an email for import validation status: ☐
[Validate data]

UniqueId: test1231231231 --This patient was previously imported and will be updated.
  RunNo: 1 -- This run was previously imported and will be updated for this patient.
    RunDemographics > You can leave Date/Time of Intubation Date as is, but it is unusual for this date to be more than a month before the time on ECMO date December 18, 2003 10:50.
    RunECLSAssessment > You can leave the data in the system as is, but these are fields outside the usual data range for FiO2 (21 and 100). Current value for FiO2 is 12.
    RunPreECLSAssessment > You can leave the data in the system as is, but these are fields outside the usual data range for FiO2 (21 and 100). Current value for FiO2 is 11.

Send me an email for import result status: ☐
The patients and runs above will be added/updated when you press the Confirm button: [Confirm]

Image no: 1.15

To lock and submit a run, all fields that are required for run/patient locking in the registry application must be included. Without those fields, a patient or run can successfully be imported, but it will not be submitted/locked.

Patients and runs that are imported using the XML import file can only be edited/updated by the XML import process. Imported data cannot be edited by in the Registry application. Patients and runs imported can be viewed in the Registry application.

When adding equipment for runs, all equipment information is stored in <Equipment></Equipment> tag. To add Hemofilters and TemperatureRegulations devices, <HemofilterId> and <TemperatureRegulationId> tags are used, while adding MembraneLungs and Pumps, <MembraneLungs> and <Pumps> tags are used. (image: 1.16)
<MembraneLungs> and <Pumps> can contain multiple devices of their respective type.

```xml
<Equipment>
    <HemofilterId>132</HemofilterId>
    <TemperatureRegulationId>107</TemperatureRegulationId>
    <Pumps>
        <Device>
            <DeviceId>150</DeviceId>
            <AddedReplaced>1</AddedReplaced>
            <ReplaceReasonId>1</ReplaceReasonId>
            <StartTime>04/11/2019 21:22</StartTime>
            <EndTime>04/11/2019 21:29</EndTime>
        </Device>
        <Device>
            <DeviceId>211</DeviceId>
            <AddedReplaced>2</AddedReplaced>
            <ReplaceReasonId></ReplaceReasonId>
            <StartTime>04/12/2019 20:29</StartTime>
            <EndTime></EndTime>
        </Device>
    </Pumps>

    <MembraneLungs>
        <Device>
            <DeviceId>215</DeviceId>
            <AddedReplaced>1</AddedReplaced>
            <ReplaceReasonId>1</ReplaceReasonId>
            <StartTime>04/11/2019 21:22</StartTime>
            <EndTime>04/11/2019 21:29</EndTime>
        </Device>
        <Device>
            <DeviceId>211</DeviceId>
            <AddedReplaced>2</AddedReplaced>
            <ReplaceReasonId></ReplaceReasonId>
            <StartTime>04/12/2019 20:29</StartTime>
            <EndTime></EndTime>
        </Device>
    </MembraneLungs>
</Equipment>
```

Image no: 1.16

In case when there is only one device, then there is no need to provide <AddedReplaced>, <ReplaceReasonId>, <StartTime>, <EndTime> tags. (image: 1. 17)
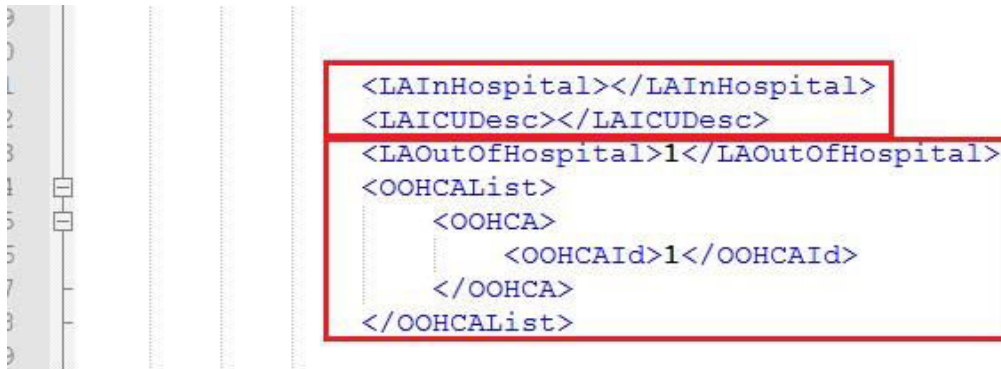
```xml
<Equipment>
    <HemofilterId>132</HemofilterId>
    <TemperatureRegulationId>107</TemperatureRegulationId>
    <Pumps>
        <Device>
            <DeviceId>150</DeviceId>
        </Device>
    </Pumps>

    <MembraneLungs>
        <Device>
            <DeviceId>215</DeviceId>
        </Device>
    </MembraneLungs>
</Equipment>
```

Image no: 1.17

<DeviceId> tag stands for <PumpId> and <MembraneLungId. <ReplaceReasonId> is a required tag when the <AddedReplaced> tag has the value of '1'. This means that this device was replaced and the system will require a replacement reason for why that device was replaced. Other validation, such as date validations for <StartTime> and <EndTime>, are same as they are described in the Database Definitions document and within the registry application.
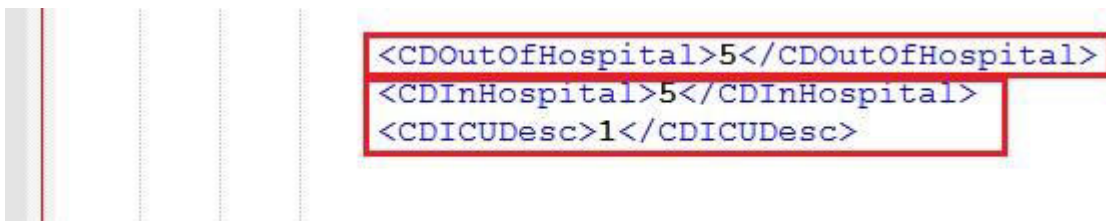
In the new ECPR addendum section, there are some XML tags that cannot be present in the XML import file when certain tags from this group are present. These include the Location of Arrest in the ECPR addendum. Location of Arrest can be 'In hospital' or 'Out of Hospital'. Depending on which location is used, different sub XML elements can or cannot be inserted. In the next image (image 1.18) there are two red blocks that contain two different types of arrest. Only one of them can be present in the XML import file. Tag <LAICUDesc> can only be used if the value for the <LAInHospital> tag is present and only if the value is '5'. The same is true for <OOHCAList>, which can only be used if there is a value in the <LAOutOfHospital> tag.

Image no: 1.18

The same rule applies for Location of Cannulation arrest. The run can have Out of Hospital Arrest or In Hospital Arrest. The <CDICUDesc> tag can only be used if the <CDInHospital> element has a value and that value is '5'. (image 1.19)

Image no: 1.19

When transferring run to another center, <TransferELSOCenter>, <TransferNonELSOCenter> tags are used. < TransferELSOCenter > tag must hold valid center number existing in Registry database, while <TransferNonELSOCenter> can hold any name or number, it doesn't matter if center is not present in registry database. Both of those tags cant exist together, only one of them can be used. In order to transfer run, <Discontinuation> must be set to NULL, <DischargedAlive> must be set to 'On ECMO' and <DischargeLocation> must be 'Transferred to another hospital'.

On next image (image 1.20) we are transferring run to existing Registry center number 1.

```
<Outcome>
    <Discontinuation></Discontinuation>
    <Extubated>1</Extubated>
    <OralEndotrachealTubeRemoval>08/11/2019 10:50</OralEndotrachealTubeRemoval>
    <CannulaSiteRepair>3</CannulaSiteRepair>
    <DischargedAlive>2</DischargedAlive>
    <DischargeLocation>3</DischargeLocation>
    <DischargeDate>12/13/2019 10:50</DischargeDate>
    <ICUDischargeDate>08/13/2019 10:50</ICUDischargeDate>
    <TransferELSOCenter>1</TransferELSOCenter>
</Outcome>
```

Image no: 1.20

To receive run in another center, tags <ReceiveELSOCenter> and <ReceiveNonELSOCenter> are used. In this example we will receive run in center 1. So <ReceiveELSOCenter> tag should be used. <ReceiveNonELSOCenter> can hold any name or number while <ReceiveELSOCenter> must hold valid Registry center number, and that must be the number of center who sent the run to receiving center. To receive run from another center, receiving run must have same patient birthdate as the run sent to this center, TimeOn must be same as TimeOff of transferred run, and <PatientTransported> value must be set to 1 which is equal to 'Transported on ECMO' (image 1.21).

```
<PreECLSSupport>
    <AdmitDate>12/17/2003 16:17</AdmitDate>
    <PatientTransported>1</PatientTransported>
    <PreECLSArrest>1</PreECLSArrest>
    <Transplant>1</Transplant>
    <Trauma>1</Trauma>
    <MechanicalScUsed>1</MechanicalScUsed>
    <RenPulOtherScUsed>0</RenPulOtherScUsed>
    <MedicationsScUsed>0</MedicationsScUsed>
    <VasoactivelScUsed>0</VasoactivelScUsed>
    <Support>
        <Code>
            <CodeId>104</CodeId>
        </Code>
        <Code>
            <CodeId>103</CodeId>
        </Code>
    </Support>
    <ReceiveELSOCenter>1</ReceiveELSOCenter>
</PreECLSSupport>
```
Image no: 1.21

After validating XML import file, system will check if there is a match of transferring/receiving run, and if there is one, user will receive green message in validation for imported run, stating: '>>>>ReceiveCenter: Match found. After update, Pre-ECLS Assessment section will be disabled for edit.'. After inserting this run, Pre-ECLS Assessment section will be disabled for edit.

If you have questions on the XML import process, please email registrysupport@elso.org.