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:

```
   1    <?xml version="1.0" encoding="UTF-8"?>
   2    <PatientList xmlns="urn:run-schema">
   3        <PatientXML>
 720        <PatientXML>
 721            <RunList>
 722                <RunXML>
1434                <RunXML>
1436            </RunList>
1437        </PatientXML>
1438        <PatientXML>
1440    </PatientList>
1441
```

Image no: 1.1

In image 1.1, we have a patient list that contains three patients or three <PatientXML> elements, where the second 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 Run Info, 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 information for Patient, which is the parent element of the <RunList> element. This image illustrates the structure.

```
   1    <?xml version="1.0" encoding="UTF-8"?>
   2    <PatientList xmlns="urn:run-schema">
   3    <PatientXML>
   4        <UniqueId>TestPatient123s</UniqueId>
   5        <LocalUniqueId>1234abcd</LocalUniqueId>
   6        <Birthdate>06/10/1962 13:40</Birthdate>
   7        <Apgar1>4</Apgar1>
   8        <Apgar5>5</Apgar5>
   9        <Delivery>1</Delivery>
  10        <MaternalAge>23</MaternalAge>
  11        <RunList>
  12            <RunXML>
 724        </RunList>
 725    </PatientXML>
 726    </PatientList>
```

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 and runs using the XML import process, all required fields must be included. Some required fields include: UniqueId, Birthdate, Sex, TimeOn, SupportType, Mode, and RunNo. Required fields can be seen in XML Import schema file, available for download on the ELSO website. In some cases, some fields are required for a specific section.

```xml
<RunXML>
    <RunInfo>
        <RunNo>1</RunNo>
        <SupportType>1</SupportType>
        <WeightUnknown>0</WeightUnknown>
        <AdmissionWeight>97.8</AdmissionWeight>
        <HeightUnknown>0</HeightUnknown>
        <AdmissionHeight>80</AdmissionHeight>
        <Intubation>2</Intubation>
        <IntubationDate>10/17/2002 10:50</IntubationDate>
        <InvasiveVentilation>1</InvasiveVentilation>
        <InvasiveVentilationDT>10/15/2002 12:23</InvasiveVentilationDT>
    </RunInfo>
    <Modes>
        <ConcurrentMode>
            <Mode>
                <StartTime>03/11/2019 10:00</StartTime>
                <EndTime>03/11/2019 16:00</EndTime>
                <ECLSMode>1</ECLSMode>
            </Mode>
            <Mode>
                <StartTime>03/11/2019 20:00</StartTime>
                <EndTime>12/13/2019 22:00</EndTime>
                <ECLSMode>2</ECLSMode>
            </Mode>
```
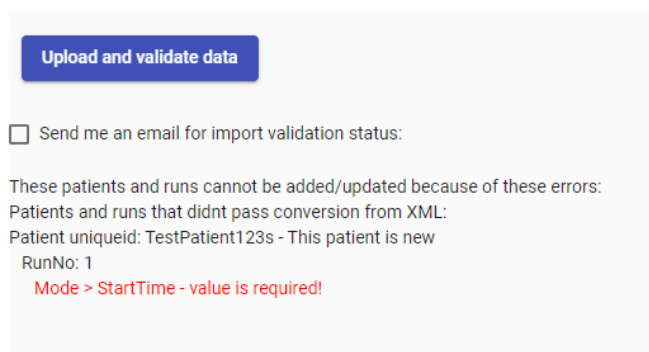
Image no: 1.3

The <RunXML> element contains run sections such as RunInfo and Modes from the Registry Application and those sections contain the appropriate fields (image 1.3). <RunNo> and <SupportType> can be found in the <RunInfo> section (marked with red rectangle. 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 two other 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, while the Mode is marked as <ECLSMode>. The value for <ECLSMode> is the number that will represent that Mode. The element <EndTime> is not a 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 the 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. Missing required fields will be shown as red errors, while missing fields that are only required for the run to be marked as submitted will be displayed as blue errors (image 1.4 and image 1.5).

Image no: 1.4
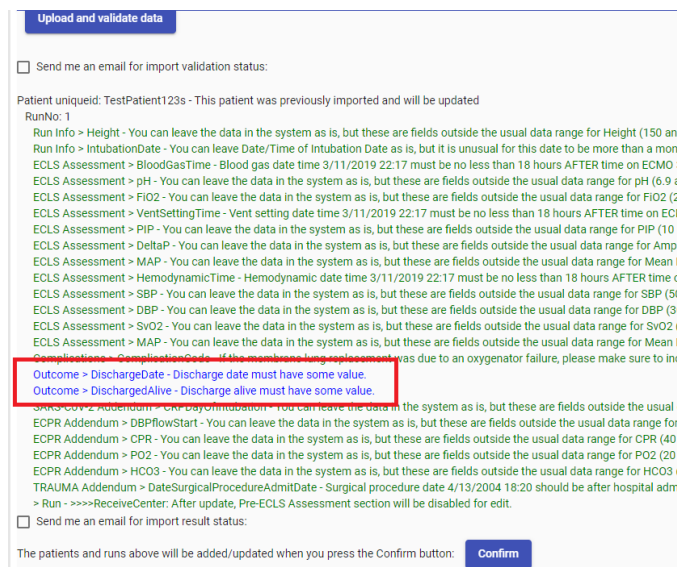
Image no: 1.5

To update the data for an existing patient, place the same data that was previously used for patient creation, with new changes to values if needed, import the file. That will update the Patient/Run if there are no red errors.
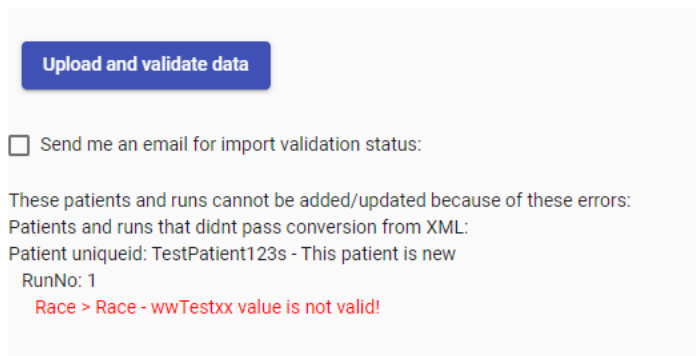
If an element needs to be reset to NULL value, set that element to empty value like this: <BirthWeight></BirthWeight>.

If a list needs to be reset to an empty list (Diagnoses, Complications, Races etc.), the XML file should contain an empty list, like this: <PatientsRaces></PatientsRaces>. If <PatientsRaces> contain any races 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.

To submit a run, all fields that are required for run/patient submission in the registry application must be included. Without those fields, a patient or run can be successfully imported, but it will not be submitted. Imported data cannot be edited by in the Registry application. Patients and runs imported can be viewed in the Registry application.

Red errors are also shown when a field contains a wrong value. If the wrong value is entered in the Race 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 Race (Image 1.6).

Upload and validate data

☐ Send me an email for import validation status:

These patients and runs cannot be added/updated because of these errors:
Patients and runs that didnt pass conversion from XML:
Patient uniqueid: TestPatient123s - This patient is new
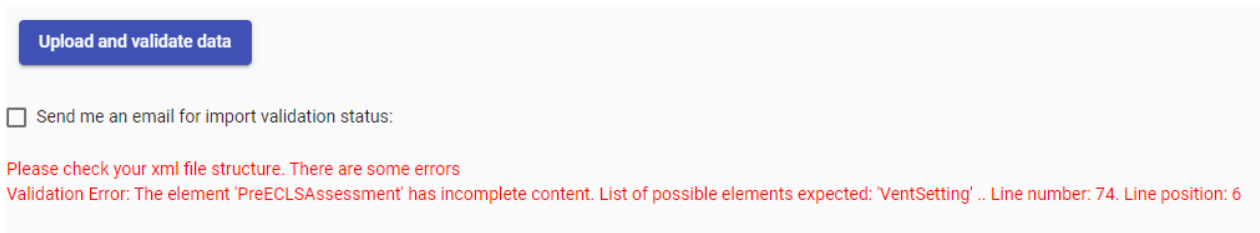RunNo: 1
Race > Race - wwTestxx value is not valid!

Image no: 1.6

If an XML element is not closed properly, a red error will also appear, or if a section element is missing, for example VentSetting (image 1.7 and image 1.8).

Upload and validate data

☐ Send me an email for import validation status:

Please check your xml file structure. The 'VentSettingTime' start tag on line 60 position 40 does not match the end tag of 'VentSetting'. Line 69, position 7.
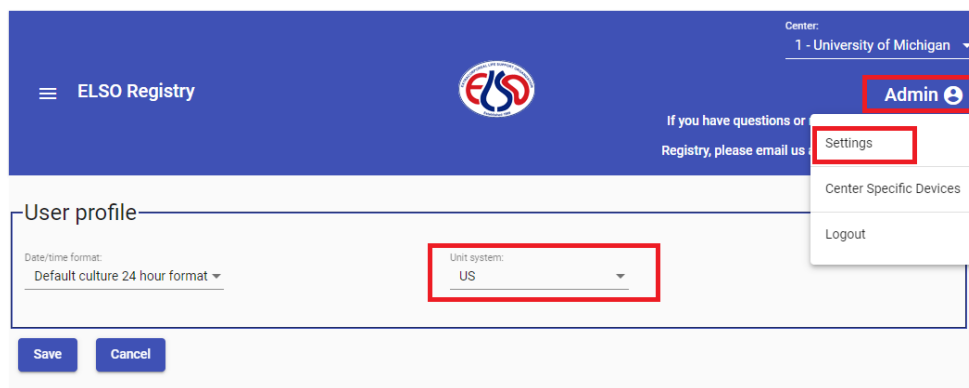
Image no: 1.7

Image no: 1.8

The screen that displays warnings will also display warnings about min/max, hard/soft limits, and date validations. This is also true when a run contains an inactive code such as a complication or infection that cannot be used anymore. A red error will show that value is not valid.

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 field 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 "username" icon. The settings where "Unit System" dropdown can be adjusted there (Image 1.9).

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 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 a measure unit from International Units (SI) system.

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 1.10).
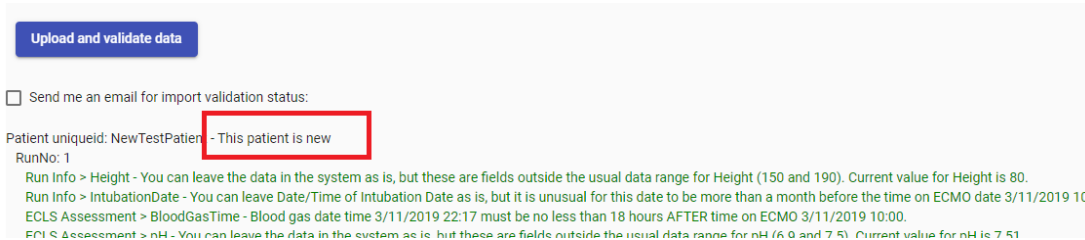

image 1.10

When updating an existing patient, the Patient will be labeled as: "-This patient was previously imported and will be updated". This will denote that a patient is being updated in the database (image 1.11).
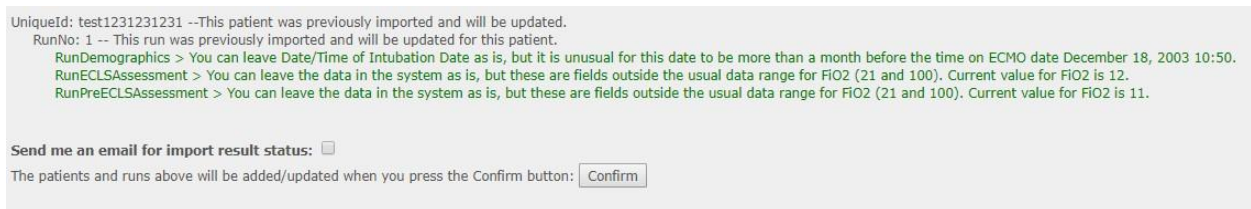

Image 1.11

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 1.12).
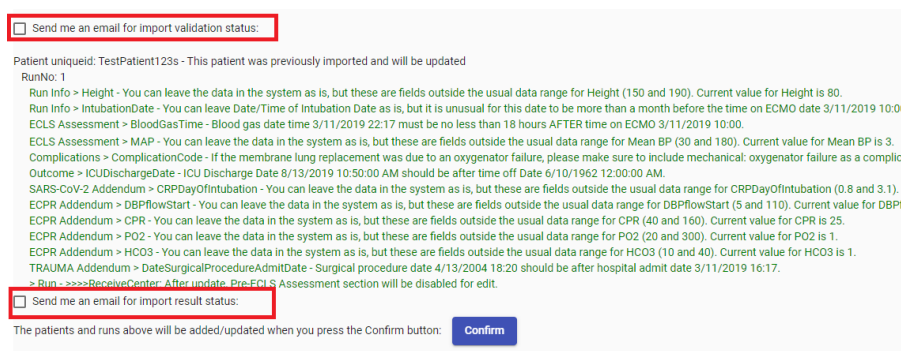

Image 1.12

When adding equipment for runs, all equipment information is stored in the <Equipment></Equipment> element. To add Hemofilters and Temperature Regulations devices, <HemofilterId> and <TemperatureRegulationId> elements are used, while adding MembraneLungs and Pumps, <MembraneLungId> and <PumpId> elements are used when there is single device of that type, to add more devices of MembraneLung or Pump type, <MembraneLungs> and <Pumps> elements are used. (image 1.13)

```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>
```
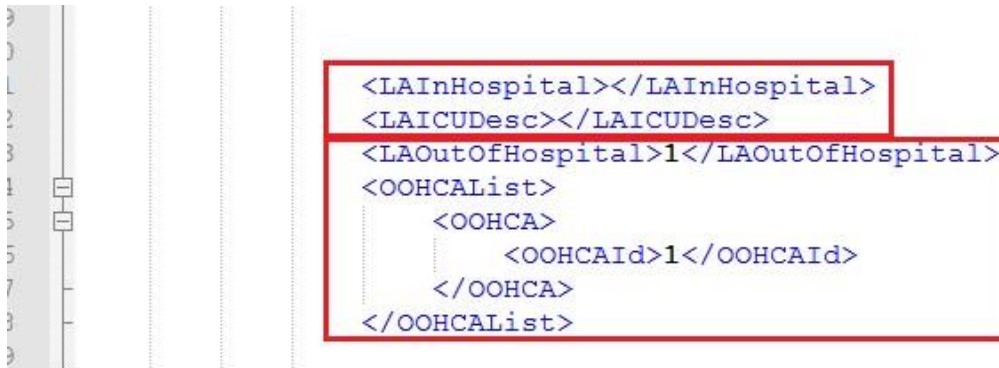
Image no: 1.13

<DeviceId> element stands for <PumpId> and <MembraneLungId. <ReplaceReasonId> is a required element when the <AddedReplaced> element 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 the same as they are described in the Database Definitions document and within the registry application.

There are certain elements that cannot be present when other elements are present. In the ECPR addendum section, there are some XML elements that cannot be present in the XML import file
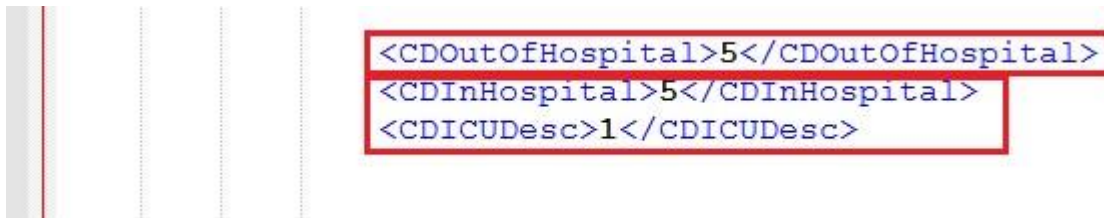
when certain elements from this group are present. These include the Location of Arrest in the ECPR addendum. Location of Arrest can be 'In hospital' or 'Out of Hospital'. Depending on which location is used, different sub XML elements can or cannot be inserted. In the next image (image 1.18) there are two red blocks that contain two different types of arrest. Only one of them can be present in the XML import file. Element <LAICUDesc> can only be used if the value for the <LAInHospital> element 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> element.

Image no: 1.14

The same rule applies for Location of Cannulation arrest. The run can have Out of Hospital Arrest or In Hospital Arrest. The <CDICUDesc> element can only be used if the <CDInHospital> element has a value and that value is '5' (image 1.15).

Image no: 1.15

When transferring a run to another center, <TransferELSOCenter>, <TransferNonELSOCenter> elements are used. <TransferELSOCenter> element must hold a 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 the registry database. Both of those elements cannot exist together, only one of them can be used. In order to transfer a run, <Discontinuation> must be set to NULL, <DischargedAlive> must be set to 'On ECMO' and <DischargeLocation> must be 'Transferred to another hospital'. On the next image (image 1.16) we are transferring a run to an 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: 1.16

To receive a run from another center, the elements <ReceiveELSOCenter> and <ReceiveNonELSOCenter> are used. In this example we will receive a run from center 1. So the <ReceiveELSOCenter> element should be used. <ReceiveNonELSOCenter> can hold any name or number while <ReceiveELSOCenter> must hold a valid Registry center number, and that must be the center number that sent the run to the receiving center. To receive a run from another center, the 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 1.17).

```
<RunInfo>
    <RunNo>1</RunNo>
    <SupportType>1</SupportType>
    <WeightUnknown>0</WeightUnknown>
    <AdmissionWeight>97.8</AdmissionWeight>
    <COVID19>1</COVID19>
    <MisC>1</MisC>
    <HeightUnknown>0</HeightUnknown>
    <AdmissionHeight>80</AdmissionHeight>
    <Intubation>2</Intubation>
    <IntubationDate>10/17/2002 10:50</IntubationDate>
    <InvasiveVentilation>1</InvasiveVentilation>
    <InvasiveVentilationDT>10/15/2002 12:23</InvasiveVentilationDT>
    <AdmitDate>03/11/2019 16:17</AdmitDate>
    <PatientTransported>1</PatientTransported>
    <PreECLSArrest>1</PreECLSArrest>
    <Transplant>1</Transplant>
    <Trauma>1</Trauma>
    <ReceiveELSOCenter>1</ReceiveELSOCenter>
</RunInfo>
```

Image no: 1.17

After validating the XML import file, the 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: '> Run - >>>>ReceiveCenter: After update, the Pre-ECLS Assessment section will be disabled for edit.'. After inserting this run, the Pre-ECLS Assessment section will be disabled for edit.

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