



**DARPA
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CHALLENGE**

Interface Control Document Data Competition

**Revision 2
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2 Introduction

The goal of this document is to convey the high-level concept and infrastructure used to evaluate a team's submission to the Data Competition. We will also describe the necessary interface for teams to integrate their submitted model with JHU/APL's evaluation system as part of the competition's process to formally assess each team's performance. This document only covers the evaluation system for the Data Competition for Phase 1. For information on the Systems and Virtual Competitions please refer to their respective *Interface Control Documents*.

The remainder of this document is organized as follows: Section 3 describes the evaluation system, input and response format expected at evaluation time, and the evaluation process; Section 4 describes the evaluation environment expected for the Phase 1 workshop and challenge events; Section 5 describes the Client Shell provided as a boilerplate code to aid in model preparation and submission for successful integration with the evaluation system. Appendices provide supporting information.

3 Evaluation System

This section contains information about the evaluation system planned for workshop and challenge events in the Data Competition. All formal evaluation procedures will be performed on JHU/APL networks.

Model submissions will be evaluated using a *held-out* test dataset in a simulated online prediction environment, in accordance with the scoring procedure described in the DTC Rules Document. Models will be evaluated on a single patient case at a time. For each case, models will be provided with incremental segments of Electronic Health Record (EHR) and Vital Signs (VS) data over the timespan of the case and given the opportunity to predict subsequent Life-Saving Interventions (LSIs).

Figure 1 provides a high-level description of the three interacting modules:

1. **Evaluator**, which hosts all logic required to distribute test data to the teams' client containers (via Rabbit MQ), and evaluate their responses;
2. **Rabbit MQ Sever**, which hosts the server that governs the transfer of data between the Client Container and the Evaluator;
3. **Client Container**, a Docker container which processes input data, runs model inference, and responds with LSI predictions (via Rabbit MQ).

During submission time, AWS administrators will automatically pull-down code from the *submission* branch of the team's assigned GitHub repository. The code will then be containerized using a standard buildspec configuration to produce a Client Container. This Client Container will run within the evaluation system alongside the Evaluator within the JHU/APL network. During evaluation, the Evaluator sends input data to the Client Container and receives prediction responses via Rabbit MQ's messaging protocol. At the end of the evaluation process, the system produces a log with performance metrics for each team.

The Rabbit MQ Server and Evaluator will be developed and maintained by JHU/APL. To properly interface with the JHU/APL evaluation system, teams’ software must be compliant with the overall evaluation system. To confirm compliance with the evaluation system, the JHU/APL team is developing a Continuous Integration/Continuous Development (CI/CD) system integrated with the DTC AWS network and the teams’ GitHub repositories. This CI/CD system will build code and perform a series of unit tests. If all tests pass, then the submission should be compliant with the evaluation system. Furthermore, JHU/APL will provide a Client Shell as a starting point for teams to build upon (see Section 5).

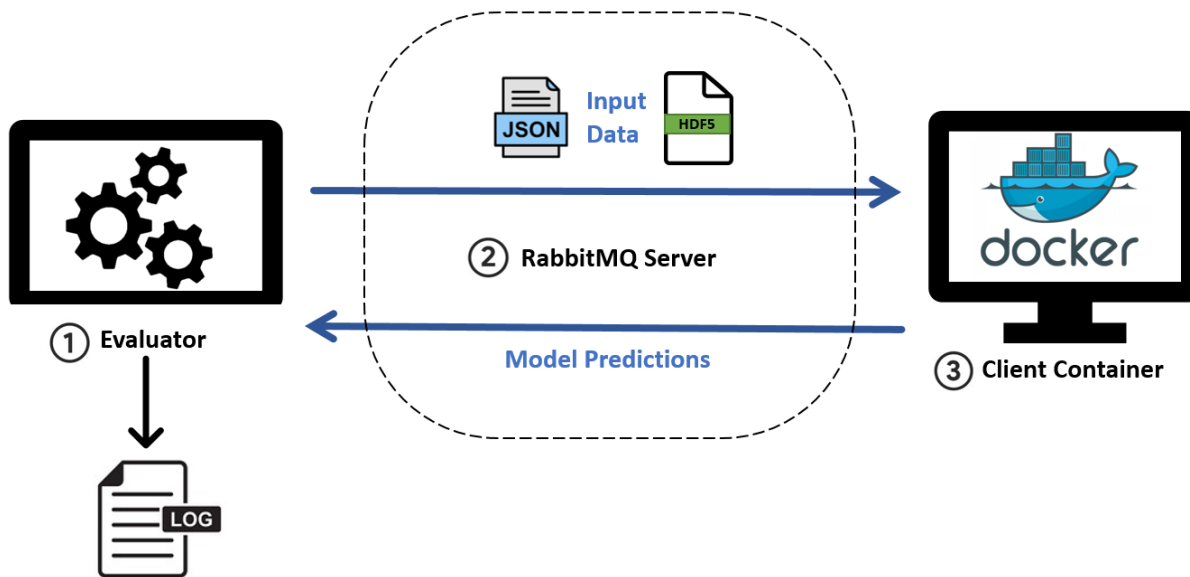


Figure 1: High-level architecture of the JHU/APL evaluation system. This system is composed of 1) the Evaluator, 2) Rabbit MQ server, and 3) the Client Container, containing the team’s model. The Evaluator sends test data to the Client Container (JSON and HDF5 files) using RabbitMQ messages, and the Client Container responds with the LSI predictions.

3.1 Communication Protocol

During evaluation, the Evaluator and the Client Container will pass messages through two persistent channels: 1) “input_queue” and 2) “results_queue.” The *input_queue* channel will transport messages relating to the inputs. These messages can either contain the test inputs for the model or receipt acknowledgements of these messages. The *results_queue* will transport all messages pertaining to predictions and receipt acknowledgement of these messages. In this section, we will detail the communication protocol between the Evaluator and the Client Container. This includes the message formats and the messaging sequence.

3.1.1 Input Data Message Format

During evaluation of a given patient case, models will be evaluated using a simulated online prediction paradigm. Models will be provided with sequential segments of data over the course of the case, incrementally providing medical data as the case unfolds and providing opportunities at each segment for the model to predict future LSIs relative to the current segment. Segments will

typically contain 5 minutes of data, with slightly smaller or larger windows at the edges of a case. They will be consecutive, non-overlapping with only new, unseen data provided in each segment, so models will be responsible for accumulating or storing past data, if necessary.

Due to differences between training dataset format and the segmented data used at evaluation time (as described below), teams will be provided with Python tools in the Client Shell Github repository (see Section 5) that will prepare data as it will be provided in evaluation.

For a given case and time window, input data will be comprised of segment metadata, a single JSON file containing Electronic Health Record (EHR) data, and a single HDF5 file containing Vital Signs (VS) data. Segment metadata includes a unique segment identifier (string), a unique case identifier (string), an indicator for end of case (boolean), and start- and end-timestamps relative to the beginning of the case (integers). The end-of-case indicator will be used to notify the client that the current case is finished, and the next data segment sent will belong to a new patient case.

Here is an example of the bundled input data:

```
{
  "segment_id": "OUmJvhCVC5"
  "case_id": "wv9ufeR87I"
  "end_of_case": False,
  "start_time": 900,
  "end_time": 1800,
  "EHR": <JSON as binary file>,
  "VS": <HDF5 as binary file>
}
```

Message 1: Bundled data format

Depending on data availability within each case, the JSON and/or HDF5 files for a given segment may be empty. Additionally, any fields within these files are optional. For any available data, all field names within both the JSON and HDF5 file are consistent with the data dictionary and documentation provided with the training dataset. The structure of these files differs from the training dataset as described below.

The JSON file contains EHR data available for prediction. Depending on the time window being evaluated, contents of the EHR data will include a subset of the data provided in the training dataset. These are grouped into the following categories:

- **Start-of-Case.** Data provided at the beginning of the case, for example GCS taken at the scene, injury type, and general demographic information.
- **At-Admission.** Data provided at hospital admission, for example vitals taken at admission and injury severity.
- **Event Time.** Timestamped data provided according to the time window in which they occur, along with timestamps relative to the beginning of the case (in seconds), for example procedures, labs, and medications.

Note that some fields provided in the EHR training dataset fall in none of these categories and will be excluded completely from the evaluation (for example, fields related to outcome or information not available in the acute period of treatment). Appendix A includes the list of possible fields provided during evaluation within each of the categories above. Appendix B includes example JSON files provided at different timepoints during a case.

The HDF5 file contains all Vital Signs (VS) data within the time window. Timeseries data will be truncated to the time window being evaluated with timestamps relative to the beginning of the case (in seconds). The single HDF5 file will include any available trends and signal data from pre-hospital and in-hospital VS data with an internal structure that mirrors the file structure provided in the training dataset.

Here is the internal structure of the HDF5 file containing all VS data sources:

```

in_hospital/
  signal/
  trends/
pre_hospital/
  signal/
  trends/
  
```

Here, “signal/” and “trends/” would contain datasets provided in separate HDF5 files in the training dataset. Only available data will be included, so not all datasets shown above will appear in every segment. The field names for each signal or trend timeseries within the HDF5 file will be identical to those in the training data and the accompanying data dictionary.

3.1.2 Client Response Message Format

Client response should contain the segment identifier (string) and the list of predicted LSIs (string). An empty list will be interpreted as the absence of any LSI predictions.

Table 1 contains the string labels expected for each LSI group, where LSI groups correspond to those used in the *LSI_table.csv* in the training dataset.

The full list of Life Saving Intervention (LSI) responses are as follows:

LSI GROUP	LABEL
Airway & Respiration	airway_and_respiration
Bleeding Control	bleeding_control
Blood Products	blood_products
Cardiovascular Procedures	cardiovascular_procedures
Chest Decompression	chest_decompression
Crystalloid Products	crystalloid_products
Neurologic Products & Procedures	neurologic_products_and_procedures
RSI Sedation Medications	rsi_sedation_medications
Vascular Access & Monitoring	vascular_access_and_monitoring
Vaso/Cardioactive Medications	vaso_cardioactive_medications
Limb Salvage	limb_salvage
Damage Control Procedures	damage_control_procedures

Here is an example response with 2 LSI groups predicted:

```
{
  "segment_id": "OUmJvhCVC5",
  "lsi_predictions": ["chest_decompression", "crystalloid_products"]
}
```

Message 2: Response format

When no LSI is predicted, an empty list is expected in the response:

```
{
  "segment_id": "OUmJvhCVC5",
  "lsi_predictions": []
}
```

Message 3: Empty response format

After the response is received, the evaluation will continue with the next segment. If a response is not received within 5 minutes after the input message was sent, an empty response will be assumed and the evaluation will continue.

3.1.3 Response Acknowledgement

The Evaluator will provide the following status information as acknowledgement after each response is received from the Client Container (or response timeout is reached):

```
{
  "segment_id": "OUmJvhCVC5",
  "delta_runtime_sec": 0.2,
  "runtime_remaining_sec": 144000.8,
  "cases_remaining": 240
}
```

Message 4: Evaluator response acknowledgment

where "segment_id" is the unique identifier for the segment just processed, "delta_runtime_sec" is the time elapsed in seconds between when input data was sent and a response was received by the Evaluator for the current segment, "runtime_remaining_sec" is the total available runtime in seconds remaining for the evaluation, and "cases_remaining" is the total number of patient cases remaining in the evaluation.

3.2 Evaluation Process

The Evaluator is responsible for accessing the held-out test dataset, processing and serving data segments to the client container (via RabbitMQ), logging responses from the client container, and performing all necessary calculations to evaluate model performance.

The Client Container is responsible for housing the submitted model, ingesting input data as provided via RabbitMQ, aggregating or storing information across data segments (as needed), pre-processing data and running model inference, and sending model responses with LSI predictions back to the Evaluator.

Once a Client Container is successfully loaded in the evaluation system, the Evaluator will begin sending test data to the Client Container to perform model inferences. Suppose that the test dataset contains N patients, $P \in \{p_1, p_2, p_3, \dots, p_N\}$, and each patient, p_i , has T time amount of recorded data. Let τ be the predetermined window size (e.g., $\tau = 5$ minutes).

Figure 2 describes step-by-step how the Evaluator and Client Container communicate during the evaluation of a single case:

- 1) **Evaluator packages input message.** The Evaluator will provide input data in the initial time window for patient p_1 , $t_{p_1} \in [0, \tau)$. This will contain data and metadata described above in Section 3.2.1.
- 2) **Evaluator sends input message.** Once the input data is constructed, the Evaluator will send to the Client Container within a single message via RabbitMQ's protocol. The Evaluator expects an acknowledgement from the Client Container.
- 3) **Client acknowledges input message.** The Client Container will receive the message and acknowledge receipt. It will then be the model's responsibility to parse the message properly and perform any pre-processing activities prior to performing inference.
- 4) **Client performs inference and sends response.** The Client Container performs model inference and constructs a response containing the list of predicted LSIs, as described above in Section 3.2.2. The response will be sent to the Evaluator as a message via RabbitMQ's messaging protocol.
- 5) **Evaluator acknowledges response.** The evaluator acknowledges receipt of the Client response with the time elapsed used for prediction. The total time available for the remaining evaluation will be reduced accordingly.
- 6) **Repeat Steps 1-5 for remainder of case.** The Evaluator will store Client response and prepare data for the next segment, $t_{p_1} \in [\tau, 2\tau)$, and repeat Steps 1-5 for the remaining segments in the case. Note that each data point is provided once within the time window in which it occurs. It is the Client Container's responsibility to store historical data from previous windows within the same case.
- 7) **Evaluator indicates end of case.** When there is no further data available for the case, the Evaluator sends a message with the end-of-case boolean flag set to "True" as described in Section 3.2.1. This will signal to the Client Container that the next input data will come from a new patient case.
- 8) **Client acknowledges end of case.** Client acknowledges end of case.
- 9) **Continue with next case.** The Evaluator will move on to patient p_2 , starting with the initial segment $t_{p_2} \in [0, \tau)$. The system will continue to iterate through all N patients.

The process above will run for every model submission, after which each teams' Event Score will be calculated from the stored model responses over the entire evaluation according to the procedure described in the DTC Rules Document.

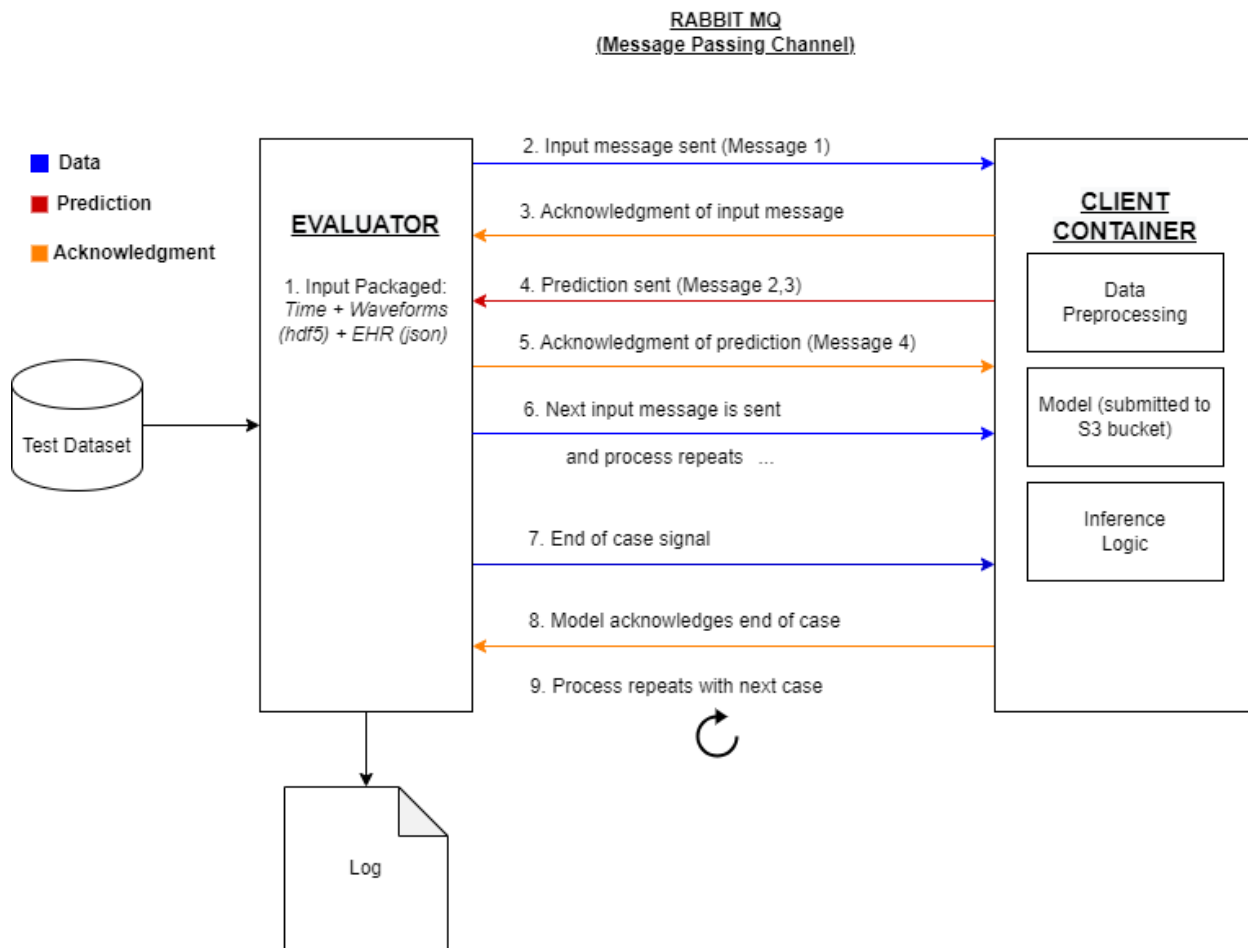


Figure 2: Messages between the Evaluator and the Client Container. At the end of a team's evaluation, the Evaluator will produce a per-team comprehensive score and a report compiling the performance of all participating teams.

3.2.1 Response Log

With each response from the Client Container (after Step 5 above), the following information will be stored to facilitate post-hoc metrics calculation and scoring:

- Patient case identifier
- Segment identifier
- Time window of evaluation segment
- Time elapsed from message sent to response received
- LSI predictions (if any)

3.2.2 Time Limitation

To ensure efficient solutions and timely evaluation, a total time limitation will be allotted for evaluation of each teams' submission. Ahead of each Workshop and Challenge event, teams will

be provided with the total time limitation and the number of cases and evaluation segments to expect (below). During the evaluation, models will be provided with feedback about run-time and remaining cases as described in Section 3.1.3. It is the teams’ responsibility to ensure their algorithm performs inference in the time provided. To prevent inadvertent hanging of a model consuming the time remaining, a 5 minute timeout will be applied to each response.

4 Evaluation Environment

We are expecting the following hardware environment and constraints for the Workshop Event:

CPU	1 CPU w/ 8 cores @ 3.50 GHz
RAM	100 GB
GPU	Titan V (12 GB VRAM, single GPU)
GPU DRIVER	NVIDIA-DRIVER Version 510.47.03
NETWORK	No access
TEST CASES	425 patient cases, 27000 evaluation segments (5 min duration)
TIME LIMITATION	24 hours

For the Challenge Event, the evaluation environment will be identical with the exception of the number of test cases and time limitation: 850 cases and 48 hours, respectively. Any changes in the evaluation environment will be communicated to teams ahead of any submission deadline.

5 Client Container Compliance

Each team must submit valid code to be used in the formal evaluation process. To facilitate proper integration with the JHU/APL evaluation system, JHU/APL is developing a CI/CD system. This system will containerize the submitted code using a standard *buildspec* and perform a series of *unit tests* to assess the built submission’s compliance with the evaluation system. The buildspec and unit test will be distributed at a future date. To test code on the CI/CD system, teams should push code to the *compliance-test* branch of their team’s repository. This action will automatically trigger the CI/CD system to pull the repository and build the code with the most recent commit. Once the build is complete, the CI/CD system will perform a series of unit tests to assess the submission’s compliance with the evaluation system. The submission must pass all unit tests to ensure proper integration with the evaluation system. Build logs (including test errors) will be stored in each team’s S3 bucket for review under the *build_logs* directory. There will be no limit to the number of times a team can test code through the CI/CD system, however costs related to running the CI/CD system will be subtracted from the team’s budget. These costs are expected to be minimal. To reduce budget usage, code should be pushed to the *compliance-test* branch sparingly.

Ahead of submission deadline, teams should push code they wish to submit to the *submission* branch and tag the specific commit that should be used for evaluation. The tag nomenclature will follow this structure: *submission-phase<PHASE_NUMBER>-<EVENT_TYPE>*, where $PHASE_NUMBER \in \{1, 2, 3\}$ and $EVENT_TYPE \in \{\text{workshop, challenge}\}$. For example, for the Phase 1 Workshop and Challenge events, the intended submission should be tagged as *submission-*

phase1-workshop and *submission-phase1-challenge*, respectively. This will ensure that the specific, unambiguous commit is evaluated as the official submission. Teams may modify which commit is tagged up to the submission deadline, at which point the code will be pulled down for evaluation.

JHU/APL will provide a client shell that includes implementation instructions as starter code. The shell contains the minimum required structure to pass all unit tests and create a working Client Container. It is expected that teams will need to add their own packages and model-specific code to the provided client shell.

Client Shell, buildspec, and unit test scripts will be provided to teams in an AWS CodeCommit repository (<https://git-codecommit.us-east-1.amazonaws.com/v1/repos/client-shell>). In addition, teams will be provided with tools to convert data from the training dataset into the format expected at evaluation time. We will announce future updates to this repository on the DTC Forum.

6 Appendix A – Fields Provided During Evaluation

Table A.1: Start-of-Case UMB Fields

Table	Field
demo_scores	SEXID
demo_scores	RACEID
demo_scores	race_descrip
demo_scores	AGE
demo_scores	INJTYPEID
demo_scores	INJURYTYPEDESCRIP
demo_scores	ICD10ECODE
demo_scores	RTS_S
ems	LANDVSAIR

Table A.2: At-Admission UMB Fields

Table	Field
demo_scores	ADM_TEMP
demo_scores	ADM_SYSBP
demo_scores	ADM_DYSBP
demo_scores	ADM_HR
demo_scores	ADM_RR
demo_scores	ADM_O2SAT
demo_scores	ADM_GCS_EYE
demo_scores	ADM_GCS_VERBAL
demo_scores	ADM_GCS_MOTOR
demo_scores	GCSTOTAL
demo_scores	BRAINSEV
demo_scores	FACESEV
demo_scores	NECKSEV
demo_scores	THORAXSEV
demo_scores	ABDSEV
demo_scores	SPINESEV
demo_scores	UPPEREXTSEV
demo_scores	LOWEREXTSEV
demo_scores	ISS
demo_scores	TRISS
demo_scores	RTS_A
injury	AISSEVERITY
injury	ISSBODYREGION
injury	ICD10CODE

LSI_table*	lsi_group
LSI_table*	lsi_description
LSI_table*	in_hospital

*Note: Pre-hospital LSI records are provided at-admission (in_hospital = 0).

Table A.3: Event Time UMB Fields

Table	Field	Timestamp Field
death	BRAINDEATH_elapsed_from_start [†]	BRAINDEATH_elapsed_from_adm
death	WITHDRAWAL_CARE_elapsed_from_start [†]	WITHDRAWAL_CARE_elapsed_from_adm
labs	OBSDATETIME_elapsed_from_start [†]	OBSDATETIME_elapsed_from_adm, RSLTDATETIME_elapsed_from_adm
labs	COMPTXT	OBSDATETIME_elapsed_from_adm, RSLTDATETIME_elapsed_from_adm
labs	TESTTEXT	OBSDATETIME_elapsed_from_adm, RSLTDATETIME_elapsed_from_adm
labs	RSLTDATETIME_elapsed_from_start [†]	RSLTDATETIME_elapsed_from_adm
labs	RSLT	RSLTDATETIME_elapsed_from_adm
labs	UNITS	RSLTDATETIME_elapsed_from_adm
non_op_procs	DESCRIP	elapsed_from_adm
non_op_procs	elapsed_from_start [†]	elapsed_from_adm
operations	CPT	OR_START_TIME_elapsed_from_adm, OR_STOP_TIME_elapsed_from_adm
operations	SERVICEID	OR_START_TIME_elapsed_from_adm, OR_STOP_TIME_elapsed_from_adm
operations	SERVICE_DESCRIP	OR_START_TIME_elapsed_from_adm, OR_STOP_TIME_elapsed_from_adm
operations	PROCTEXT	OR_START_TIME_elapsed_from_adm, OR_STOP_TIME_elapsed_from_adm
operations	OR_START_TIME_elapsed_from_start [†]	OR_START_TIME_elapsed_from_adm, OR_STOP_TIME_elapsed_from_adm
operations	OR_STOP_TIME_elapsed_from_start [†]	OR_STOP_TIME_elapsed_from_adm
medications	display_name	elapsed_from_adm
medications	mar_action	elapsed_from_adm
medications	sig	elapsed_from_adm
medications	dose_unit	elapsed_from_adm
medications	route	elapsed_from_adm
medications	pat_loc	elapsed_from_adm
medications	pharm_class	elapsed_from_adm
medications	pharm_subclass	elapsed_from_adm
medications	thera_class	elapsed_from_adm
medications	elapsed_from_start [†]	elapsed_from_adm
pta_vitals*	PTA_SBP	elapsed_from_adm
pta_vitals*	PTA_DBP	elapsed_from_adm

pta_vitals*	PTA_HR	elapsed_from_adm
pta_vitals*	PTA_RR	elapsed_from_adm
pta_vitals*	PTA_TEMP	elapsed_from_adm
pta_vitals*	PTA_GCS_TOTAL	elapsed_from_adm
pta_vitals*	PTA_GCS_V	elapsed_from_adm
pta_vitals*	PTA_GCS_M	elapsed_from_adm
pta_vitals*	PTA_GCS_E	elapsed_from_adm
pta_vitals*	elapsed_from_start†	elapsed_from_adm
LSI_table	lsi_group	elapsed_from_adm
LSI_table	lsi_description	elapsed_from_adm
LSI_table	in_hospital	elapsed_from_adm
LSI_table	elapsed_from_start†	elapsed_from_adm

*Note: if “elapsed_from_adm” in pta_vitals is *null*, this record will be provided at-admission.

†Elapsed times will be provided from start of case.

Table A.4: Start-of-Case UPitt Fields

Table	Field
burns	BurnsMethod
burns	BurnsPerc1stDegree
burns	BurnsPerc2ndDegree
burns	BurnsPerc3rdDegree
burns	BurnsPercArmsAnterior
burns	BurnsPercArmsPoterior
burns	BurnsPercHeadAnterior
burns	BurnsPercHeadPoterior
burns	BurnsPercLegsAnterior
burns	BurnsPercLegsPoterior
burns	BurnsPercTrunkAnterior
burns	BurnsPercTrunkPoterior
burns	CarboninMouth
burns	PoorVentilation
burns	SingedNasalHairs
burns	TBSA
burns	Type
burns	CO
fluids	INBeforeCOLL
fluids	INBeforeCrys
fluids	INBeforeOther
fluids	OUTBeforeEBL
fluids	OUTBeforeOther
fluids	OUTBeforeUO

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injurydetails	DrugsAlcoholIndicator
injurydetails	DrugsAlcoholIndicator1
injurydetails	DrugsAlcoholIndicator2
injurydetails	DrugsAlcoholIndicator3
injurydetails	DrugsAlcoholIndicator4
injurydetails	DrugsAlcoholIndicator5
injurydetails	FallHeight
injurydetails	FallHeightUnits
injurydetails	FallSurface
injurydetails	InjuryCause
injurydetails	IntentionalInjury
injurydetails	LandedOn
injurydetails	ReasonForEncounter
injurydetails	WorkRelated
injurydetails	InjuryMechanism
injurydetails	InjuryMechanism1
injurydetails	InjuryMechanism2
injurydetails	InjuryMechanism3
injurydetails	TraumaCenterCriterion
injurydetails	TraumaCenterCriterion1
injurydetails	TraumaCenterCriterion2
injurydetails	TraumaCenterCriterion3
injurydetails	TraumaCenterCriterion4
injurydetails	TraumaCenterCriterion5
ipfmisc	BurnArea
ipfmisc	BurnBodySide
ipfmisc	BurnDegree
ipfmisc	BurnPercentage
ipfmisc	Impression
ipfmisc	AbdomenAppearance
ipfmisc	AbdomenPalpation
ipfmisc	BackBoardPTA
ipfmisc	CCollarPTA
ipfmisc	CIDPTA
ipfmisc	ImmobilizationPTAOutcome
ipfmisc	ImmobilizationPTAPerformedBy
ipfmisc	KEDPTA
ipfmisc	Trachea
ipfmisc	InjurySymptom
ipfmisc	PrimaryInjurySystem

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ipfspc	MentalAssessment
ipfspc	NeurologicalAssessment
ipfspc	SkinAssessment
neuro	LevelofConsciousness
neuro	ChemParalyzed
neuro	InitialGCSEye
neuro	InitialGCSMotor
neuro	InitialGCSTotal
neuro	InitialGCSVerbal
neuro	LossofConsciousness
neuro	MotorLA
neuro	MotorLL
neuro	MotorRA
neuro	MotorRL
neuro	PupilReactivityL
neuro	PupilReactivityR
neuro	PupilSizeL
neuro	PupilSizeR
neuro	RevisedTraumaScore
neuro	RevisedTraumaScoreBP
neuro	RevisedTraumaScoreResp
neuro	SensoryLA
neuro	SensoryLL
neuro	SensoryRA
neuro	SensoryRL
patient	AgeInYears
patient	AgeType
patient	ChiefComplaint
patient	ChiefComplaintDuration
patient	Gender
patient	Height
patient	HeightType
patient	MedicalNecessity
patient	Race
patient	ReasonforInterfacilityTransfer
patient	Weight
patient	PatientAge
patient	WeightType
patient	PatientActivity
priorivs	IVGauge

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priorivs	IVRate
priorivs	IVSeq
priorivs	IVSite
priorivs	IVSolution
priormeds	MedRoute
priormeds	MedConcentration
priormeds	MedDose
priormeds	MedDrip
priormeds	MedName
priormeds	MedNameCoded
priormeds	MedRouteName
priormeds	MedSeq
priormeds	RouteCoded
scene	AnatomicLocation
scene	AnatomicLocation1
scene	AnatomicLocation2
scene	AnatomicLocation3
scene	AnatomicLocation4
scene	AnatomicLocation5
scene	AnatomicLocation6
scene	AnatomicLocation7
scene	Belongings
scene	FinalAcuity
scene	InitialPatientAcuity
scene	NumberPatientsAtScene
scene	SceneDescription

Table A.5: At-Admission UPitt Fields

Table	Field
airway	AirwayOutcome
airway	AirwayPerformedBy
airway	AirwaySecuredVia
airway	AirwayStatus
airway	AirwayVerification
airway	AirwayVerification1
airway	AirwayVerification2
airway	AirwayVerification3
airway	AirwayVerification4
airway	AirwayVerification5
airway	AirwayVerification6

cardiac	AEDUse
cardiac	CardiacArrestPresent
cardiac	CPRBy
cardiac	DefibBy
cardiac	DefibrillatorType
cardiac	EndEvent
cardiac	Etiology
cardiac	InitialRhythm
cardiac	ReasonTerminated
cardiac	Resuscitation1
cardiac	Resuscitation2
cardiac	TherapeuticHypothermia
cardiac	WhoWitnessed
cardiac	CPRTType
cardiac	CPRTType1
cardiac	CPRTType2
cardiac	CPRTType3
cardiac	CPRTType4
cardiac	DestRhythm
cardiovascular	CapillaryRefill
cardiovascular	Edema
cardiovascular	JVD
cardiovascular	PulseBrachialL
cardiovascular	PulseBrachialR
cardiovascular	PulseCarotidL
cardiovascular	PulseCarotidR
cardiovascular	PulseFemoralL
cardiovascular	PulseFemoralR
cardiovascular	PulseRadialL
cardiovascular	PulseRadialR
cardiovascular	TempDegreesType
cardiovascular	Temperature
cardiovascular	TemperatureObtainedMethod
cardiovascular	InvasiveArterialLine
drain	ChestTubeSizeL
drain	ChestTubeSizeR
drain	ChestTubeSuctionL
drain	ChestTubeSuctionR
drain	Colostomy
drain	FoleySize

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drain	Hematuria
drain	Ileostomy
drain	NGSuction
drain	NGTubeSize
drain	OGSuction
drain	OGTube
drain	Other
drain	PEGCapped
drain	PEGTube
drain	Ventriculostomy
drain	VentriculostomyColor
patient	BarriersToCareNew
patient	BloodType
receiving	HospitalUnit
receiving	ModetoRec
receiving	ReceivingHospitalUnit
receiving	ReceivingID
receiving	ReceivingType
receiving	RecHospDesignation
receiving	ReceivingModeDescriptor
receiving	ReferringModeDescriptor
receiving	ReceivingName
respiratory	BreathSoundsLeft
respiratory	BreathSoundsRight
respiratory	OxygenDeliveryMethod
respiratory	OxygenFlow
respiratory	RespEffort
scene	FinalAcuity
ventilator	BreathType_vent
ventilator	FIO2_vent
ventilator	IERation_vent
ventilator	InspPressure_vent
ventilator	ITime_vent
ventilator	MeanAirwayPressure_vent
ventilator	MV_vent
ventilator	PEEP_vent
ventilator	PIP_vent
ventilator	PressureSupport_vent
ventilator	Rate_vent
ventilator	RespRateM_vent

ventilator	TV_vent
ventilator	Ino_vent
ventilator	PTA
ventilator	VentMode
hosp_ais	ais_severity_issbodyregion
hosp_wide	hospital
hosp_wide	destination
hosp_wide	age
hosp_wide	sex
hosp_wide	ecode
hosp_wide	sbp
hosp_wide	resp
hosp_wide	gcs
hosp_wide	gcs_m
hosp_wide	iss
hosp_wide	ethnicity
hosp_wide	etiology
hosp_wide	hgt_fall
hosp_wide	inj_type
hosp_wide	extric_s
hosp_wide	sign_life
hosp_wide	base_def
hosp_wide	blood_pre
hosp_wide	sao2_a
hosp_wide	pulse_a
hosp_wide	sedated_a
hosp_wide	pupil_a
hosp_wide	par_drg_a
hosp_wide	intubat_a
hosp_wide	temp_c
hosp_wide	lsys_bp_s
hosp_wide	lsys_bp_1
hosp_wide	lsys_bp_r
hosp_wide	lsys_bp_2
hosp_wide	maximum_ais_1
hosp_wide	maximum_ais_2
hosp_wide	maximum_ais_3
hosp_wide	maximum_ais_4
hosp_wide	maximum_ais_5
hosp_wide	maximum_ais_6

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hosp_wide	max_sev_aisbr_1
hosp_wide	max_sev_aisbr_2
hosp_wide	max_sev_aisbr_3
hosp_wide	max_sev_aisbr_4
hosp_wide	max_sev_aisbr_5
hosp_wide	max_sev_aisbr_6
hosp_wide	max_sev_aisbr_7
hosp_wide	max_sev_aisbr_8
hosp_wide	max_sev_aisbr_9
hosp_wide	race
hosp_wide	transfer
hosp_wide	rts
hosp_wide	pstriss
hosp_icd_dx	icd9dx
hosp_icd_dx	icd10dx
hosp_trqt	trqt_use
hosp_trqt	trqt
hosp_trqt	trqt_place
hosp_trqt	trqt_type

Table A.6: Event Time UPitt Fields

Table	Field	Timestamp Field
events	BloodPressureDiastolic	elapsed_from_adm
events	BloodPressureSystolic	elapsed_from_adm
events	BPMethod	elapsed_from_adm
events	Carboxyhemoglobin	elapsed_from_adm
events	ECGMethod	elapsed_from_adm
events	EndotrachealCO2	elapsed_from_adm
events	EndotrachealCO2Type	elapsed_from_adm
events	GCSEye	elapsed_from_adm
events	GCSMotor	elapsed_from_adm
events	GCSVerbal	elapsed_from_adm
events	Glucose	elapsed_from_adm
events	HeartRate	elapsed_from_adm
events	HeartRateMethod	elapsed_from_adm
events	LevelofConsciousness	elapsed_from_adm
events	MeanArterialPressure	elapsed_from_adm
events	OxygenSaturation	elapsed_from_adm
events	Procedure	elapsed_from_adm
events	PulseRhythm	elapsed_from_adm

events	Respiration	elapsed_from_adm
events	RespiratoryEffort	elapsed_from_adm
events	RhythmCoded	elapsed_from_adm
events	TempDegreesType	elapsed_from_adm
events	Temperature	elapsed_from_adm
events	TemperatureObtainedMethod	elapsed_from_adm
events	VitalRhythms	elapsed_from_adm
events	elapsed_from_start [†]	elapsed_from_adm
ipfgen	AssessmentLocation	elapsed_from_adm
ipfgen	elapsed_from_start [†]	elapsed_from_adm
labs	ALB	elapsed_from_adm
labs	AlcoholOnBreath	elapsed_from_adm
labs	ALT	elapsed_from_adm
labs	APAP	elapsed_from_adm
labs	APHI	elapsed_from_adm
labs	AST	elapsed_from_adm
labs	BE	elapsed_from_adm
labs	BGAccess	elapsed_from_adm
labs	BILI	elapsed_from_adm
labs	BloodAlcohol	elapsed_from_adm
labs	BNP	elapsed_from_adm
labs	BUN	elapsed_from_adm
labs	CA	elapsed_from_adm
labs	CL	elapsed_from_adm
labs	CO2	elapsed_from_adm
labs	COHB	elapsed_from_adm
labs	CPK	elapsed_from_adm
labs	CR	elapsed_from_adm
labs	DDimer	elapsed_from_adm
labs	GLU	elapsed_from_adm
labs	HcgSerum	elapsed_from_adm
labs	HcgUrine	elapsed_from_adm
labs	HCO3	elapsed_from_adm
labs	HCT	elapsed_from_adm
labs	HGB	elapsed_from_adm
labs	INR	elapsed_from_adm
labs	IonizedCalcium	elapsed_from_adm
labs	K	elapsed_from_adm
labs	LactateArterial	elapsed_from_adm
labs	LactateVenous	elapsed_from_adm

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labs	Lipase	elapsed_from_adm
labs	MG	elapsed_from_adm
labs	NA	elapsed_from_adm
labs	PCO2	elapsed_from_adm
labs	PH	elapsed_from_adm
labs	PLTS	elapsed_from_adm
labs	PO2	elapsed_from_adm
labs	PT	elapsed_from_adm
labs	PTA	elapsed_from_adm
labs	PTT	elapsed_from_adm
labs	RBC	elapsed_from_adm
labs	SAT	elapsed_from_adm
labs	SVO2	elapsed_from_adm
labs	TBILI	elapsed_from_adm
labs	Troponin	elapsed_from_adm
labs	WBC	elapsed_from_adm
labs	elapsed_from_start†	elapsed_from_adm
proclabs	LabIonizedCalcium	elapsed_from_adm
proclabs	LabLactateArterial	elapsed_from_adm
proclabs	LabLactateVenous	elapsed_from_adm
proclabs	LabPTA	elapsed_from_adm
proclabs	LabsBE	elapsed_from_adm
proclabs	LabsBGAccess	elapsed_from_adm
proclabs	LabsCl	elapsed_from_adm
proclabs	LabsGlu	elapsed_from_adm
proclabs	LabsHCO3	elapsed_from_adm
proclabs	LabsHgb	elapsed_from_adm
proclabs	LabsK	elapsed_from_adm
proclabs	LabsNa	elapsed_from_adm
proclabs	LabsOther	elapsed_from_adm
proclabs	LabsPCO2	elapsed_from_adm
proclabs	LabspH	elapsed_from_adm
proclabs	LabsPO2	elapsed_from_adm
proclabs	LabsSAT	elapsed_from_adm
proclabs	LabSVO2	elapsed_from_adm
proclabs	elapsed_from_start†	elapsed_from_adm
procmain	AirwayAction	elapsed_from_adm
procmain	AirwayOxygenFlow	elapsed_from_adm
procmain	CardiacAction	elapsed_from_adm
procmain	CardiacDefibType	elapsed_from_adm

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procmain	CardiacPacingEnergy	elapsed_from_adm
procmain	CardiacPacingMode	elapsed_from_adm
procmain	CardiacPacingRate	elapsed_from_adm
procmain	CardiacShockEnergy	elapsed_from_adm
procmain	CardiacShockType	elapsed_from_adm
procmain	DrainAction	elapsed_from_adm
procmain	DrainSide	elapsed_from_adm
procmain	DrainSize	elapsed_from_adm
procmain	DrainSizeUnit	elapsed_from_adm
procmain	DrainSuction	elapsed_from_adm
procmain	HospNotifyAlertType	elapsed_from_adm
procmain	HospNotifyMethod	elapsed_from_adm
procmain	HospNotifyRegistryCandidate	elapsed_from_adm
procmain	ImmobOption	elapsed_from_adm
procmain	InitiateIVGauge	elapsed_from_adm
procmain	InitiateIVSite	elapsed_from_adm
procmain	InitiateIVType	elapsed_from_adm
procmain	IntubationCMatLips	elapsed_from_adm
procmain	IntubationCuffFill	elapsed_from_adm
procmain	IntubationCuffFillQty	elapsed_from_adm
procmain	IntubationLaryngoscopicGrade	elapsed_from_adm
procmain	IntubationLaryngoscopeBlade	elapsed_from_adm
procmain	IntubationMallampati	elapsed_from_adm
procmain	IntubationMethod	elapsed_from_adm
procmain	IntubationRSIProtocol	elapsed_from_adm
procmain	IntubationSellickManeuver	elapsed_from_adm
procmain	IntubationSize	elapsed_from_adm
procmain	IntubationStyletUsed	elapsed_from_adm
procmain	MedicalConsultMethod	elapsed_from_adm
procmain	MedicationDosage	elapsed_from_adm
procmain	MedicationDosageUnit	elapsed_from_adm
procmain	MedicationName	elapsed_from_adm
procmain	MedicationRate	elapsed_from_adm
procmain	MedicationRateUnit	elapsed_from_adm
procmain	MedicationRoute	elapsed_from_adm
procmain	Procedure	elapsed_from_adm
procmain	ProcedureAttempts	elapsed_from_adm
procmain	ProcedureAuthorization	elapsed_from_adm
procmain	elapsed_from_start [†]	elapsed_from_adm
procmain	ProcedureResponse	elapsed_from_adm

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procmain	ProcedureSuccessful	elapsed_from_adm
procmain	TitrateMedication	elapsed_from_adm
procmain	TitrateNewDose	elapsed_from_adm
procmain	TitrateNewDoseRoute	elapsed_from_adm
procmain	TitrateNewDoseUnit	elapsed_from_adm
procmain	ComplicationAirwayIntubation	elapsed_from_adm
procmain	ComplicationAirwayIntubation1	elapsed_from_adm
procmain	ComplicationAirwayIntubation2	elapsed_from_adm
procmain	ComplicationAirwayIntubation3	elapsed_from_adm
procmain	ComplicationAirwayIntubation4	elapsed_from_adm
procmain	ComplicationAirwayIntubation5	elapsed_from_adm
procmain	ProcedureComplication	elapsed_from_adm
procmain	ProcedureComplication1	elapsed_from_adm
procmain	ProcedureComplication2	elapsed_from_adm
procmain	ProcedureComplication3	elapsed_from_adm
procmain	ProcedureComplication4	elapsed_from_adm
procmain	ProcedureComplication5	elapsed_from_adm
procmain	ProcedureFailureReason	elapsed_from_adm
procmain	ProcedureFailureReason1	elapsed_from_adm
procmain	ProcedureFailureReason2	elapsed_from_adm
procmain	ProcedureFailureReason3	elapsed_from_adm
procmain	ProcedureFailureReason4	elapsed_from_adm
procother	ImmobilizationAction	elapsed_from_adm
procother	ImmobilizationAction1	elapsed_from_adm
procother	ImmobilizationAction2	elapsed_from_adm
procother	ImmobilizationAction3	elapsed_from_adm
procother	ImmobilizationAction4	elapsed_from_adm
procother	ImmobilAssessment	elapsed_from_adm
procother	ImmobilAssessment1	elapsed_from_adm
procother	ImmobilAssessment2	elapsed_from_adm
procother	ImmobilAssessment3	elapsed_from_adm
procother	ImmobilAssessment4	elapsed_from_adm
procother	ImmobilAssessment5	elapsed_from_adm
procother	ImmobilSite	elapsed_from_adm
procother	ImmobilSite1	elapsed_from_adm
procother	ImmobilSite2	elapsed_from_adm
procother	ImmobilSite3	elapsed_from_adm
procother	ImmobilSite4	elapsed_from_adm
procother	elapsed_from_start [†]	elapsed_from_adm
procother	IntubationIndication	elapsed_from_adm

procother	IntubationIndication1	elapsed_from_adm
procother	IntubationIndication2	elapsed_from_adm
procother	IntubationIndication3	elapsed_from_adm
procother	IntubationIndication4	elapsed_from_adm
procother	IntubationIndication5	elapsed_from_adm
procother	IntubationVerification	elapsed_from_adm
procother	IntubationVerification1	elapsed_from_adm
procother	IntubationVerification2	elapsed_from_adm
procother	IntubationVerification3	elapsed_from_adm
procother	IntubationVerification4	elapsed_from_adm
procother	IntubationVerification5	elapsed_from_adm
procother	IntubationVerification6	elapsed_from_adm
procvent	Procedure	elapsed_from_adm
procvent	ITime	elapsed_from_adm
procvent	MeanAirwayPressure	elapsed_from_adm
procvent	VentilatorAction	elapsed_from_adm
procvent	VentilatorMode	elapsed_from_adm
procvent	VentilatorMode1	elapsed_from_adm
procvent	VentilatorMode2	elapsed_from_adm
procvent	nippv_id	elapsed_from_adm
procvent	vent_id	elapsed_from_adm
procvent	vent_before	elapsed_from_adm
procvent	AutoPeep	elapsed_from_adm
procvent	BreathType	elapsed_from_adm
procvent	BreathType1	elapsed_from_adm
procvent	BreathType2	elapsed_from_adm
procvent	Deltap	elapsed_from_adm
procvent	FiO2	elapsed_from_adm
procvent	FlowRate	elapsed_from_adm
procvent	IERation	elapsed_from_adm
procvent	InspPressure	elapsed_from_adm
procvent	MV	elapsed_from_adm
procvent	PEEP	elapsed_from_adm
procvent	PIP	elapsed_from_adm
procvent	PressureSupport	elapsed_from_adm
procvent	Rate	elapsed_from_adm
procvent	elapsed_from_start [†]	elapsed_from_adm
procvent	RespRateM	elapsed_from_adm
procvent	Sensitivity	elapsed_from_adm
procvent	TV	elapsed_from_adm

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procvent	ProcedureVentilatorPTA	elapsed_from_adm
procvent	VentilatorVersion	elapsed_from_adm
times	DateArrived_elapsed_from_start [†]	DateArrived_elapsed_from_adm
times	DateArriveRec_elapsed_from_start [†]	DateArriveRec_elapsed_from_adm
times	DateAtPt_elapsed_from_start [†]	DateAtPt_elapsed_from_adm
times	DateAvailable_elapsed_from_start [†]	DateAvailable_elapsed_from_adm
times	DateDispatched_elapsed_from_start [†]	DateDispatched_elapsed_from_adm
times	DateEnroute_elapsed_from_start [†]	DateEnroute_elapsed_from_adm
times	DateInQtrs_elapsed_from_start [†]	DateInQtrs_elapsed_from_adm
times	DateLeavePt_elapsed_from_start [†]	DateLeavePt_elapsed_from_adm
times	DateLeaveRef_elapsed_from_start [†]	DateLeaveRef_elapsed_from_adm
times	DateNotified_elapsed_from_start [†]	DateNotified_elapsed_from_adm
times	DateofDescent_elapsed_from_start [†]	DateofDescent_elapsed_from_adm
times	DateReceived_elapsed_from_start [†]	DateReceived_elapsed_from_adm
times	DateStandby_elapsed_from_start [†]	DateStandby_elapsed_from_adm
times	DateTxCare_elapsed_from_start [†]	DateTxCare_elapsed_from_adm
LSI_table	lsi_group	elapsed_from_adm
LSI_table	lsi_description	elapsed_from_adm
LSI_table	in_hospital	elapsed_from_adm
LSI_table	elapsed_from_start [†]	elapsed_from_adm

[†]Elapsed times will be provided from start of case.

7 Appendix B – Example EHR Partition JSONs

All data is drawn from the sample dataset, which contains unprotected, scrambled. As a result, the values of fields may not be consistent.

Example EHR data segment with start-of-case data from the UMB dataset:

```
{
  "demo_scores": [
    {
      "SEXID": "M",
      "RACEID": "C",
      "race_descrip": "White",
      "AGE": 61,
      "INJTYPEID": 1,
      "INJURYTYPEDESCRIP": "Blunt",
      "ICD10ECODE": "V22.4XXA",
      "RTS_S": 7.8408
    }
  ],
  "ems": [
    {
      "LANDVSAIR": "A"
    }
  ]
}
```

Example EHR data segment containing hospital admission and timestamped data from the UMB dataset:

```
{
  "LSI_table": [
    {
      "lsi_group": "Bleeding Control",
      "lsi_description": "Pelvic Binder",
      "in_hospital": 0,
      "elapsed_from_start": NaN
    }
  ],
  "demo_scores": [
    {
      "ADM_TEMP": 36.4,
      "ADM_SYSBP": 88,
      "ADM_DYSBP": 50,
      "ADM_HR": 79.0,
      "ADM_RR": 16,
      "ADM_O2SAT": 94,
      "ADM_GCS_EYE": 4.0,
      "ADM_GCS_VERBAL": 5.0,
    }
  ]
}
```

```

"ADM_GCS_MOTOR": 6.0,
"GCSTOTAL": 15.0,
"BRAINSEV": 0,
"FACESEV": 0,
"NECKSEV": 0,
"THORAXSEV": 0,
"ABDSEV": 3,
"SPINESEV": 0,
"UPPEREXTSEV": 0,
"LOWEREXTSEV": 0,
"ISS": 9,
"TRISS": 0.989,
"RTS_A": 7.1082,
"elapsed_from_start": 2400.0
}
],
"injury": [
{
"AISSEVERITY": 2.0,
"ISSBODYREGION": 4,
"ICD10CODE": "S36.529A"
},
{
"AISSEVERITY": 3.0,
"ISSBODYREGION": 4,
"ICD10CODE": "S36.893A"
}
],
"non_op_procs": [
{
"DESCRIP": "Cardiac Monitoring",
"elapsed_from_start": 2400.0
},
{
"DESCRIP": "CT Scan - Abdomen",
"elapsed_from_start": 2400.0
},
{
"DESCRIP": "CT Scan - Cervical Spine",
"elapsed_from_start": 2400.0
},
{
"DESCRIP": "CT Scan - Thoracic Spine",
"elapsed_from_start": 2400.0
}
],
"pta_vitals": [
{
"PTA_SBP": 113.0,
"PTA_DBP": 67.0,
"PTA_HR": 85.0,
"PTA_RR": 18.0,
"PTA_TEMP": NaN,
"PTA_GCS_TOTAL": 15.0,

```

```

    "PTA_GCS_V": 5.0,
    "PTA_GCS_M": 6.0,
    "PTA_GCS_E": 4.0,
    "elapsed_from_start": NaN
  }
]
}

```

Example EHR data segment containing timestamped data after hospital admission from the UMB dataset:

```

{
  "LSI_table": [
    {
      "lsi_group": "Crystalloid Products",
      "lsi_description": "Plasmalyte",
      "in_hospital": 1,
      "elapsed_from_start": 2870.0
    }
  ],
  "labs": [
    {
      "COMPTTEXT": "Osmolality (serum)",
      "TESTTEXT": "Osmolality",
      "RSLT": "339",
      "UNITS": "MoM/kg",
      "RSLTDATETIME_elapsed_from_start": 2750.0,
      "OBSDATETIME_elapsed_from_start": 350.0
    },
    {
      "COMPTTEXT": "Albumin Level",
      "TESTTEXT": "CMP",
      "RSLT": "5.0",
      "UNITS": "g/dL",
      "RSLTDATETIME_elapsed_from_start": 2930.0,
      "OBSDATETIME_elapsed_from_start": 350.0
    }
  ],
  "medications": [
    {
      "display_name": "plasmalyte-A bolus",
      "mar_action": "Given",
      "sig": 500.0,
      "dose_unit": "mL",
      "route": "Intravenous",
      "pat_loc": "PACU",
      "pharm_class": "Minerals & electrolytes",
      "pharm_subclass": "Electrolyte Mixtures",
      "thera_class": "Nutritional Products",
      "elapsed_from_start": 2875.0
    }
  ]
}

```