

# **Asthma Exacerbations (AE) Database and Analysis: Summarizing Report**

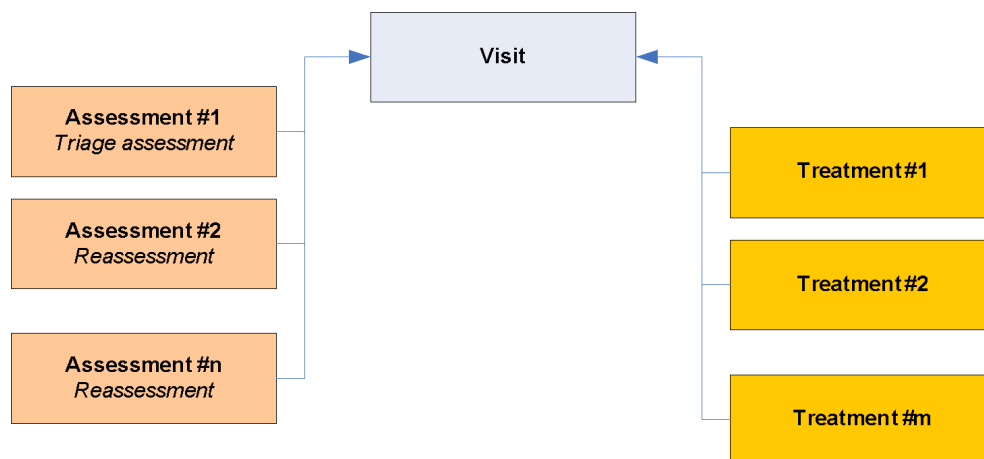
## **1. AE database**

### **1.1. Source database**

The data in the source asthma exacerbations (AE) database was collected and transcribed by means of a retrospective chart study in the summer of 2004. The study was based on a sample of randomly selected patients with asthma who were seen in the ED at xxx between January 1, 2003 and December 31, 2003. In addition to visits occurring in 2003, charts of selected patients were reviewed for additional ED visits for asthma occurring at any time after January 1, 2000. The first visit in the database was on November 3, 2000, while the last one was on July 7, 2004.

The triage process and way by which the patients' charts are filled out is as follows. First, when a patient with asthmatic exacerbations arrives at the ED, a triage nurse gathers basic information on the patient's presenting complaint. At this point the patient is also registered (this includes collecting basic demographics). Then the physician collects and records multiple pieces of information, including the patient's underlying disease severity, presence of known risk factors signifying more serious disease, outcomes of previous exacerbations, and the length and severity of symptoms during this exacerbation. At the same time the patient is assessed (physically examined) for the first time – this initial assessment is denoted as the triage assessment. Management of the asthma exacerbations includes repeated treatments (i.e., masks) at intervals from every few minutes (continuous) to every few hours. All prescribed treatments are recorded on the chart. Moreover, throughout the patient's ED stay, the patient is reassessed by the physician or by the nurse to check her/his response to treatment and the same attributes which were collected during the triage assessment are recorded. Repeated assessments (reassessments) may be performed irregularly as they depend not only on the patient's condition, but also on the load in the ED.

Data was transcribed from the charts into a database where each of the multiple assessments and treatments that were made for a given patient is recorded. The general schema of the database is presented in Figure 1. The database is aimed at storing information about visits – there may be several visits recorded for the same patient and each is represented as a separate entry. Each visit is linked to all conducted assessments (including the triage assessment and subsequent reassessments) and all prescribed and applied treatments (masks). Attributes describing visit, assessment and treatment are presented in Table 1, 2 and 3 respectively. Visits, assessments and treatments are also time-stamped, thus it is possible to calculate time offsets between specific assessments and treatments (the triage assessment is used as a starting point, as it is the actual moment when the management process starts).



**Figure 1. Schema of the source AE database**

**Table 1. Visit attributes**

#	Attribute	Code	Possible values
1	Registration Age	REG_AGE	Age in years (continuous)
2	Primary Care	PRIM_CARE	FD, PEDS, OTHER, NONE
3	Chest Clinic	CHEST_CLINIC	YES, NO
4	Current Inhaled Steroids	CURR_INH_STEROID	LT_1W (< 1 week), GE_1W_LT_4W (≥ 1 week and < 4 weeks), GE_4W (≥ 4 weeks), NONE, PRN
5	Age of First Symptoms	AGE_FIRST_SX	Age in years (continuous)
6	Previous Oral Steroids	PREV_ORAL_STEROID	LT_1M(< 1 month), GE_1M_LT_3 (≥ 1 month and < 3 months), GE_3M_LT_12M (≥ 3 months and < 12 months), GE_12M (≥ 12 months), NONE
7	Previous ED Last Year	PREV_ED_LAST_YEAR	1_VISIT (1 visit), 2_VISTIS (2 visits), 3_VISITS (3 visits), GE_4_VISITS (≥ 4 visits), NONE
8	Previous Admission	PREV_ADM	FLOOR, ICU, NONE
9	Smokey Environment	ENV_SMOKE	YES, NO
10	Dander in Environment	ENV_DANDER	YES, NO
11	Carpets in Environment	ENV_CARPETS	YES, NO
12	Allergic Environment	ALLG_ENV	YES, NO
13	Allergic Pets	ALLG_PETS	YES, NO
14	Allergic Food	ALLG_FOOD	YES, NO
15	PTHX Atopy	PTHX_ATOPY	YES, NO
16	FMHX Asthma	FMHX_ASTHMA	YES, NO
17	Allergy Exposure	ALLG_EXP	YES, NO
18	URTI Symptoms	URTI_SX	YES, NO
19	Fever	FEVER	YES, NO
20	Duration of Symptoms	DUR_ASTHMA_SX	Duration in hours (continuous)
21	Ventilation in Last 24h	VENT_LAST_24H	Number of treatments (integer)
22	Arrival to the ED	ARRV_ED	AMBULANCE, PARENTS

#	Attribute	Code	Possible values
23	Category	CORR_CATEGORY	SHORT, LONG, ADMIT

**Table 2. Assessment attributes**

#	Attribute	Code	Possible values
1	Temperature	TEMP	Temperature in °C (continuous)
2	<del>Temperature Type</del>	<del>TEMP_TYPE</del>	<del>AXILLARY, ORAL, RECTAL</del>
3	Respiratory Rate	RESP_RATE	Breaths per minute (continuous)
4	Heart Rate	HEART_RATE	Beats per minute (continuous)
5	Oxygen Saturation	SAO2	Saturation (continuous)
6	Oxygen Environment	SAO2_ENV	ROOM_AIR (room air), SUPPL_O2 (supplemental oxygen)
7	Air Entry	AIR_ENTRY	GOOD, FAIR, POOR
8	Distress	DISTRESS	NONE, MILD, MODERATE, SEVERE
9	Skin Colour	COLOUR	PINK, PALE, DUSKY
10	Expiratory Wheeze	EXP_WHEEZE	NONE, MILD, MODERATE, SEVERE
11	Inspiratory Wheeze	INSP_WHEEZE	NONE, MILD, MODERATE, SEVERE
12	Retractions	RETRACTIONS	NONE, MILD, MODERATE, SEVERE
13	<del>Assessment Type</del>	<del>ASS_TYPE</del>	<del>TRIAGE, MD, RN</del>

**Table 3. Treatment attributes**

#	Attribute	Code	Possible values
1	Treatment Type	RX_TYPE	Type of treatment (text, e.g., VA, Vent, Tylenol, Pulmicort, Dex, Other, ...)
2	Treatment Other	RX_OTHER	Other treatment (text, e.g., gravol, codeine, ....)

In the next step retrieved numerical values were discretized. For the majority of numerical (either continuous or integer) attributes -- REG\_AGE, AGE\_FIRST\_SX, DUR\_ASTHMA\_SX, VENT\_LAST\_24H and SAO2, we discretized values extracted directly from the database – discretization intervals for these attributes are presented in Tables 5, 6, 7, 8 and 11. We used conditional discretization of RESP\_RATE and HEART\_RATE, where different discretization intervals were defined for specific intervals of REG\_AGE (discretization of RESP\_RATE and HEART\_RATE was age-dependent) – applied intervals are presented in Tables 12 and 13. Moreover, values of TEMP were corrected before discretization with regard to TEMP\_TYPE (corrections are presented in Table 9) and then corrected values were discretized according to intervals from Table 10.

Discretized values of SAO2 were further corrected to consider oxygen environment identified by SAO2\_TYPE (saturations measured in different environments would be difficult to compare and the correction solved this problem). Applied correction is presented in Table 14. Moreover, original values of INSP\_WHEEZE, EXP\_WHEEZE, RETRACTIONS and AIR\_ENTRY were corrected into binary ones as presented in Tables 15 and 16. This minimized the number of possible values and diminished the impact of subjective assessment on the recorded information.

**Table 5. Discretization for REG\_AGE**

Original value	Discretized value
< 3 years	LT_3Y
≥ 3 and < 7 years	GE_3Y_LT_7Y

$\geq 7$ years	GE_7Y
----------------	-------

**Table 6. Discretization for AGE\_FIRST\_SX**

Original value	Discretized value
< 1 year	LT_1Y
$\geq 1$ and < 3 years	GE_1Y_LT_3Y
$\geq 3$ years	GE_3Y

**Table 7. Discretization for DUR\_ASTHMA\_SX**

Original value	Discretized value
< 12 hours	LT_12H
$\geq 12$ and < 48 hours	GE_12H_LT_48H
$\geq 48$ hours	GE_48H

**Table 8. Discretization for VENT\_LAST\_24H**

Original value	Discretized value
< 1	LT_1
$\geq 1$ and < 3	GE_1_LT_3
$\geq 3$ and < 6	GE_3_LT_6
$\geq 6$	GE_6

**Table 9. Pre-discretization correction for TEMP**

Temperature type (TEMP_TYPE)	Correction
AXILLARY	+ 0.8
ORAL <sup>1</sup>	0.0
RECTAL	0.0

**Table 10. Discretization for TEMP**

Original value	Discretized value
< 38	LT_38
$\geq 38$ and < 39	GE_38_LT_39
$\geq 39$	GE_39

<sup>1</sup> We assumed ORAL when no TEMP\_TYPE was recorded in the database.

**Table 11. Discretization for SAO2**

Original value	Discretized value
< 88	LT_88
≥ 88 and < 93	GE_88_LT_93
≥ 93 and < 95	GE_93_LT_95
≥ 95	GE_95

**Table 12. Discretization for RESP\_RATE**

Registration age (REG_AGE)	Original value	Discretized value
< 3 years (LT_3Y)	< 30	NORMAL
	≥ 30 and < 40	MILD_ABNORMAL
	≥ 40	ABNORMAL
≥ 3 and < 7 years (GE_3Y_LT_7Y)	< 36	NORMAL
	≥ 24 and < 36	MILD_ABNORMAL
	≥ 36	ABNORMAL
≥ 7 years (GE_7Y)	< 20	NORMAL
	≥ 20 and < 28	MILD_ABNORMAL
	≥ 28	ABNORMAL

**Table 13. Discretization for HEART\_RATE**

Registration age (REG_AGE)	Original value	Discretized value
< 3 years (LT_3Y)	< 110	NORMAL
	≥ 110 and < 130	MILD_ABNORMAL
	≥ 130	ABNORMAL
≥ 3 and < 7 years (GE_3Y_LT_7Y)	< 90	NORMAL
	≥ 90 and < 120	MILD_ABNORMAL
	≥ 120	ABNORMAL
≥ 7 years (GE_7Y)	< 70	NORMAL
	≥ 70 and < 120	MILD_ABNORMAL
	≥ 120	ABNORMAL

**Table 14. Post-discretization correction for SAO2**

Oxygen environment (SAO2_ENV)
-------------------------------

Discretized value	ROOM_AIR <sup>2</sup> (room air)	SUPPL_O2 (supplemental oxygen)
LT_88	LT_88	LT_88
GE_88_LT_93	GE_88_LT_93	LT_88
GE_93_LT_95	GE_93_LT_95	GE_88_LT_93
GE_95	GE_95	GE_93_LT_95

**Table 15. Correction for INSP\_WHEEZE, EXP\_WHEEZE and RETRACTIONS**

Old value	New value
MILD	PRESENT
MOD	PRESENT
SEVERE	PRESENT
NONE	ABSENT

**Table 16. Correction for AIR\_ENTRY**

Old value	New value
FAIR	GOOD
GOOD	GOOD
POOR	REDUCED

---

<sup>2</sup> We assumed ROOM\_AIR if no value of SAO2\_ENV was recorded in the database.