

# P1752 Sleep Schema Subgroup Meeting

Sponsored by IEEE Engineering in Medicine & Biology (EMB) Standards Committee

- 9 Oct 2018
- Teleconference

# Attendance

- **Put your name and affiliation in the chat window for attendance today.**
- If you are joining only via phone, please email [charlotte.chen@philips.com](mailto:charlotte.chen@philips.com) with “P1752 Sleep Schema Subgroup call” as subject
- The document shows attendance is under <https://ieeesa.imeetcentral.com/omh/folder/WzlwLDEwMjY4MDg1XQ/>.
  - If you attended the call, please verify that your name is listed
  - If you name is not listed, either edit the document above or email [charlotte.chen@philips.com](mailto:charlotte.chen@philips.com)

# Agenda

1. Attendance
2. Use Case Development Summary
3. Schema Development Preparation
  - Update on the list of mapping (include 15 mins open discussion)
  - Schema Content & Example (include 15 mins open discussion)
  - Discuss & Decide the schema development approaches (include 10 mins discussion)
4. Action Items
5. Q&A

# Sleep Schema Subgroup Deliverables

- **Clinically important sleep attributes**
- **Common sleep attributes of the existing relevant devices and apps**
- **Standard Comparison Report (Review and mapping)**
- **Proposed sleep schemas (modified and new) and use cases**
  - (1) Macrostructure
  - (2) Microstructure
  - (3) Subjective sleep experience
  - (4) Other sleep related phenomena

# Timeline for Stage2

**July 23, 2018**

Kick Off

**Nov 5, 2018** Review on Sleep Schemas and use cases

**Nov 19, 2018**

- Propose Sleep Schemas and use cases
- All the deliverables are ready

# Use Case Development Summary

# Summary of Use Cases Development (1)

- Review/Comment/Discuss on the final draft use cases:
  - Participants: Antoni, Banu, David, Josh, Paul, Koichiro, Simona, Charlotte
  - Outcomes:
    - (1) Better understanding of the sleep attributes;
    - (2) Discussion notes captured on the use case final worksheet;
    - (3) Uploaded the final use case worksheet to iMeet on Sept 27 (link below):

<https://iee-sa.imeetcentral.com/omh/folder/WzlwLDEwMjY4MDc3XQ/WzIsNjE5ODQwNjRd/>

# Schema Development Preparation

- Overview of Schema development tasks
- Review/Discuss the updated list of mapping
- Discuss the proposed approach



# Overview of Schema Development Tasks

## ❖ Review and Understand the Existing Work (Open mHealth)

- Design principles:

<http://www.openmhealth.org/documentation/#/schema-docs/schema-design-principles>

- Existing templates for various schemas:

<http://www.openmhealth.org/documentation/#/schema-docs/write-a-schema>

- Existing sleep schemas:

<http://www.openmhealth.org/schema/omh/sleep-duration-2.0.json>

[http://www.openmhealth.org/documentation/#/schema-docs/schema-library/schemas/omh\\_sleep-episode](http://www.openmhealth.org/documentation/#/schema-docs/schema-library/schemas/omh_sleep-episode)

## ❖ Propose Modified and New Sleep Schemas

# Review and Discuss the Updated List of Mapping

# Update on the List of Mapping (1)

- Discussion outcomes on the draft list of mapping (Paul, Antoni, Simona, Charlotte):

(1) Understand how to determine if a schema should be defined for a sleep attribute or a set of sleep attributes (Simona's email on Sept19);

---Is it enough for the data to be meaningful?

(2) Use time interval/time point for a quantitative measure;

(3) Include both data acquisition and report time (effective time frame);

(4) Two types of subjective measurements (relevant to a quantitative measure or not, schema needed for non-quantitative measures);

(5) [Updated list of mapping in iMeet for review/discussion;](#)

<https://iee-sa.imeetcentral.com/omh/folder/WzlwLDEwMjY4MDc3XQ/WzlsNjlwNjY0NTRd/>

# Update on List of Mapping (2)

- Information included on the worksheet:
  - Schema ID;
  - Schema Name**;
  - Sleep Attribute(s) **with units**;
  - Associated Sleep Attributes**;
  - Use Case ID;
  - Types of Measures (e.g. Trend/Statistics(over a sleep session/episode, weekly, monthly), real time)**;
  - Measure(s) Acquired: Time Interval (beginning timestamp, end timestamp) or Time Point (timestamp)**;
  - Measure(s) Reported: Effective Time Interval or Effective Time Point**;
  - Body Site(s)**;
  - Health Events/Conditions**;
  - Location/Setting**;
  - Device/App Info (e.g. manufacturer, name/model, serial number)**;
  - Clinical Data Standards (e.g. SNOMED, LOINC code)**;

# Review/Discuss the Updated List of Mapping (1)

Schema ID	Schema Name	Sleep Attribute1 (unit)	Sleep Attribute2 (unit)	Sleep Attribute3 (unit)	Sleep Attribute4 (unit)	Sleep Attribute5 (unit)	Associated Sleep Attribute(s)	Use Case ID	Types of Measures (e.g. one time/realtime, Trend/Statistics--- weekly/monthly, over a sleep session/episode)
2018-S1	SleepOnsetLatency	SOL (hrs, mins, secs)					WASO, Self-report	2018-U1	single sleep session, trend (weekly or monthly average)
2018-S2	TotalSleepTime	TST (hrs, mins, secs)					TIB, SOL, WASO, Self-report	2018-U2	single sleep session, trend (weekly or monthly average)
2018-S3	TimeInBed	TIB (hrs, mins, secs)					TST, SOL, WASO, Self-report	2018-U3	single sleep session, trend (weekly or monthly average)
2018-S4	WakeAfterSleepOnset	WASO (hrs, mins, secs)					SOL, AI, Self-report	2018-U4	single sleep session, trend (weekly or monthly average)
2018-S5	ArousalState	AI (total counts /hr of sleep)					MA, WAK	2018-U5	single sleep session, trend (weekly or monthly average)
2018-S6	SleepStages	DREM (hrs, mins, secs)	DDS (hrs, mins, secs)	DLS (hrs, mins, secs)	TST (hrs, mins, secs)			2018-U6, 2018-U7, 2018-U8	single sleep session

# Review/Discuss the Updated List of Mapping (2)

Schema ID	Schema Name	Sleep Attribute1 (unit)	Sleep Attribute2 (unit)	Sleep Attribute3 (unit)	Sleep Attribute4 (unit)	Sleep Attribute5 (unit)	Associated Sleep Attribute(s)	Use Case ID	Types of Measures (e.g. one time/realtime, Trend/Statistics--- weekly/monthly, over a sleep session/episode)
2018-S7	DeepSleepAmount	DDS (hrs, mins, secs)	TST (hrs, mins, secs)				DLS, DREM	2018-U7	single sleep session, trend (weekly or monthly average)
2018-S8	LightSleepAmount	DLS (hrs, mins, secs)	TST (hrs, mins, secs)				DDS, DREM	2018-U8	single sleep session, trend (weekly or monthly average)
2018-S9	Snore	SNS (counts)	SD (hrs, mins, secs)	TST (hrs, mins, secs)			AHI	2018-U9, 2018-U10, 2018-U11	single sleep session
2018-S10	OSA	AHI (counts/hr of sleep)	SNS (yes, no)	SD (hrs, mins, secs)	TST (hrs, mins, secs)	BP (surpine, side, facedown---Data type (Enum))	AI, SpO2, Resp	2018-U11, 2018-U13	overnight
2018-S11	BodyMovement	BM (counts)					DDS, DLS, AI	2018-U12	single sleep session
2018-S12	SleepEnviromentalFactors	L (lux)	Snd (dB)	Atmp (°C, °F)			TST, SOL, WASO, AI, WAK, DDS, DLS	2018-U14, 2018-U15, 2018-U16	single sleep session

# Review/Discuss the Updated List of Mapping (3)

Schema ID	TIME INTERVAL Beginning Timestamp measure(s) acquired	TIME INTERVAL Ending Timestamp measures acquired	TIME POINT Timestamp measure(s) acquired	EFFECTIVE TIME INTERVAL Beginning Timestamp measure(s) reported	EFFECTIVE TIME INTERVAL Ending Timestamp measure(s) reported	EFFECTIVE TIME POINT Timestamp measure(s) reported	Body Site(s) measure(s) acquired	Health Events/Conditions	Location/Setting measures acquired	Device/App Info (e.g. manufacturer, name/model, serial number)	Clinical Data Standards (e.g. SNOMED, LOINC code)
2018-S1							wrist, scalp				
2018-S2											
2018-S3											
2018-S4											
2018-S5											
2018-S6							EEG headset				

# Review/Discuss the Updated List of Mapping (4)

Measure	TIME INTERVAL Beginning Timestamp measure(s) acquired	TIME INTERVAL Ending Timestamp measures acquired	TIME POINT Timestamp measure(s) acquired	EFFECTIVE TIME INTERVAL Beginning Timestamp measure(s) reported	EFFECTIVE TIME INTERVAL Ending Timestamp measure(s) reported	EFFECTIVE TIME POINT Timestamp measure(s) reported	Body Site(s) measure(s) acquired	Health Events/Conditions	Location/Setting measures acquired	Device/App Info (e.g. manufacturer, name/model, serial number)	Clinical Data Standards (e.g. SNOMED, LOINC code)
sleep overnight							EEG headset				
sleep overnight, weekly or (average)											
sleep overnight, weekly or (average)											
sleep overnight							microphone placed close to head			microphone, microphone on mobile phone	
fit							face mask, torso band				
sleep overnight							wrist, torso band				
sleep overnight									bedroom, sleep lab		



# Developing a Schema

- Schema Content

- Schema Example (TotalSleepTime)

# Schema Content

- According to Open mHealth, each schema includes at least the following sections:
  - schema header (“reference” section: SNOMED, LOINC, RxNORM, or UCUM)
  - “definitions”
  - “properties”
  - “required”
- Suggest the following:
  - Start with these fields for developing a new schema;
  - During schema development, we could create new/modify existing fields as needed;

# Schema Example (1)

```
1 {
2   "$schema": "http://json-schema.org/draft-04/schema#", (TBD)
3   "type": "object",
4   "description": "This schema represents the total sleep time over a sleep session, which
5   can be the main sleep event (i.e., a night sleep for most people) or a nap.",
6   "references": [
7     {
8       "description": "The SNOMED code represents sleep, function (observable entity)",
9       "url": "http://url.bioontology.org/ontology/SNOMEDCT/258158006"
10    } (TBD)
11  ],
12  "definitions": {
13    "unit_value": {
14      "$ref": "unit-value-1.x.json"
15    },
16    "duration_unit_value": {
17      "$ref": "duration-unit-value-1.x.json"
18    },
19    "time_frame": {
20      "$ref": "time-frame-1.x.json"
21    },
22    "date_time": {
23      "$ref": "date-time-1.x.json"
24    }
25  },
26 }
```

# Schema Example (2)

```
27   "properties": {
28     "total_sleep_time": {
29       "description": "The total amount of time spent asleep from sleep onset time to
final awakening time during a main slepp session. It does not include any time that a person
is awake after first falling asleep at the beginning of the main sleep session",
30       "$ref": "#/definitions/duration_unit_value"
31     },
32     "latency_to_sleep_onset": {
33       "description": "Amount of time between when person starts to want to go to sleep
and sleep onset.",
34       "$ref": "#/definitions/duration_unit_value"
35     },
36     "wake_after_sleep_onset": {
37       "description": "The accumulated awakening duration between the sleep onset and
final awakening.",
38       "$ref": "#/definitions/duration_unit_value"
39     },
40     "is_main_sleep": {
41       "type": "boolean"
42     },

```

# Schema Example (3)

```
43     "acquisition_time_frame": {
44         "description": "The initial sleep onset time maps to start_date_time, the final
awakening time maps to end_date_time and total sleep session duration maps to duration.",
45         "allof": [
46             {
47                 "$ref": "#/definitions/time_frame"
48             },
49             {
50                 "required": ["time_interval"]
51             }
52         ]
53     },
54     "required": [
55         "total_sleep_time",
56         "acquisition_time_frame"
57     ]
58 }
59
```

# Schema Example (4)

```
60 Sample Data:
61 {
62   "total_sleep_time": {
63     "value": 8.5,
64     "unit": "h"
65   },
66   "acquisition_time_frame": {
67     "time_interval": {
68       "start_date_time": "2018-10-05T21:35:00Z",
69       "duration": {
70         "value": 9,
71         "unit": "h"
72       }
73     }
74   },
75   "latency_to_sleep_onset": {
76     "value": 17.0,
77     "unit": "min"
78   },
79   "wake_after_sleep_onset": {
80     "value": 13.0,
81     "unit": "min"
82   },
83   "is_main_sleep": true
84 }
85 }
```

# Discuss the Schema Development Approaches

# Proposed Approaches

## ➤ Determine if adopt the existing Open mHealth schema structure

- Entire team

## ➤ Draft Schemas (Two Approaches, only 4 responses with a tie)

(1) Create a volunteer based ad hoc team to draft all the schemas

(2) Divide into possibly two groups to develop schemas:

---Macrostructure and microstructure

---Subjective sleep experience and other sleep related phenomena

## ➤ Review/Comment

- Entire team





# Action Items

- Review/Discuss/Modify the updated list of mapping by Oct. 12, 2018
- Draft schemas done by Nov. 5, 2018
- Review schemas completed by Nov. 19, 2018
- Propose the schemas with use cases after Nov. 19, 2018

# Future Meetings

- Continue with Tuesdays at 8:30 AM Pacific / 11:30 AM Eastern
- Upcoming meetings
  - Nov 6, 2018
  - Dec 4, 2018 (TBD)

Adjournment