IEEE STANDARDS ASSOCIATION

IEEE

P1752 Sleep Schema Subgroup Meeting

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

- 5 March 2019
- 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 with "P1752 Sleep Schema Subgroup call" as subject
- The document shows attendance is under https://ieee-sa.imeetcentral.com/omh/folder/WzIwLDEwMjY4MDg1XQ/ .
  --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

Agenda

1. Attendance
2. Modified timelines
3. Update from the qualitative schema task group (30 mins)
   ---Review drafted qualitative schemas and sample data
1. Update from quantitative schema task group
   --- Review drafted quantitative schemas and sample data (25 mins)
5. Action Items
6. 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 (quantitative and qualitative)**

(1) Quantitative Measurement Schemas (including macrostructure, microstructure and etc.)

(2) Qualitative Measurement Schemas (including subjective sleep experience, other sleep related phenomena and etc.)

Timeline for Stage2

July 23, 2018
Kick Off

-Complete review Quantitative Sleep Schemas by **March 10, 2019**
-Draft Qualitative Measure Schema Development by **March 15, 2019**

-Complete Quantitative Schemas and Use Cases on **March 22, 2019**
-**Drafted/Start to review** qualitative measure schemas **March 18, 2019**
-All the deliverables are ready by **April 12, 2019**

Qualitative Schema Task Group Updates (Banu)

Sleep Subgroup: Status

- Follow up of meeting held on Feb 5, 2019

  --- Drafting a survey schema

  --- Reached out to sub group for drafting survey schema

  --- Working Members: Simona, Charlotte, Banu and Stephanie

  --- Three working meetings to draft and validate sleep qualitative schemas

  --- Completed and ready for subgroup review : SSS and OSA Stop Bang

Stanford Sleepiness Scale – Survey Schema

```
{
    "$schema": "http://json-schema.org/draft-05/schema#",

    "description": "This schema models the Stanford Sleepiness Scale (SSS), 1972 version.",
    "type": "object",

    "references": [
        {
            "description": "Stanford Sleepiness Scale (SSS), 1972 version",
            "url": "https://web.stanford.edu/~dement/sss.html/"
        }
    ],
```

Stanford Sleepiness Scale – Survey Schema (Contd.)

```
    "definitions": {
        "survey": {
            "$ref": "survey-0.x.json"
        },
        "survey_item": {
            "$ref": "survey-item-0.x.json"
        },
        "survey_categorical_answer": {
            "$ref": "survey-categorical-answer-0.x.json"
        },
        "survey_categorical_answer_item": {
            "description": "Self-rating scale which is used to quantify progressive steps in sleepiness at a certain point in time.",
            "allOf": [
                {
                    "$ref": "#/definitions/survey_item"
                },
                {
                    "type": "object",
                    "properties": {
                        "answers": {
                            "type": "array",
                            "items": {
                                "$ref": "#/definitions/survey_categorical_answer"
                            },
                            "maxItems": 1
                        }
                    }
                }
            ]
        },
```

Stanford Sleepiness Scale – Survey Schema (Contd.)

```
    },
    "sleepiness_scale_item": {
        "description": "Seven -point Likert-type scale has descriptors ranging from "feeling active, vital alert, or wide awake" (score = 1)
                        to "no longer fighting sleep, sleep onset soonand having dream-like thoughts" (score = 7)",
        "allOf": [
            {
                "$ref": "#/definitions/survey_categorical_answer_item"
            },
            {
                "type": "object",
                "properties": {
                    "answers": {
                        "items": {
                            "enum": [
                                {
                                    "code": 1,
                                    "value": "Feeling active, vital, alert, or wide awake"
                                },
                                {
                                    "code": 2,
                                    "value": "Functioning at high levels, but not at peak; able to concentrate"
                                },
                                {
                                    "code": 3,
                                    "value": "Awake, but relaxed; responsive but not fully alert"
                                },
                                {
                                    "code": 4,
                                    "value": "Somewhat foggy, let down"
                                },
                                {
                                    "code": 5,
                                    "value": "Foggy; losing interest in remaining awake; slowed down"
                                },
                                {
                                    "code": 6,
                                    "value": "Sleepy, woozy, fighting sleep; prefer to lie down"
                                },
                                {
                                    "code": 7,
                                    "value": "No longer fighting sleep, sleep onset soon; having dream-like thoughts"
                                },
                                {
                                    "code": X,
                                    "value": "Asleep"
                                }
```

Stanford Sleepiness Scale – Survey Schema


```
    },
    "allOf": [
        {
            "$ref": "#/definitions/survey"
        },
        {
            "properties": {
                "items": {
                    "type": "array",
                    "minItems": 1,
                    "items": [
                        {
                            "allOf": [
                                {
                                    "$ref": "#/definitions/sleepiness_scale_item"
                                },
                                {
                                    "properties": {
                                        "question": {
                                            "enum": [
                                                {
                                                    "label": "1",
                                                    "text": "Please select one answer to rate your current level of sleepiness"
                                                }
                                            ]
                                        }
                                    }
                                }
                            ]
                        },
                    ],
                    "additionalItems": false
                }
            }
        }
    ]
}
```

Stanford Sleepiness Scale – Survey Completed


```
{
    "items": [
        {
            "question": {
                "label": "1",
                "text": "Please select one answer to rate your current level of sleepiness"
            },
          "answers": [
            {
              "code": 2,
              "value": "Functioning at high levels, but not at peak; able to concentrate"
            }
          ],
            "asked_date_time": "2015-02-05T07:24:00Z",
            "answered_date_time": "2015-02-05T07:24:05Z"
        }
    ],
    "delivery_details": {
        "start_date_time": "2015-02-05T07:24:00Z",
        "end_date_time": "2015-02-05T07:26:00Z",
        "end_status": "completed"
    },
    "score": 2
}
```

OSA Stop Bang– Survey Schema

```
{
    "$schema": "http://json-schema.org/draft-04/schema#",

    "description": "This schema models the Sleep Scale from the Medical Outcomes Study (MOS-SS).",
    "type": "object",

    "references": [
        {
            "description": "Screening Obstructive Sleep Apnea?",
            "url": "http://www.stopbang.ca/osa/screening.php"
        }
    ],
```

OSA Stop Bang– Survey Schema (Contd.)

```
13
14      "definitions": {
15          "survey": {
16              "$ref": "survey-0.x.json"
17          },
18          "survey_item": {
19              "$ref": "survey-item-0.x.json"
20          },
21          "survey_categorical_answer": {
22              "$ref": "survey-categorical-answer-0.x.json"
23          },
24          "survey_categorical_answer_item": {
25              "description": "A survey item that has one categorical answer.",
26              "allOf": [
27                  {
28                      "$ref": "#/definitions/survey_item"
29                  },
30                  {
31                      "type": "object",
32                      "properties": {
33                          "answers": {
34                              "type": "array",
35                              "items": {
36                                  "$ref": "#/definitions/survey_categorical_answer"
37                              },
38                              "maxItems": 1
39                          }
40                      }
41                  }
42              ]
43          },
```

OSA Stop Bang– Survey Schema (Contd.)

```
        },
        "confirm_deny_item": {
            "description": "A categorical answer item where the answer is one of two categories (Yes, No).",
            "allOf": [
                {
                    "$ref": "#/definitions/survey_categorical_answer_item"
                },
                {
                    "type": "object",
                    "properties": {
                        "answers": {
                            "items": {
                                "enum": [
                                    {
                                        "code": 1,
                                        "value": "Yes"
                                    },
                                    {
                                        "code": 2,
                                        "value": "No"
                                    }
                                ]
                            }
                        }
                    }
                }
            ]
        }
    },
```

OSA Stop Bang– Survey Schema (Contd.)

```
    },
    "allOf": [
        {
            "$ref": "#/definitions/survey"
        },
        {
            "properties": {
                "items": {
                    "type": "array",
                    "minItems": 8,
                    "items": [
                        {
                            "allOf": [
                                {
                                    "$ref": "#/definitions/confirm_deny_item"
                                },
                                {
                                    "properties": {
                                        "question": {
                                            "enum": [
                                                {
                                                    "label": "1.",
                                                    "text": "1. Do you Snore Loudly (loud enough to be heard through closed doors
                                                        or your bed-partner elbows you for snoring at night)?"
                                                }
                                            ]
                                        }
                                    }
                                }
                            ]
                        },
```

Similar blocks of code for 8 questions

OSA Stop Bang – Survey Completed


```
{
    "items": [
        {
            "question": {
                "label": "1",
                "text": "Do you Snore Loudly (loud enough to be heard through closed doors or your bed-partner elbows you for snoring at night)?"
            },
            "answers": [
                {
                    "code": 1,
                    "value": "Yes"
                }
            ],
            "asked_date_time": "2019-03-03T07:24:00Z",
            "answered_date_time": "2019-03-03T07:24:05Z"
        },
        {
            "question": {
                "label": "2",
                "text": "Do you often feel Tired, Fatigued, or Sleepy during the daytime (such as falling asleep during driving or talking to someone)?"
            },
            "answers": [
                {
                    "code": 1,
                    "value": "Yes"
                }
            ],
            "asked_date_time": "2019-03-03T07:24:06Z",
            "answered_date_time": "2019-03-03T07:24:10Z"
        },
        {
            "question": {
                "label": "3",
                "text": "Has anyone Observed you Stop Breathing or Choking/Gasping during your sleep?"
            },
```

OSA Stop Bang – Survey Completed (Contd.)


```
            },
            "answers": [
                {
                    "code": 2,
                    "value": "No"
                }
            ],
            "asked_date_time": "2019-03-03T07:24:11Z",
            "answered_date_time": "2019-03-03T07:24:13Z"
        },
        {
            "question": {
                "label": "4",
                "text": "Do you have or are being treated for High Blood Pressure?"
            },
            "answers": [
                {
                    "code": 2,
                    "value": "No"
                }
            ],
            "asked_date_time": "2019-03-03T07:24:14Z",
            "answered_date_time": "2019-03-03T07:24:16Z"
        },
        {
            "question": {
                "label": "5",
                "text": "Body Mass Index more than 35 kg/m2?"
            },
            "answers": [
                {
                    "code": 2,
                    "value": "No"
                }
            ],
            "asked_date_time": "2019-03-03T07:24:17Z",
            "answered_date_time": "2019-03-03T07:24:19Z"
```

OSA Stop Bang – Survey Completed (Contd.)


```
        {
            "question": {
                "label": "7",
                "text": "Neck size large? For male, is your shirt collar 17 inches / 43cm or larger? For female, is your shirt collar 16 inches / 41cm c
            },
            "answers": [
                {
                    "code": 2,
                    "value": "No"
                }
            ],
            "asked_date_time": "2019-03-03T07:24:23Z",
            "answered_date_time": "2019-03-03T07:24:28Z"
        },
        {
            "question": {
                "label": "8",
                "text": "Gender = Male ?"
            },
            "answers": [
                {
                    "code": 2,
                    "value": "No"
                }
            ],
            "asked_date_time": "2019-03-03T07:24:29Z",
            "answered_date_time": "2019-03-03T07:24:31Z"
        }
    ],
    "delivery_details": {
        "start_date_time": "2019-03-03T07:24:00Z",
        "end_date_time": "2019-03-03T07:24:31Z",
        "end_status": "completed"
    },
    "score":2
}
```

Sleep Subgroup: qualitative measure schema task group

- The next steps for this task group:

P1752 Sleep WG

Qualitative Sleep Measures - Drafting of Schemas

Choice of Questionnaire

S.No	Name of Questionnaire	To be drafted by
1	**The Stanford Sleepiness Scale (SSS)**	**Banu**
2	**Epworth Sleepiness Scale**	**Drafted by Simona (Available in imeet)**
3	Karolinska Sleepiness Scale	Banu
4	Pittsburgh Sleep Quality Index(PSQI)	Banu
5	Insomnia Severity Index (ISI)	Charlotte
6	OSA Berlin Questionnaire	
7	**Stop-Bang Questionnaire**	**Stephanie**
8	Restless Legs Syndrome Diagnostic Index (RLS-DI)	
9	Narcolepsy	
10	Functional Outcomes of Sleep Questionnaire	

Sleep Subgroup: qualitative measure schema task group

- The next steps for this task group:

(a) Continue drafting the schema for remaining questionnaires.

(b) Present for comments and suggestions.

Quantitative Schema Task Group Updates

- Review the drafted quantitative schemas and sample data (30 mins)

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;

Previous Drafted Schemas and Sample Data

--total_sleep_time and sample data (Josh)
--time_in_bed sample data (Paul)

Total Sleep Time Schema (1)

```
// total-sleep-time schema
// version: draft
// created: 3 December 2018
// modified: 20 February 2019
// proposed revisions:
{
    "$schema": "http://json-schema.org/draft-04/schema#",
    "description": "This schema represents total sleep time, i.e. The total sleep time is the interval between initial sleep onset time and final awakening time minus the duration of all awakenings."
    "type": "object",
    "references": [ ],

    "definitions": {
        "duration_unit_value": {
            "$ref": "duration-unit-value-1.x.json"
        },
        "time_frame": {
            "$ref": "time-frame-1.x.json"
        }
    },

    "properties": {
        "total_sleep_time": {
            "description": "Total time asleep from bedtime until getting out of bed in the morning or across the 24-h period. This excludes any time that a person is awake after first falling asleep
            "allOf": [
                {
                    "$ref": "#/definitions/duration_unit_value"
                },
                {
                    "properties": {
                        "unit": {
                            "enum": [
                                "sec",
                                "min",
                                "h"
                            ]
                        }
                    }
                }
            ]
        },
```

Total_Sleep_Time Schema (2)

```
        "sleep_duration_events": {
            "description": "Individual sleep events and their durations to describe at what points throughout the night is the individual is asleep, and when summarized equal the total_sleep_time.",
            "type": "array",
            "contains": {
              "sleep_event_time_frame": {
                "allOf": [
                  {
                    "$ref": "#/definitions/time_frame"
                  },
                  {
                    "required": ["time_interval"]
                  }
                ]
            },
              "required": [
                "sleep_event_time_frame"
              ]
            }
        },
        "effective_time_frame": {
            "description": "As a measure of a duration, time asleep should not be associated to a date time time frame. Hence, effective time frame is restricted to be a time interval.",
            "allOf": [
                {
                    "$ref": "#/definitions/time_frame"
                },
                {
                    "required": ["time_interval"]
                }
            ]
        },
        "required": [
          "total_sleep_time",
          "effective_time_frame"
    ]
},
```

Total_Sleep_Time_Sample_Data (1)


```
{
  "total_sleep_time": {
        "value": 5.5,
        "unit": "hh"
  },
  "effective_time_frame": {
    "time_interval": {
      "start_date_time": "2019-02-19T22:30:00Z",
      "end_date_time": "2019-02-20T04:50:00Z"
    }
  }
}
```

Total_Sleep_Time_Sample_Data (2)


```
{
  "total_sleep_time": {
        "value": 330
        "unit": "min"
  },
  "sleep_duration_events": [
    {
    "sleep_event_time_frame": {
        "start_date_time": "2019-02-19T22:30:00Z",
        "end_date_time": "2019-02-19T23:50:00Z"
    }
    },
    {
    "sleep_event_time_frame": {
        "start_date_time": "2019-02-20T00:15:00Z",
        "end_date_time": "2019-02-20T02:15:00Z"
    }
    },
    {
    "sleep_event_time_frame": {
        "start_date_time": "2019-02-20T02:30:00Z",
        "end_date_time": "2019-02-20T04:00:00Z"
    }
    },
    {
    "sleep_event_time_frame": {
        "start_date_time": "2019-02-20T04:10:00Z",
        "end_date_time": "2019-02-20T04:50:00Z"
    }
    }
  ],
  "effective_time_frame": {
    "time_interval": {
      "start_date_time": "2019-02-19T22:30:00Z",
      "end_date_time": "2019-02-20T04:50:00Z"
    }
  }
}
```

Time_In_Bed_Sample_Data (1)

```
{
    "effective_time_frame": {
        "time_interval": {
            "start_date_time": "2019-02-17T22:00:00Z",
            "end_date_time": "2019-02-18T06:30:00Z"
        }
    },
    "time_in_bed": {
        "value": 8.5,
        "unit": "hh"
    },
    "is_main_sleep": true
}

{
    "effective_time_frame": {
        "time_interval": {
            "start_date_time": "2019-02-18T22:30:00Z",
            "end_date_time": "2019-02-19T06:10:00Z"
        }
    },
    "time_in_bed": {
        "value": 460,
        "unit": "min"
    },
    "is_main_sleep": true
}
```

New Drafted Schemas and Sample Data

--sleep_stages schema and sample data (Josh)
--sleep_apnea schema and sample data (Paul)

Sleep_Stages Schema (1)

```
// sleep-stages schema
// version: draft
// created: 20 February 2019
// modified: 23 February 2019
// proposed revisions:
{
    "$schema": "http://json-schema.org/draft-04/schema#",
    "description": "This schema represents durations for varying sleep stage, i.e. The total duration of REM, Light, and Deep sleep as a summation of equatable stages between initial
    "type": "object",
    "references": [ ],

    "definitions": {
        "duration_unit_value": {
            "$ref": "duration-unit-value-1.x.json"
        },
        "time_frame": {
            "$ref": "time-frame-1.x.json"
        },
        "descriptive_statistic": {
            "$ref": "descriptive-statistic-1.x.json"
        },
        "descriptive_statistic_denominator": {
            "$ref": "descriptive-statistic-denominator-1.x.json"
        }
    },

    "properties": {
        "total_sleep_duration_REM": {
            "description": "Total time in REM Sleep Stage from bedtime until getting out of bed in the morning or across the 24-h period. This excludes any time that a person is awake
            "allOf": [
                {
                    "$ref": "#/definitions/duration_unit_value"
                },
                {
                    "properties": {
                        "unit": {
                            "enum": [
                                "sec",
                                "min",
                                "h"
```

Sleep_Stages Schema (2)

```
sleep onset time and final awakening time minus the duration of all other stages.",

 after first falling asleep at the beginning of the night and any other sleep stage durations.",
```

Sleep_Stages Schema(3)

```
                                ]
                            }
                        }
                    }
                ]
            },
            "total_sleep_duration_light": {
                "description": "Total time in Light Sleep Stage from bedtime until getting out of bed in the morning or across the 24-h period. This excludes any time that a person
                "allOf": [
                    {
                        "$ref": "#/definitions/duration_unit_value"
                    },
                    {
                        "properties": {
                            "unit": {
                                "enum": [
                                    "sec",
                                    "min",
                                    "h"
                                ]
                            }
                        }
                    }
                ]
            },
            "total_sleep_duration_deep": {
                "description": "Total time in Deep Sleep Stage from bedtime until getting out of bed in the morning or across the 24-h period. This excludes any time that a person
                "allOf": [
                    {
                        "$ref": "#/definitions/duration_unit_value"
                    },
                    {
                        "properties": {
                            "unit": {
                                "enum": [
                                    "sec",
                                    "min",
                                    "h"
                                ]
                            }
                        }
```

Sleep _Stages Schema(4)

```
 is awake after first falling asleep at the beginning of the night and any other sleep stage durations.",

is awake after first falling asleep at the beginning of the night and any other sleep stage durations.",
```

Sleep _Stages Schema(5)

```
                    }
                }
            ]
        },
        "sleep_stage_events": {
            "description": "Individual sleep events and their durations to describe at what points throughout the night is the individual is asleep, and when summarized equal the total_sleep_time.",
            "type": "array",
            "contains": {
              "sleep_stage_state": {
                "enum": [
                  "REM",
                  "Light",
          "Deep",
          "Awake"
                ]
              },
              "sleep_stage_time_frame": {
                "allOf": [
                  {
                    "$ref": "#/definitions/time_frame"
                  },
                  {
                    "required": ["time_interval"]
                  }
                ]
        },
            "required": [
              "sleep_stage_state",
        "sleep_stage_time_frame"
            ]
        }
        },
        "effective_time_frame": {
            "description": "As a measure of a duration, time asleep should not be associated to a date time time frame. Hence, effective time frame is restricted to be a time interval.",
            "allOf": [
                {
                    "$ref": "#/definitions/time_frame"
                },
                {
                    "required": ["time_interval"]
```

Sleep_Stages Schema (6)

```
121                 }
122               ]
123           },
124           "is_main_sleep": {
125             "type": "boolean"
126           },
127           "descriptive_statistic": {
128             "$ref": "#/definitions/descriptive_statistic"
129           },
130           "descriptive_statistic_denominator": {
131
132             "anyOf": [
133               {
134                 "$ref": "#/definitions/descriptive_statistic_denominator"
135               },
136               {
137                 "description": "If the value needed is a standard unit of duration, select from the duration-unit-value value set.",
138                 "type": "string"
139               }
140             ]
141           },
142           "required": [
143         "anyOf": [
144             "total_sleep_duration_REM",
145             "total_sleep_duration_light",
146             "total_sleep_duration_deep",
147           ],
148         "anyOf": [
149           "sleep_stage_events",
150         "descriptive_statistic"
151           ],
152           "effective_time_frame"
153         ]
154     }
```

Sleep_Stages_Sample_data (1)


```
{
  "total_sleep_duration_deep": {
        "value": 2,
        "unit": "hh"
  },
  "sleep_stage_events": [
    {
    "sleep_stage_state" : {
      "value": "Deep"
    },
    "sleep_event_time_frame": {
        "start_date_time": "2019-02-20T00:30:00Z",
        "end_date_time": "2019-02-20T02:00:00Z"
    }
    },
    {
    "sleep_stage_state" : {
      "value": "Deep"
    },
    "sleep_event_time_frame": {
        "start_date_time": "2019-02-20T03:00:00Z",
        "end_date_time": "2019-02-20T03:30:00Z"
    }
    }
  ],
  "effective_time_frame": {
    "time_interval": {
      "start_date_time": "2019-02-19T22:30:00Z",
      "end_date_time": "2019-02-20T04:50:00Z"
    }
  }
}
```

Sleep_Stages_Sample_Data (2)


```
{
  "total_sleep_duration_REM": {
        "value": 70,
        "unit": "min"
  },
  "total_sleep_duration_light": {
        "value": 140,
        "unit": "min"
  },
  "total_sleep_duration_deep": {
        "value": 120,
        "unit": "min"
  },
  "total_sleep_duration_awake": {
        "value": 50,
        "unit": "min"
  },
  "sleep_stage_events": [
    {
      "sleep_stage_state" : {
        "value": "REM"
      },
      "sleep_event_time_frame": {
        "start_date_time": "2019-02-19T22:30:00Z",
        "end_date_time": "2019-02-19T22:50:00Z"
      }
    },
    {
      "sleep_stage_state" : {
        "value": "Light"
      },
      "sleep_event_time_frame": {
        "start_date_time": "2019-02-19T22:50:00Z",
        "end_date_time": "2019-02-19T23:50:00Z"
      }
    },
    {
      "sleep_stage_state" : {
        "value": "Awake"
      },
      "sleep_event_time_frame": {
        "start_date_time": "2019-02-19T23:50:00Z",
        "end_date_time": "2019-02-20T00:15:00Z"
      }
    },
```

Sleep_Stages_Sample_Data (3)


```
    {
      "sleep_stage_state" : {
        "value": "Light"
      },
      "sleep_event_time_frame": {
        "start_date_time": "2019-02-20T00:15:00Z",
        "end_date_time": "2019-02-20T00:30:00Z"
      }
    },
    {
      "sleep_stage_state" : {
        "value": "Deep"
      },
      "sleep_event_time_frame": {
        "start_date_time": "2019-02-20T00:30:00Z",
        "end_date_time": "2019-02-20T02:00:00Z"
      }
    },
    {
      "sleep_stage_state" : {
        "value": "Light"
      },
      "sleep_event_time_frame": {
        "start_date_time": "2019-02-20T02:00:00Z",
        "end_date_time": "2019-02-20T02:15:00Z"
      }
    },
    {
      "sleep_stage_state" : {
        "value": "Awake"
      },
      "sleep_event_time_frame": {
        "start_date_time": "2019-02-20T02:15:00Z",
        "end_date_time": "2019-02-20T02:30:00Z"
      }
    },
    {
      "sleep_stage_state" : {
        "value": "REM"
      },
      "sleep_event_time_frame": {
        "start_date_time": "2019-02-20T02:30:00Z",
        "end_date_time": "2019-02-20T02:45:00Z"
      }
    },
```

Sleep_Stages_Sample_Data (4)


```
    {
      "sleep_stage_state" : {
        "value": "Light"
      },
      "sleep_event_time_frame": {
        "start_date_time": "2019-02-20T02:45:00Z",
        "end_date_time": "2019-02-20T03:00:00Z"
      }
    },
    {
      "sleep_stage_state" : {
        "value": "Deep"
      },
      "sleep_event_time_frame": {
        "start_date_time": "2019-02-20T03:00:00Z",
        "end_date_time": "2019-02-20T03:30:00Z"
      }
    },
    {
      "sleep_stage_state" : {
        "value": "Light"
      },
      "sleep_event_time_frame": {
        "start_date_time": "2019-02-20T03:30:00Z",
        "end_date_time": "2019-02-20T03:45:00Z"
      }
    },
    {
      "sleep_stage_state" : {
        "value": "REM"
      },
      "sleep_event_time_frame": {
        "start_date_time": "2019-02-20T03:45:00Z",
        "end_date_time": "2019-02-20T04:00:00Z"
      }
    },
    {
      "sleep_stage_state" : {
        "value": "Awake"
      },
      "sleep_event_time_frame": {
        "start_date_time": "2019-02-20T04:00:00Z",
        "end_date_time": "2019-02-20T04:10:00Z"
      }
    },
```

Sleep_Stages_Sample_data (5)


```
    {
      "sleep_stage_state" : {
          "value": "Light"
      }
      "sleep_event_time_frame": {
            "start_date_time": "2019-02-20T04:10:00Z",
            "end_date_time": "2019-02-20T04:30:00Z"
      }
      },
      {
      "sleep_stage_state" : {
          "value": "REM"
      }
      "sleep_event_time_frame": {
            "start_date_time": "2019-02-20T04:30:00Z"",
            "end_date_time": "2019-02-20T04:50:00Z"
      }
      }
    ],
    "effective_time_frame": {
      "time_interval": {
          "start_date_time": "2019-02-19T22:30:00Z",
          "end_date_time": "2019-02-20T04:50:00Z"
      }
    }
  }
```

Sleep_Stages_Sample_Data (6)

```
{
  "total_sleep_duration_REM": {
        "value": 60,
        "unit": "min"
  },
  "total_sleep_duration_light": {
        "value": 180,
        "unit": "min"
  },
  "total_sleep_duration_deep": {
        "value": 90,
        "unit": "min"
  },
  "total_sleep_duration_awake": {
        "value": 30,
        "unit": "min"
  },
  "effective_time_frame": {
    "time_interval": {
      "start_date_time": "2019-02-19T22:30:00Z",
      "end_date_time": "2019-02-26T22:30:00Z"
    }
  },
  "descriptive_statistic": "average",
  "descriptive_statistic_denominator": "w"
}
```

Sleep_Apnea Schema (1)

```
// sleep-apnea schema
// version: draft 0.2
// created: 7 January 2019
// modified: 5 Febuary 2019
// proposed revisions:
{
    "$schema": "http://json-schema.org/draft-04/schema#",

    "description": "This schema represents obstructive sleep apnoea either as a measurement or several measurements made over time (see Descriptive schema for a list of aggregate measures)",
    "type": "object",
    "references": [
        {
            "description": "The SNOMED code represents dApnea Hypopnea Index (assessment scale)",
            "url": "http://purl.bioontology.org/ontology/SNOMEDCT/716202005"
        }
    ],

    "definitions": {
        "time_frame": {
            "$ref": "time-frame-1.x.json"
        },
        "descriptive_statistic": {
            "$ref": "descriptive-statistic-1.x.json"
        }
    },

    "properties": {
        "usage_hours": {
            "properties": {
                    "unit": {
                    "enum": [
                            "sec",
                            "min",
                            "hh" ]
                    }
            }
        },
        "mask_seal": {
            "type": "number"
        },
```

Sleep_Apnea Schema (2)

```
41          "mask_on_off": {
42              "type": "number"
43          },
44          "ahi": {
45              "type": "number"
46          }
47      },
48
49      "required": [
50          "usage_hours",
51          "ahi"
52      ]
53  }
54
```

Sleep_Apnea_Sample_Data (1)

```
{
    "usage_hours": {
            "value": "5.8",
            "unit": "hh"
        },
        "mask_seal": {
            "value": 85,
            "unit": "%"
        },
        "mask_on_off": {
            "value": 2,
        },
        "ahi": {
            "value": "0.6",
            "unit": "e/h"
        },
}

{
    "usage_hours": {
            "value": "7.5",
            "unit": "hh"
        },
        "mask_seal": {
            "value": 100,
            "unit": "%"
        },
        "mask_on_off": {
            "value": 1,
        },
        "ahi": {
            "value": "1.5",
            "unit": "e/h"
        },
}
```

Action Items

- Finish reviewing the quantitative schemas by March. 10, 2019
- Finish drafting subjective schema for shortlisted questionnaires by March. 15, 2019

Future Meetings

- Continue with Tuesdays at 8:30 AM Pacific / 11:30 AM Eastern
- Upcoming meetings
  - April 2, 2019

Adjournment