P1752 Sleep Schema Subgroup Meeting

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

- 6 Dec 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. Status updates
4. Review comments on the 1st batch of quantitative schemas
5. Discuss/Comment on upcoming schema review calls
6. Action Items
7. 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.) --- Pivoted: Draft a set of sleep survey questions and schema(s) to cover various of survey question/answer types

Timeline for Stage2 Remaining Work

-Complete addressing comments for Quantitative Sleep Schemas by **May 12, 2019**
-Complete reviewing Qualitative Measure Schemas by **May 31, 2019**

-Validate Quantitative Schemas by **Oct 28, 2019**
-Draft Qualitative Measure Schemas by **Nov 19,**

-Review/Discuss/Address WG comments on 1st batch Quantitative Schemas by **Nov 26/Dec 5/Jan 6, 2020**
-Distribute Survey Schemas by **(TBD by WG)**

Status Update

➢ Reviewed and summarized WG review comments on 1st batch schemas (details on the next slide)

➢ Presented the main WG comments on 1st batch in WG meeting on Nov 26

➢ Prepared the 2nd batch quantitative schemas

➢ Introduced the 2nd batch schemas in WG meeting on Nov 26

➢ Qualitative schema review introduction on hold

Review Comments on 1ˢᵗ Batch Quantitative Schemas

Review Comments on ambient-light Schema

	Schema Line or Line Range	Comments	Date (comment)	Email Address of the person who made comments	Resolution
1					
2	4	Suggest to have description read simply: This schema represents the ambient light (the rest is in the schema itself and having too many details here may create update mismatches later)	7-Mar	simona.carini@ucsf.edu	
3	28	the description does not match the object, because the wavelength is optional	11/15/2019	simona.carini@ucsf.edu	
4	28	The text "The wavelength might have specific physiological impact to a person and its intensity might affect the degree of the specific impact." is not a description; it may go into the use case	11/15/2019	simona.carini@ucsf.edu	
5	21	remove definition since it is not used to define any property	11/20/2019	simona.carini@ucsf.edu	
6	sample data	unit of measure is lx	11/15/2019	simona.carini@ucsf.edu	
7	sample data	I recommend to clearly separate the instances, possibly one per file	11/15/2019	simona.carini@ucsf.edu	
8	sample data	I also recommend having one instance that shows only the required data elements	11/15/2019	simona.carini@ucsf.edu	

```json
{
    "$schema": "http://json-schema.org/draft-07/schema#",

    "description": "This schema represents measurement of ambient light. It could be either a single measurement or the result of aggregated measurements over the time",
    "type": "object",

    "definitions": {
        "illuminance_unit_value": {
            "$ref": "illuminance-unit-value-1.0.json"
        },
        "length_unit_value": {
            "$ref": "length-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": {
        "ambient_light": {
            "description": "An array of individual light wavelength and its intensity to describe the composition of the ambient light. The wavelength might have specific
            "type" : "array",
            "items": [
                {
```

physiological impact to a person and its intensity might affect the degree of the specific impact.",

```json
                    "type": "object",
                    "properties": {
                        "wavelength": {
                            "allOf": [
                                {
                                    "$ref": "#/definitions/length_unit_value"
                                },
                                {
                                    "properties": {
                                        "unit": {
                                            "enum": [
                                                "nm"
                                            ]
                                        }
                                    }
                                }
                            ]
                        },
                        "intensity": {
                            "$ref": "#/definitions/illuminance_unit_value"
                        }
                    },
                    "required": [
                        "intensity"
                    ]
                }
            ]
        },
        "effective_time_frame": {
            "$ref": "#/definitions/time_frame"
        },
        "descriptive_statistic": {
            "$ref": "#/definitions/descriptive_statistic"
        }
    },
    "required": [
        "ambient_light",
        "effective_time_frame"
    ]
}
```

```json
{
    "ambient_light": [
        {
            "wavelength": {
                "value": 440,
                "unit": "nm"
            },
            "intensity": {
                "value": 9.8,
                "unit": "lux"
            }
        },
        {
            "wavelength": {
                "value": 453,
                "unit": "nm"
            },
            "intensity": {
                "value": 10.1,
                "unit": "lux"
            }
        },
        {
            "wavelength": {
                "value": 461,
                "unit": "nm"
            },
            "intensity": {
                "value": 10.8,
                "unit": "lux"
            }
        }
    ],
    "effective_time_frame": {
        "date_time": "2019-02-06T23:00:00Z"
    }
}
```

```json
38
39  {
40      "ambient_light": [
41          {
42              "intensity": {
43                  "value": 10.8,
44                  "unit": "lux"
45              }
46          }
47      ],
48      "effective_time_frame": {
49          "time_interval": {
50              "start_date_time": "2019-02-05T23:00:00Z",
51              "end_date_time": "2019-02-06T06:00:00Z"
52          }
53      },
54      "descriptive_statistic": "average"
55  }
56
57  {
58      "ambient_light": [
59          {
60              "wavelength": {
61                  "value": 450,
62                  "unit": "nm"
63              },
64              "intensity": {
65                  "value": 10.2,
66                  "unit": "lux"
67              }
68          }
69      ],
70      "effective_time_frame": {
71          "time_interval": {
72              "start_date_time": "2019-02-05T23:00:00Z",
73              "end_date_time": "2019-02-6T06:00:00Z"
74          }
75      },
76      "descriptive_statistic": "average"
77  }
```

Review Comments on ambient-sound Schema

	Schema Line or Line Range	Comments	Date (comment)	Email Address of the person who made comments	Resolution	Date (resolution)
1						
2	34	unclear why descriptive statistic is a required element: if the datapoint is a single measurement there is no statistic, is there?	11/15/2019	simona.carini@ucsf.edu	20 Nov: propose this is required to support both average and peak (max - for transient noise intrusion) sound levels. 28 Nov: after discussion agreed that descriptive_statistic this should be optional to support both point-in-time and time interval measures i.e. absolute and avg/min/etc	11/28/2019
3	sample data	Related to the comment above: I recommend to show an instance of an individual measurement	11/15/2019	simona.carini@ucsf.edu	Amended as suggested	11/28/2019
4	sound unit value: line 4 and 16	the schema represent sound unit of measure. Also, the unit description should descibe what dB is and why there are 2 different units (I have updated the link to UCUM so it goes to the right paragraph)	11/15/2019	simona.carini@ucsf.edu		
5						
6	schema	no comment	11/27/2019	shiv.hiremath@temple.edu		
7	Sample data	no comment	11/27/2019	shiv.hiremath@temple.edu		

```json
{
    "$schema": "http://json-schema.org/draft-07/schema#",

    "description": "This schema represents the ambient sound",
    "type": "object",

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

    "properties": {
        "ambient_sound": {
            "$ref": "#/definitions/sound_unit_value"
        },
        "effective_time_frame": {
            "$ref": "#/definitions/time_frame"
        },
        "descriptive_statistic": {
            "$ref": "#/definitions/descriptive_statistic"
        }
    },

    "required": [
        "ambient_sound",
        "effective_time_frame"
    ]
}
```

```json
{
    "ambient_noise": {
        "value": 75,
        "unit": "dB"
    },
    "effective_time_frame": {
            "date_time": "2019-02-05T06:00:00Z"
        }
}
```

```json
{
    "ambient_noise": {
        "value": 70,
        "unit": "dBA"
    },
    "effective_time_frame": {
        "time_interval": {
            "start_date_time": "2019-02-05T06:00:00Z",
            "end_date_time": "2019-02-06T06:00:00Z"
        }
    },
    "descriptive_statistic": "average"
}

{
    "ambient_noise": {
        "value": 90,
        "unit": "dBA"
    },
    "effective_time_frame": {
        "time_interval": {
            "start_date_time": "2019-02-05T06:00:00Z",
            "end_date_time": "2019-02-06T06:00:00Z"
        }
    },
    "descriptive_statistic": "maximum"
}
```

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Review Comments on ambient-temperature Schema

	Schema Line or Line Range	Comments	Date (comment)	Email Address of the person who made comments	Resolution	Date (resolution)
1	**Schema Line or Line Range**	**Comments**	**Date (comment)**	**Email Address of the person who made comments**	**Resolution**	**Date (resolution)**
2	schema	no comment	11/27/2019	shiv.hiremath@temple.edu		
3	Sample data	I liked that the sample data was	11/27/2019	shiv.hiremath@temple.edu		
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						

```json
{
    "$schema": "http://json-schema.org/draft-07/schema#",

    "description": "This schema represents the ambient temperature",
    "type": "object",
    "references": [
        {
            "description": "The SNOMED code represents Ambient temperature (observable entity)",
            "url": "http://purl.bioontology.org/ontology/SNOMEDCT/250825003"
        }
    ],

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

    "properties": {
        "ambient_temperature": {
            "$ref": "#/definitions/temperature_unit_value"
        },
        "effective_time_frame": {
            "$ref": "#/definitions/time_frame"
        },
        "descriptive_statistic": {
            "$ref": "#/definitions/descriptive_statistic"
        }
    },

    "required": [
        "ambient_temperature",
        "effective_time_frame"
    ]
}
```

```json
1  {
2      "ambient_temperature": {
3          "value": 75,
4          "unit": "F"
5      },
6      "effective_time_frame": {
7          "date_time": "2013-02-05T07:25:00Z"
8      }
9  }
10
11 {
12     "ambient_temperature": {
13         "value": 75,
14         "unit": "F"
15     },
16     "effective_time_frame": {
17         "time_interval": {
18             "start_date_time": "2015-02-05T06:00:00Z",
19             "end_date_time": "2015-02-06T06:00:00Z"
20         }
21     },
22     "descriptive_statistic": "average"
23 }
```

Review Comments on sleep-onset-latency Schema

	Schema Line or Line Range	Comments	Date (comment)	Email Address of the person who made comments	Resolution	Date (resolution)
1						
2	26-36	Remove restriction of duration units	11/19/2019	simona.carini@ucsf.edu		
3	50	add description: should be the same across all schemas, something along the lines of "Whether the data refers to the main sleep episode(s)."	11/19/2019	simona.carini@ucsf.edu		
4	sample data	separate each instance into its own file	11/19/2019	simona.carini@ucsf.edu		
5						
6	schema	no comment	11/27/2019	shiv.hiremath@temple.edu		
7	Sample data	I wonder if an example with False will be helpful as an example	11/27/2019	shiv.hiremath@temple.edu		
8						

```json
{
    "$schema": "http://json-schema.org/draft-04/schema#",
    "type": "object",
    "description": "This schema represents sleep onset latency, i.e. the amount of time between when a person starts to want to go to sleep and sleep onset."
    "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": {
        "sleep_onset_latency": {
            "allOf": [
                {
                    "$ref": "#/definitions/duration_unit_value"
                },
                {
                    "properties": {
                        "unit": {
                            "enum": [
                                "sec",
                                "min",
                                "h"
                            ]
                        }
                    }
                }
            ]
        },
```

```
40          "effective_time_frame": {
41              "description": "As a measure of a duration, sleep onset latency should not be associated to a date time time frame. Hence, effective time frame i
42              "allOf": [
43                  {
44                      "$ref": "#/definitions/time_frame"
45                  },
46                  {
47                      "required": ["time_interval"]
48                  }
49              ]
50          },
51          "is_main_sleep": {
52              "type": "boolean"
53          },
54          "descriptive_statistic": {
55              "$ref": "#/definitions/descriptive_statistic"
56          },
57          "descriptive_statistic_denominator": {
58              "anyOf": [
59                  {
60                      "$ref": "#/definitions/descriptive_statistic_denominator"
61                  },
62                  {
63                      "description": "If the value needed is a standard unit of duration, select from the duration-unit-value value set.",
64                      "type": "string"
65                  }
66              ]
67          }
68      },
69
70      "required": [
71          "sleep_onset_latency",
72          "effective_time_frame"
73      ]
74  }
```

```json
1  {
2      "effective_time_frame": {
3          "time_interval": {
4              "start_date_time": "2018-02-05T21:35:00Z",
5              "end_date_time": "2018-02-05T39:05:00Z",
6          }
7      },
8      "sleep_onset_latency": {
9          "value": 17.5,
10         "unit": "min"
11     },
12     "is_main_sleep": true
13 }
14
15 {
16     "effective_time_frame": {
17         "time_interval": {
18             "start_date_time": "2018-04-05T21:35:00Z",
19             "end_date_time": "2018-05-05T22:00:00Z",
20         }
21     },
22     "sleep_onset_latency": {
23         "value": 15.25,
24         "unit": "min"
25     },
26     "is_main_sleep": true,
27     "descriptive_statistic": "average",
28     "descriptive_statistic_denominator": "d"
29 }
30
```

Review Comments on time-in-bed Schema

	Schema Line or Line Range	Comments	Date (comment)	Email Address of the person who made comments	Resolution	Date (resolution)
1						
2	4	David's earlier comment has not been really addressed and should be discussed: if the measure has value, then the description should be more precise as to what TIB includes and excludes	11/19/2019	simona.carini@ucsf.edu	Amended the description	1-Dec-19
3	26-36	see my comment on the previous version of the schema: remove time unit restrictions	11/19/2019	simona.carini@ucsf.edu	Removed	1-Dec-19
4	50	see comments in other schemas: add description of this data element	11/19/2019	simona.carini@ucsf.edu	Added	1-Dec-19
5	sample data	please use valid unit of measure for hours (h)	11/19/2019	simona.carini@ucsf.edu	Corrected	1-Dec-19
6	sample data	please separate instances into different files and remove hanging comma after "true" in the second instance; I'd recommend to have one instance that includes only the required elements	11/19/2019	simona.carini@ucsf.edu		
7	sample data	please add one sample instance showing a case of aggregate measure	11/19/2019	simona.carini@ucsf.edu		
8						
9	Schema	I wonder if "s" is the SI unit for "sec". Or maybe for enumeration "sec" abbreviation is OK	11/27/2019	shiv.Hiremath@temple.edu		
10						
11	sample data	no additional comments	11/27/2019	shiv.hiremath@temple.edu		

```json
{
    "$schema": "http://json-schema.org/draft-07/schema#",
    "type": "object",
    "description": "This schema represents time in bed, an interval derived from the time the person went to bed and the time they got up out of bed. It does not

    include extended periods out of bed other than brief interruptions. If the person gets out of bed in the middle of

    the sleep session to watch TV for example this period of time should be subtracted from time in bed",

    "definitions": {
        "duration_unit_value": {
            "$ref": "duration-unit-
        },
        "time_frame": {
            "$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": {
        "time_in_bed": {
            "allOf": [
                {
                    "$ref": "#/definitions/duration_unit_value"
                }
            ]
        },
        "effective_time_frame": {
            "description": "As a measure of a duration, time in bed should not be associated to a date time time frame. Hence, effective time frame is restricted
            "allOf": [
                {
                    "$ref": "#/definitions/time_frame"
                },
                {
                    "required": ["time_interval"]
                }
            ]
        },
```

```
39      "is_main_sleep": {
40          "description":"This value is used to differentiate brief periods of sleep (naps) from a main sleep session",
41          "type": "boolean"
42      },
43      "descriptive_statistic": {
44          "$ref": "#/definitions/descriptive_statistic"
45      },
46      "descriptive_statistic_denominator": {
47
48          "anyOf": [
49              {
50                  "$ref": "#/definitions/descriptive_statistic_denominator"
51              },
52              {
53                  "description": "If the value needed is a standard unit of duration, select from the duration-unit-value value set.",
54                  "type": "string"
55              }
56          ]
57      },
58  },
59
60  "required": [
61      "time_in_bed",
62      "effective_time_frame"
63  ]
64  }
```

```json
{
    "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,
}
```

Review Comments on light-sleep-percentage Schema (1)

	Schema Line or Line Range	Comments	Date (comment)	Email Address of the person who made comments	Resolution	Date (resolution)
1						
2	79-80	I am still unconvinced about the value of exposing this data element without the context information, which at a minimum is total_sleep_time	11/19/2019	simona.carini@ucsf.edu		
3		My recommendation is to consider adding light_sleep_duration to the schema total_sleep_time	11/20/2019	simona.carini@ucsf.edu		
4	4	The description is inconsistent: it first states that the schema represents "light sleep percentage in a sleep session" then later states that it can be used for the result of aggregating measurements over time	11/19/2019	simona.carini@ucsf.edu		
5	27 and 44	There is redundancy here and I am not sure it is clear why: given light sleep duration and %, it is possible to calculate TST; also, given TST and light sleep duration, it is possible to calculate light sleep duration	11/19/2019	simona.carini@ucsf.edu		
6	44	A reminder that this means an object comprised of possibly all the data elements defined in the schema total_sleep_time. At a minimum, this object will include a duration of TST plus an effective_time_frame	11/19/2019	simona.carini@ucsf.edu		

Review Comments on light-sleep-percentage Schema (2)

7	sample data	As per the above comment, the 3rd instance will not validate	11/19/2019	simona.carini@ucsf.edu		
8	sample data	please separate each instance into its own file	11/19/2019	simona.carini@ucsf.edu		
9	sample data	please use valie duration units (wk for week)	11/19/2019	simona.carini@ucsf.edu		
10	sample data	the 3rd instance says that the average weekly TST over the given time frame is 454 minutes, which seems unlikely)	11/19/2019	simona.carini@ucsf.edu		
11						
12	schema	no additional comments	11/27/2019	shiv.hiremath@temple.edu		
13	sample data	no additional comments	11/27/2019	shiv.hiremath@temple.edu		
14						

```json
{
    "$schema": "http://json-schema.org/draft-07/schema#",
    "type": "object",
    "description": "This schema represents the light sleep percentage in a sleep session (main sleep or nap), i.e., the percentage of total sleep time

    "definitions": {
        "duration_unit_value": {
            "$ref": "duration-unit-value-1.x.json"
        },
        "unit_value": {
            "$ref": "unit-value-1.x.json"
        },
        "time_frame": {
            "$ref": "time-frame-1.x.json"
        },
        "descriptive_statistic": {
            "$ref": "descriptive-statistic-1.x.json"
        },
        "descriptive_statistic_denominator": {
            "$ref": "descriptive-statistic-denominator-1.x.json"
        },
        "total_sleep_time": {
            "$ref": "total-sleep-time-1.x.json"
        }
    },
    "properties": {
        "light_sleep_duration": {
            "$ref": "#/definitions/duration_unit_value"
        },
        "light_sleep_percentage": {
            "allOf": [
                {
                    "$ref": "#/definitions/unit_value"
                },
                {
                    "properties": {
                        "unit": {
                            "enum": [ "%" ]
                        }
                    }
                }
            ]
        },
```

```json
44          "total_sleep_time": {
45            "$ref": "#/definitions/total_sleep_time"
46          },
47          "effective_time_frame": {
48            "description": "As a measure of a duration, light sleep duration should not be associated to a date time time frame. Hence, effective time fram
49            "allOf": [
50              {
51                "$ref": "#/definitions/time_frame"
52              },
53              {
54                "required": [ "time_interval" ]
55              }
56            ]
57          },
58          "is_main_sleep": {
59            "type": "boolean"
60          },
61          "descriptive_statistic": {
62            "$ref": "#/definitions/descriptive_statistic"
63          },
64          "descriptive_statistic_denominator": {
65
66            "anyOf": [
67              {
68                "$ref": "#/definitions/descriptive_statistic_denominator"
69              },
70              {
71                "description": "If the value needed is a standard unit of duration, select from the duration-unit-value value set.",
72                "type": "string"
73              }
74            ]
75          },
76        },
77
78      "required": [
79        "light_sleep_percentage",
80        "effective_time_frame"
81      ]
82  }
```

```json
{
    "light_sleep_percentage": {
        "value": 50,
        "unit": "%"
    },
    "light_sleep_duration": {
        "value": 240,
        "unit": "min"
    },
    "is_main_sleep": true,
    "effective_time_frame": {
        "time_interval": {
            "start_date_time": "2019-02-05T22:00:00Z",
            "end_date_time": "2019-02-06T06:00:00Z"
        }
    }
}

{
    "light_sleep_percentage": {
        "value": 60,
        "unit": "%"
    },
    "effective_time_frame": {
        "time_interval": {
            "start_date_time": "2019-02-05T22:00:00Z",
            "end_date_time": "2019-02-06T06:00:00Z"
        }
    }
}
```

```json
31
32  {
33      "light_sleep_percentage": {
34          "value": 55,
35          "unit": "%"
36      },
37      "light_sleep_duration": {
38          "value": 250,
39          "unit": "min"
40      },
41      "total_sleep_time": {
42          "value": 454,
43          "unit": "min"
44      },
45      "effective_time_frame": {
46          "time_interval": {
47              "start_date_time": "2019-02-05T22:00:00Z",
48              "end_date_time": "2019-02-11T06:00:00Z"
49          }
50      },
51      "descriptive_statistic": "average",
52      "descriptive_statistic_denominator": "w"
53  }
```

Review Comments on deep-sleep-percentage Schema

	Schema Line or Line Range	Comments	Date (comment)	Email Address of the person who made comments	Resolution	Date (resolution)
2		see all my comments re: light sleep percentage	19-Nov-19	simona.carini@ucsf.edu		
3						
4	schema	no comment	11/27/2019	shiv.hiremath@temple.edu		
5	Sample data	Do we need both % and minute	11/27/2019	shiv.hiremath@temple.edu		
6						
7						

```json
{
    "$schema": "http://json-schema.org/draft-07/schema#",
    "type": "object",
    "description": "This schema represents the deep sleep percentage in a sleep session (main sleep or nap), i.e., the percentage of time in deep sleep (N3)

    "definitions": {
        "duration_unit_value": {
            "$ref": "duration-unit-value-1.x.json"
        },
        "unit_value": {
            "$ref": "unit-value-1.x.json"
        },
        "time_frame": {
            "$ref": "time-frame-1.x.json"
        },
        "descriptive_statistic": {
            "$ref": "descriptive-statistic-1.x.json"
        },
        "descriptive_statistic_denominator": {
            "$ref": "descriptive-statistic-denominator-1.x.json"
        },
        "total_sleep_time": {
            "$ref": "total-sleep-time-1.x.json"
        }
    },
    "properties": {
        "deep_sleep_duration": {
            "$ref": "#/definitions/duration_unit_value"
        },
        "deep_sleep_percentage": {
            "allOf": [
                {
                    "$ref": "#/definitions/unit_value"
                },
                {
                    "properties": {
                        "unit": {
                            "enum": [ "%" ]
                        }
                    }
                }
            ]
        },
```

```json
44      "total_sleep_time": {
45          "$ref": "#/definitions/total_sleep_time"
46      },
47      "effective_time_frame": {
48          "description": "As a measure of a duration, deep sleep duration should not be associated to a date time time frame. Hence, effective time frame is re
49          "allOf": [
50              {
51                  "$ref": "#/definitions/time_frame"
52              },
53              {
54                  "required": [ "time_interval" ]
55              }
56          ]
57      },
58      "is_main_sleep": {
59          "type": "boolean"
60      },
61      "descriptive_statistic": {
62          "$ref": "#/definitions/descriptive_statistic"
63      },
64      "descriptive_statistic_denominator": {
65
66          "anyOf": [
67              {
68                  "$ref": "#/definitions/descriptive_statistic_denominator"
69              },
70              {
71                  "description": "If the value needed is a standard unit of duration, select from the duration-unit-value value set.",
72                  "type": "string"
73              }
74          ]
75      }
76  },
77
78  "required": [
79      "deep_sleep_percentage",
80      "effective_time_frame"
81  ]
82  }
```

```json
{
  "deep_sleep_percentage": {
    "value": 35,
    "unit": "%"
  },
  "deep_sleep_duration": {
    "value": 168,
    "unit": "min"
  },
  "is_main_sleep": true,
  "effective_time_frame": {
    "time_interval": {
      "start_date_time": "2019-02-05T22:00:00Z",
      "end_date_time": "2019-02-06T06:00:00Z"
    }
  }
}

{
  "deep_sleep_percentage": {
    "value": 30,
    "unit": "%"
  },
  "effective_time_frame": {
    "time_interval": {
      "start_date_time": "2019-02-05T22:00:00Z",
      "end_date_time": "2019-02-06T06:00:00Z"
    }
  }
}
```

```json
32  {
33      "deep_sleep_percentage": {
34          "value": 30,
35          "unit": "%"
36      },
37      "deep_sleep_duration": {
38          "value": 150,
39          "unit": "min"
40      },
41      "total_sleep_time": {
42          "value": 500,
43          "unit": "min"
44      },
45      "effective_time_frame": {
46          "time_interval": {
47              "start_date_time": "2019-02-05T22:00:00Z",
48              "end_date_time": "2019-02-11T06:00:00Z"
49          }
50      },
51      "descriptive_statistic": "average",
52      "descriptive_statistic_denominator": "w"
53  }
```

IEEE STANDARDS ASSOCIATION

Review Comments on total-sleep-time Schema

	Schema Line or Line Range	Comments	Date (comment)	Email Address of the person who made comments	Resolution	Date (resolution)
2	4 and 22	the two descriptions are not exactly the same as bedtime is not a synonym for initial sleep onset and getting out of bed is not a synonym for final awakening; there is actually no reason to repeat the description in two places	11/19/2019	simona.carini@ucsf.edu		
3	4	add definition of awakening	11/19/2019	simona.carini@ucsf.edu		
4	N/A	is there a reason is_main_sleep property has been omitted from this schema?	11/19/2019	simona.carini@ucsf.edu		
5	25	This array is missing the "items" keyword (see JSON Schema specifications on array definition)	11/19/2019	simona.carini@ucsf.edu		
6	25	The inclusion of time interval of individual events is a proposal that I think should be discussed further: it seems to me that it is either implemented in all schemas where it applies or it isn't	11/19/2019	simona.carini@ucsf.edu		
7	sample data	please separate each instance in its own file	11/19/2019	simona.carini@ucsf.edu		
8	sample data	please use valid units of duration (h, wk)	11/19/2019	simona.carini@ucsf.edu		
9	sample data	in the last instance: average weekly TST of 5 hours seems unlikely; I'd guess a daily average is more relevant in the case of sleep; if weekly is preferred, then I suggest to specify a time frame of several weeks	11/19/2019	simona.carini@ucsf.edu		
10	schema data	no additional comments	11/27/2019	shiv.hiremath@temple.edu		
11	sample data	no additional comments	11/27/2019	shiv.hiremath@temple.edu		

```json
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "type": "object",
  "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

  "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_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 awak
      "$ref": "#/definitions/duration_unit_value"
    },
    "sleep_events": {
      "description": "Individual sleep events and their durations to describe at what points throughout the night is the individual is asleep, and when summarized e
      "type": "array",
      "allOf": [
        {
          "$ref": "#/definitions/time_frame"
        },
        {
          "required": [
            "time_interval"
          ]
        }
      ]
    },
```

```json
      "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
        "allOf": [
          {
            "$ref": "#/definitions/time_frame"
          },
          {
            "required": [
              "time_interval"
            ]
          }
        ]
      },
      "descriptive_statistic": {
        "$ref": "#/definitions/descriptive_statistic"
      },
      "descriptive_statistic_denominator": {
        "anyOf": [
          {
            "$ref": "#/definitions/descriptive_statistic_denominator"
          },
          {
            "description": "If the value needed is a standard unit of duration, select from the duration-unit-value value set.",
            "type": "string"
          }
        ]
      }
    },
    "required": [
      "total_sleep_time",
      "effective_time_frame"
    ]
}
```

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

```json
34                }
35            ]
36            "effective_time_frame": {
37                "time_interval": {
38                    "start_date_time": "2019-02-19T22:30:00Z",
39                    "end_date_time": "2019-02-20T04:50:00Z"
40                }
41            }
42        }
43        {
44            "total_sleep_time": {
45                "value": 5,
46                "unit": "hh"
47            },
48            "effective_time_frame": {
49                "time_interval": {
50                    "start_date_time": "2019-02-14T22:30:00Z",
51                    "end_date_time": "2019-02-20T04:50:00Z"
52                }
53            }
54            "descriptive_statistic": "average",
55            "descriptive_statistic_denominator": "w"
56        }
57
```

Summary of Major Review Comments

1. **The inclusion of time interval of individual event were proposed in some of the schemas (e.g. total-sleep-time)**
2. Suggest to reevaluate inclusion/exclusion of statistical measures for some schemas (e.g. sleep-body-movement, on-going discussion)
3. Fix missing keyword (e.g. "item" for array) for some schema
4. Make sure to use the valid units of duration in sample data (e.g. h, wk)
5. Editorial comments (e.g. description, etc.)
6. Sample data (one file with delimiters between instances for review, one file/instance for validation)

Implications of the 1st Comment

➢ Set criteria for applicability of this proposal
    -- Relevancy for a specific sleep metric
    -- Use case(s)
➢ Determine if this proposal is applicable to a schema
➢ If applicable, make modifications
➢ Validate the syntax

Discuss/Propose Relevant Schemas (1)

➢ 1st Batch

--ambient-light

--ambient-sound

--ambient-temperature

--deep-sleep-percentage

--light-sleep-percentage

--sleep-onset-latency

--time-in-bed

--**total-sleep-time (use case?)**

Discuss/Propose Relevant Schemas (2)

> 2nd Batch

--apnea-hypopnea-index

--arousal-index

--sleep-body-movement

--sleep-episode

--sleep-stages

--snore-index

--wake-after-sleep-onset

Next Steps

➢Address WG review comments on 1st batch schemas

➢Modify the relevant schemas (1st comment):
--Propose/Document use case(s) for each relevant schemas
--Review/Finalize the list of relevant schemas
--Modify the schemas in the finalized list

➢Review/Summarize WG major comments on 2nd batch schemas

➢Prepare the revised version of 1st batch schemas for WG to review

Comments on Upcoming Schema Review Calls?

Action Items

➢ Address the WG comments on 1st batch schemas by Dec 6 (Distribute on Dec 6) (TBD)

➢ Review/Summarize the main WG comments on 2nd batch schemas by Dec 16 (TBD)

➢ Get ready to distribute the 2nd batch quantitative schemas, generic survey documents and schemas by TBD

Future Meetings

- Continue with Tuesdays at 8:30 AM Pacific / 11:30 AM Eastern
- Upcoming meetings
  - Jan 7, 2020 (tentative)

Adjournment