A Feasibility Study: Testing Whether a Sleep Application Providing Objective Sleep Data to Physicians Improves Patient-Physician Communication Regarding Sleep Experiences, Habits and Behaviors

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### Table A.1: Study instrument questions mapped to outcome variables

| Question                                                                 | Outcome                                      |
|-------------------------------------------------------------------------|----------------------------------------------|
| **Sleep Health questionnaire**                                           |                                              |
| 1. In general, how would you rate your sleep quality                    | Sleep outcome: Sleep quality subindex         |
| 2. During the past 7 days, how many days did you wake up feeling well-rested, if any? | Sleep outcome: Sleep quality subindex         |
| 3. How many nights did you have trouble **falling asleep**?             | Sleep outcome: Sleep quality subindex         |
| 4. How many nights did you have trouble staying asleep?                 | Sleep outcome: Sleep quality subindex         |
| 5. How many days did poor or insufficient sleep significantly impact your daily activities, like your work performance, socializing, exercising, or other typical activities? | Sleep outcome: Sleep quality subindex         |
| 6. How many days did you fall asleep without intending to, such as dozing off in front of the TV or in any other situation? | Sleep outcome: Sleep quality subindex         |
| 7. How many nights did you take over-the-counter or prescription medication to help you sleep? | Sleep outcome: Disordered sleep subindex      |
| **Patient Satisfaction Questionnaire**                                  |                                              |
| 1. I am very satisfied with the medical care I receive                   | General Satisfaction                         |
| 2. Doctors are good about explaining the reason for medical tests        | Communication                                |
| 3. The medical care I have been receiving is just about perfect          | General Satisfaction                         |
| 4. During my medical visits, I am always allowed to say everything that I think is important | Communication                                |
| 5. Sometimes doctors use medical terms without explaining what they mean | Communication                                |
| 6. There are things about the medical system I receive my care from that need to be improved | General Satisfaction                         |
| 7. There are some things about the medical care I receive that could be better | General Satisfaction                         |
| 8. Those who provide my medical care sometimes hurry too much when they treat me | General Satisfaction/Time with Doctor – considered G |
| 9. Doctors sometimes ignore what I tell them                             | Communication                                |
| 10. All things considered, the medical care I receive is excellent       | General Satisfaction                         |
| 11. Doctors listen carefully to what I have to say                        | Communication                                |
12. Doctors usually spend plenty of time with me

13. I am dissatisfied with some things about the medical care I receive

**Physician Satisfaction Questionnaire**

1. Encouraged the patient to express his or her thoughts concerning his or her health problems
2. Listened carefully to what the patient had to say
3. Understood what the patient had to say
4. If a physical examination was required, explained what was done and why
5. Discussed treatment options with the patient
6. Gave the patient as much information as he or she wanted
7. Checked with the patient to see if the treatment plan(s) was acceptable
8. Explained medications, if any, including possible side-effects
9. Encouraged the patient to ask questions
10. Responded to the patient’s questions and concerns
11. Involved the patient in decisions as much as he or she wanted
12. Discussed next steps including any follow-up plans
13. Checked to be sure the patient understood everything
14. Showed care and concern about the patient as a person
15. Spent the right amount of time with the patient
16. Overall, I was satisfied with my consultation about sleep
Table A.2: Study instrument questions with original scoring.

1. In general, how would you rate your sleep quality? (SL–SQ)
   - Excellent
   - Very good
   - Good
   - Only fair
   - Poor

*Scoring: Each response option is essentially converted to a 0-100 scale score. As such, excellent = 100, Very Good = 75, Good = 50, Only Fair = 25, and Poor = 0*

2. During the past 7 days, how many days did you wake up feeling well-rested, if any? (SL-SQ)
   - 7 Days
   - 6 Days
   - 5 Days
   - 4 Days
   - 3 Days
   - 2 Days
   - 1 Day
   - 0 Days

*Scoring: Each response option is essentially converted to a 0-100 scale score - 7d = 100, 6d = 86, 5d = 71, 4d = 57, 3d = 43, 2d = 29, 1d = 14, 0d = 0*

3. How many nights did you have trouble falling asleep? (SL-SQ)
   0 Days
   - 1 Day
   - 2 Days
   - 3 Days
   - 4 Days
   - 5 Days
   - 6 Days
   - 7 Days

*Scoring: Each response option is essentially converted to a 0-100 scale score - 0d = 100, 1d = 86, 2d = 71, 3d = 57, 4d = 43, 5d = 29, 6d = 14, 7d = 0*

4. And how many nights did you have trouble staying asleep? (SL-SQ)
Score of SQ subscale: Average the 6 items.

7. How many nights did you take over-the-counter or prescription medication to help you sleep? (SL-DS)
Scoring: Each response option is essentially converted to a 0-100 scale score - 0d = 100, 1d = 86, 2d = 71, 3d = 57, 4d = 43, 5d = 29, 6d = 14, 7d = 0

**The DS subscale is usually scored with 2 other items (if respondent has a sleep disorder and if the respondent has discussed sleep problems with their doctor). The answers to both of these remaining questions for the purposes of this study are likely, yes (=0). We may not want to produce the overall DS score, however, and just be able to report out in general the direct response to the question (#7), which is of interest by itself.

Patient Satisfaction:
Thinking about your sleep care specifically:

1. I am very satisfied with the medical care I receive (PSQ3, GS):
   | Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree |
   | 1               | 2     | 3         | 4        | 5                  |

2. Doctors are good about explaining the reason for medical tests (PSQ6, C):
   | Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree |
   | 1               | 2     | 3         | 4        | 5                  |

3. The medical care I have been receiving is just about perfect (PSQ11, GS):
   | Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree |
   | 1               | 2     | 3         | 4        | 5                  |

4. During my medical visits, I am always allowed to say everything that I think is important (PSQ13, C):
   | Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree |
   | 1               | 2     | 3         | 4        | 5                  |

5. Sometimes doctors use medical terms without explaining what they mean (PSQ18, C):
   | Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree |
   | 1               | 2     | 3         | 4        | 5                  |

6. There are things about the medical system I receive my care from that need to be improved (PSQ21, GS):
   | Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree |
   | 1               | 2     | 3         | 4        | 5                  |

7. There are some things about the medical care I receive that could be better (PSQ33, GS):
   | Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree |
   | 1               | 2     | 3         | 4        | 5                  |
8. Those who provide my medical care sometimes hurry too much when they treat me (PSQ35, TD/GS):

| Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree |
|----------------|-------|-----------|----------|-------------------|
| 1              | 2     | 3         | 4        | 5                 |

9. Doctors sometimes ignore what I tell them (PSQ38, C):

| Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree |
|----------------|-------|-----------|----------|-------------------|
| 1              | 2     | 3         | 4        | 5                 |

10. All things considered, the medical care I receive is excellent (PSQ42, GS):

| Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree |
|----------------|-------|-----------|----------|-------------------|
| 1              | 2     | 3         | 4        | 5                 |

11. Doctors listen carefully to what I have to say (PSQ43, C):

| Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree |
|----------------|-------|-----------|----------|-------------------|
| 1              | 2     | 3         | 4        | 5                 |

12. Doctors usually spend plenty of time with me (PSQ46, TD/GS):

| Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree |
|----------------|-------|-----------|----------|-------------------|
| 1              | 2     | 3         | 4        | 5                 |

13. I am dissatisfied with some things about the medical care I receive (PSQ49, GS):

| Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree |
|----------------|-------|-----------|----------|-------------------|
| 1              | 2     | 3         | 4        | 5                 |

Scoring: All questions highlighted, need to be reverse coded at the time of scoring – so, a response of 1 will be recoded to 5, 2 recoded to 4, 3 remains 3, 4 recoded to 2, and 5 recoded to 1. Each scale score is summed (e.g., Sum all of the 6 GS questions, range: 6-30). Scale scores can then be transformed linearly to a 0-100 possible range (e.g., 6=0, 30 = 100, unit increase = 4.167).

Focus on agreement (Strongly agree, agree, Indifferent, Disagree, strongly D) or frequency (Always Often Sometimes rarely never)

**App Satisfaction:**
1. I am satisfied with the way the app works.
2. I feel that the sleep app provides helpful or useful information.
3. I pay more attention to my sleep since using the app.
4. I feel more connected to my physician by using the app.
5. The app is easy to use.

**Physician Satisfaction/Communication**
1. Encouraged the patient to express his or her thoughts concerning his or her
| Health Problems (C) | Strongly Agree | Agree | Uncertain | Disagree | Strongly Disagree | 5 |
|---------------------|----------------|-------|-----------|----------|------------------|---|
| Listened carefully to what the patient had to say (C) | Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree | 5 |
| Understood what the patient had to say (C): | Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree | 5 |
| If a physical examination was required, explained what was done and why (C): | Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree | 5 |
| Discussed treatment options with the patient (C): | Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree | 5 |
| Gave the patient as much information as he or she wanted (GS): | Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree | 5 |
| Checked with the patient to see if the treatment plan(s) was acceptable (GS): | Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree | 5 |
| Explained medications, if any, including possible side-effects (C): | Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree | 5 |
| Encouraged the patient to ask questions (C): | Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree | 5 |
| Responded to the patient’s questions and concerns (GS): | Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree | 5 |
| Involved the patient in decisions as much as he or she wanted (GS): | Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree | 5 |
| Discussed next steps including any follow-up plans (C): | Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree | 5 |
| Checked to be sure the patient understood everything (GS) | Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree | 5 |
| Showed care and concern about the patient as a person (GS): | Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree | 5 |
15. Spent the right amount of time with the patient (GS):

| Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree |
|----------------|-------|-----------|----------|-------------------|
| 1              | 2     | 3         | 4        | 5                 |

16. Overall, I was satisfied with this consultation today (GS):

| Strongly agree | Agree | Uncertain | Disagree | Strongly Disagree |
|----------------|-------|-----------|----------|-------------------|
| 1              | 2     | 3         | 4        | 5                 |

Key:
GS: General Satisfaction
C: Communication
SL: Sleep Outcomes
   SQ = Sleep Quality Subindex
   DS = Disordered Sleep Subindex
TD: Time with doctor
APPENDIX B

Note that for a patient the measurement may not be on a daily basis, meaning not all of the dates were consecutive.

For each person, NAs were assigned for the non-consecutive dates for all variables. Taking 7 days as a week, each daily measurement was assigned week numbers starting from 1, from earliest date to the last date. The total number of weeks for each patient varied, depending on how many days his or her measurements were recorded by the Fitbit device.

For each variable, for each patient, the means of each measured variable were calculated for each week, if that week had at least one record; otherwise, NA was assigned. This calculation was done for week 1 through week 32, for each patient and each variable. There are 7 plots altogether displayed as Figures B.1-B.7 below. Each plot is for each of the 7 variables of interest. The mean (height of the bar) and the standard deviation (the error bar) for the control (orange) and intervention (blue) groups are shown. The mean of patients’ weekly means is shown, except for those weeks with less than 3 patients.

Figure B.1: Plot showing how long the patients slept for, in minutes
Figure B.2: Plot showing how long the patients spent in bed in total, in minutes

Figure B.3: Plot showing how long the patient spent in bed before falling asleep, in minutes

Figure B.4: Plot showing the number of times the patient woke up after falling asleep
**Figure B.5:** Plot showing the amount of time the patient spent awake after falling asleep, in minutes

**Figure B.6:** Plot showing the efficiency of patients' sleep
Figure B.7: Plot showing what percentage of time the patient spent awake in bed (time awake/time in bed * 100)