

WEBVTT

NOTE duration:"01:00:32.8000000"

NOTE language:en-us

NOTE Confidence: 0.859178006649017

00:00:20.010 --> 00:00:21.915 Alright hi everybody.

NOTE Confidence: 0.859178006649017

00:00:21.915 --> 00:00:25.725 Welcome, my name is Lauren Tobias.

NOTE Confidence: 0.859178006649017

00:00:25.730 --> 00:00:27.865 I'd like you to welcome to welcome

NOTE Confidence: 0.859178006649017

00:00:27.865 --> 00:00:30.444 you back to our Yale Sleep Seminar

NOTE Confidence: 0.859178006649017

00:00:30.444 --> 00:00:32.434 for the Winter Spring semester.

NOTE Confidence: 0.859178006649017

00:00:32.440 --> 00:00:34.456 I have a few quick announcements

NOTE Confidence: 0.859178006649017

00:00:34.456 --> 00:00:36.320 before I introduce today's speaker.

NOTE Confidence: 0.859178006649017

00:00:36.320 --> 00:00:38.644 So first, please take a moment to

NOTE Confidence: 0.859178006649017

00:00:38.644 --> 00:00:41.183 ensure that you're muted in order to

NOTE Confidence: 0.859178006649017

00:00:41.183 --> 00:00:43.028 receive CME credit for attendance,

NOTE Confidence: 0.859178006649017

00:00:43.030 --> 00:00:45.494 please see the chat room for instructions.

NOTE Confidence: 0.859178006649017

00:00:45.500 --> 00:00:47.943 You can text the unique ID for

NOTE Confidence: 0.859178006649017

00:00:47.943 --> 00:00:49.818 this conference anytime until 3:15

NOTE Confidence: 0.859178006649017

00:00:49.818 --> 00:00:52.104 PM Eastern Time if you're not

NOTE Confidence: 0.859178006649017
00:00:52.104 --> 00:00:53.967 already registered with DLC and me.
NOTE Confidence: 0.859178006649017
00:00:53.970 --> 00:00:56.136 You do need to do that.
NOTE Confidence: 0.859178006649017
00:00:56.140 --> 00:00:57.940 1st, If you have any questions
NOTE Confidence: 0.859178006649017
00:00:57.940 --> 00:00:58.840 during the presentation,
NOTE Confidence: 0.859178006649017
00:00:58.840 --> 00:01:00.792 I encourage you to make use of the
NOTE Confidence: 0.859178006649017
00:01:00.792 --> 00:01:02.604 chat room throughout the hour and
NOTE Confidence: 0.859178006649017
00:01:02.604 --> 00:01:04.889 will also have an opportunity for you
NOTE Confidence: 0.859178006649017
00:01:04.889 --> 00:01:06.851 to unmute yourself and ask questions
NOTE Confidence: 0.859178006649017
00:01:06.851 --> 00:01:09.004 directly to Doctor Goldstein at the end.
NOTE Confidence: 0.859178006649017
00:01:09.004 --> 00:01:10.750 We do have recorded versions of
NOTE Confidence: 0.859178006649017
00:01:10.813 --> 00:01:12.661 these lectures which are going to
NOTE Confidence: 0.859178006649017
00:01:12.661 --> 00:01:14.526 be available online at the link
NOTE Confidence: 0.859178006649017
00:01:14.526 --> 00:01:16.535 provided in the chat and then finally,
NOTE Confidence: 0.859178006649017
00:01:16.540 --> 00:01:18.298 please feel free to share our
NOTE Confidence: 0.859178006649017
00:01:18.298 --> 00:01:19.796 announcement for a weekly lecture
NOTE Confidence: 0.859178006649017

00:01:19.796 --> 00:01:21.392 series to anyone else who you
NOTE Confidence: 0.859178006649017

00:01:21.392 --> 00:01:22.840 think may be interested,
NOTE Confidence: 0.859178006649017

00:01:22.840 --> 00:01:24.340 or contact Debbie Lovejoy to
NOTE Confidence: 0.859178006649017

00:01:24.340 --> 00:01:26.200 be added to our email list.
NOTE Confidence: 0.859178006649017

00:01:26.200 --> 00:01:28.944 So this afternoon I have the pleasure
NOTE Confidence: 0.859178006649017

00:01:28.944 --> 00:01:31.249 of introducing Doctor Kathy Goldstein.
NOTE Confidence: 0.859178006649017

00:01:31.250 --> 00:01:33.400 Doctor Goldstein received her medical
NOTE Confidence: 0.859178006649017

00:01:33.400 --> 00:01:36.300 degree from the Medical College of Georgia.
NOTE Confidence: 0.859178006649017

00:01:36.300 --> 00:01:38.742 Didn't ask her about her feelings
NOTE Confidence: 0.859178006649017

00:01:38.742 --> 00:01:41.360 about events of this morning yet.
NOTE Confidence: 0.859178006649017

00:01:41.360 --> 00:01:43.400 She completed a neurology residency
NOTE Confidence: 0.859178006649017

00:01:43.400 --> 00:01:45.940 at the University of Colorado and
NOTE Confidence: 0.859178006649017

00:01:45.940 --> 00:01:48.085 her sleep fellowship at Northwestern,
NOTE Confidence: 0.859178006649017

00:01:48.090 --> 00:01:51.037 followed by a Masters in clinical research,
NOTE Confidence: 0.859178006649017

00:01:51.040 --> 00:01:51.461 design,
NOTE Confidence: 0.859178006649017

00:01:51.461 --> 00:01:53.145 and statistical analysis at

NOTE Confidence: 0.859178006649017
00:01:53.145 --> 00:01:54.829 the University of Michigan.
NOTE Confidence: 0.859178006649017
00:01:54.830 --> 00:01:56.835 She's currently a clinical associate
NOTE Confidence: 0.859178006649017
00:01:56.835 --> 00:01:58.840 professor in neurology at the
NOTE Confidence: 0.859178006649017
00:01:58.902 --> 00:02:01.048 University of Michigan, Ann Arbor.
NOTE Confidence: 0.859178006649017
00:02:01.048 --> 00:02:03.666 Her research interest is in sleep and
NOTE Confidence: 0.859178006649017
00:02:03.666 --> 00:02:05.430 circadian interactions with health
NOTE Confidence: 0.859178006649017
00:02:05.430 --> 00:02:08.064 and for several years she's been
NOTE Confidence: 0.859178006649017
00:02:08.064 --> 00:02:10.573 interested in the role of consumer
NOTE Confidence: 0.859178006649017
00:02:10.573 --> 00:02:12.573 sleep technologies and Sleep Medicine,
NOTE Confidence: 0.859178006649017
00:02:12.580 --> 00:02:15.010 including the role of wearables and
NOTE Confidence: 0.859178006649017
00:02:15.010 --> 00:02:17.040 smartphones, sleep tracking acts, apps.
NOTE Confidence: 0.859178006649017
00:02:17.040 --> 00:02:19.065 She's an active clinical educator.
NOTE Confidence: 0.859178006649017
00:02:19.070 --> 00:02:21.140 She lectures nationally and and
NOTE Confidence: 0.859178006649017
00:02:21.140 --> 00:02:23.540 she is slated to be Co.
NOTE Confidence: 0.859178006649017
00:02:23.540 --> 00:02:25.964 Chair of the ASM Sleep Trends
NOTE Confidence: 0.859178006649017

00:02:25.964 --> 00:02:28.010 Conference for the upcoming year.
NOTE Confidence: 0.859178006649017

00:02:28.010 --> 00:02:29.955 She's authored ASM position statement
NOTE Confidence: 0.859178006649017

00:02:29.955 --> 00:02:32.920 on the role of consumer sleep tracking.
NOTE Confidence: 0.859178006649017

00:02:32.920 --> 00:02:34.364 And also artificial intelligence
NOTE Confidence: 0.859178006649017

00:02:34.364 --> 00:02:35.447 and Sleep Medicine.
NOTE Confidence: 0.859178006649017

00:02:35.450 --> 00:02:37.970 And just recently she published an
NOTE Confidence: 0.859178006649017

00:02:37.970 --> 00:02:40.001 article that encourage everybody to
NOTE Confidence: 0.859178006649017

00:02:40.001 --> 00:02:42.257 check out in JC SM that shares the
NOTE Confidence: 0.859178006649017

00:02:42.257 --> 00:02:44.456 results of a large national survey
NOTE Confidence: 0.859178006649017

00:02:44.456 --> 00:02:46.306 examining the impact of COVID-19
NOTE Confidence: 0.859178006649017

00:02:46.310 --> 00:02:48.488 stay at home orders and sleep,
NOTE Confidence: 0.859178006649017

00:02:48.490 --> 00:02:49.934 health and working patterns,
NOTE Confidence: 0.859178006649017

00:02:49.934 --> 00:02:51.739 which I found really interesting.
NOTE Confidence: 0.859178006649017

00:02:51.740 --> 00:02:54.612 So with that I am delighted to have
NOTE Confidence: 0.859178006649017

00:02:54.612 --> 00:02:56.297 Doctor Goldstein here to discuss
NOTE Confidence: 0.859178006649017

00:02:56.297 --> 00:02:59.280 a topic that I know many of us are

NOTE Confidence: 0.859178006649017
00:02:59.280 --> 00:03:01.770 eager to learn more about consumer
NOTE Confidence: 0.859178006649017
00:03:01.770 --> 00:03:02.964 sleep technologies potentials.
NOTE Confidence: 0.859178006649017
00:03:02.964 --> 00:03:05.148 Pitfalls in the future of ambulatory
NOTE Confidence: 0.859178006649017
00:03:05.148 --> 00:03:06.744 sleep tracking? Thank you.
NOTE Confidence: 0.859178006649017
00:03:06.744 --> 00:03:09.336 I will turn myself off Doctor
NOTE Confidence: 0.859178006649017
00:03:09.336 --> 00:03:11.887 Goldstein and turn it over to you.
NOTE Confidence: 0.859178006649017
00:03:11.890 --> 00:03:12.260 Awesome,
NOTE Confidence: 0.817456901073456
00:03:12.260 --> 00:03:15.260 thank you so much Lauren and big virtual.
NOTE Confidence: 0.817456901073456
00:03:15.260 --> 00:03:16.304 Hello to everybody.
NOTE Confidence: 0.817456901073456
00:03:16.304 --> 00:03:19.740 I'm going to go ahead and get started here.
NOTE Confidence: 0.817456901073456
00:03:19.740 --> 00:03:24.290 This is your code to text to get your CME.
NOTE Confidence: 0.817456901073456
00:03:24.290 --> 00:03:26.925 And I have no conflicts
NOTE Confidence: 0.817456901073456
00:03:26.925 --> 00:03:29.033 of interest to disclose.
NOTE Confidence: 0.817456901073456
00:03:29.040 --> 00:03:32.088 OK, so here's our road map
NOTE Confidence: 0.817456901073456
00:03:32.088 --> 00:03:33.612 for today's discussion.
NOTE Confidence: 0.817456901073456

00:03:33.620 --> 00:03:35.990 Casino what is to come?
NOTE Confidence: 0.817456901073456

00:03:35.990 --> 00:03:39.266 And I do want to disclose the fact that
NOTE Confidence: 0.817456901073456

00:03:39.266 --> 00:03:42.705 this is not gonna be a review of all
NOTE Confidence: 0.817456901073456

00:03:42.705 --> 00:03:45.360 the available consumer technologies.
NOTE Confidence: 0.817456901073456

00:03:45.360 --> 00:03:47.064 The entire landscape that
NOTE Confidence: 0.817456901073456

00:03:47.064 --> 00:03:49.620 I'm going to present to you,
NOTE Confidence: 0.817456901073456

00:03:49.620 --> 00:03:52.763 a general framework with which you can
NOTE Confidence: 0.817456901073456

00:03:52.763 --> 00:03:54.594 approach consumer sleep technologies
NOTE Confidence: 0.817456901073456

00:03:54.594 --> 00:03:57.478 in general and with the specific use
NOTE Confidence: 0.817456901073456

00:03:57.478 --> 00:03:59.793 case of wearable sleep estimation
NOTE Confidence: 0.817456901073456

00:03:59.793 --> 00:04:03.083 devices that use motion and heart rate.
NOTE Confidence: 0.817456901073456

00:04:03.090 --> 00:04:04.686 So first of all.
NOTE Confidence: 0.817456901073456

00:04:04.686 --> 00:04:08.639 Why do we even care bout tracking sleep?
NOTE Confidence: 0.817456901073456

00:04:08.640 --> 00:04:11.174 So we have this really big paradox
NOTE Confidence: 0.817456901073456

00:04:11.174 --> 00:04:13.560 in Sleep Medicine and research where
NOTE Confidence: 0.817456901073456

00:04:13.560 --> 00:04:16.020 we know that sleep deprivation and

NOTE Confidence: 0.817456901073456
00:04:16.020 --> 00:04:18.483 sleep disorders cause their detriment
NOTE Confidence: 0.817456901073456
00:04:18.483 --> 00:04:20.459 through chronic exposure every
NOTE Confidence: 0.817456901073456
00:04:20.459 --> 00:04:22.674 night to disturbances in sleep,
NOTE Confidence: 0.817456901073456
00:04:22.674 --> 00:04:24.714 quality, erratic sleep timing or
NOTE Confidence: 0.817456901073456
00:04:24.714 --> 00:04:26.140 reduce sleep duration.
NOTE Confidence: 0.817456901073456
00:04:26.140 --> 00:04:29.716 That how do we measure sleep with an
NOTE Confidence: 0.817456901073456
00:04:29.716 --> 00:04:31.875 overnight polysomnogram is our gold
NOTE Confidence: 0.817456901073456
00:04:31.875 --> 00:04:34.257 standard which is great to diagnose.
NOTE Confidence: 0.817456901073456
00:04:34.260 --> 00:04:35.968 Sleep apnea, certain parasomnias
NOTE Confidence: 0.817456901073456
00:04:35.968 --> 00:04:37.676 and movement Santa titrate.
NOTE Confidence: 0.817456901073456
00:04:37.680 --> 00:04:38.128 Happy,
NOTE Confidence: 0.817456901073456
00:04:38.128 --> 00:04:40.368 but this is really impractical
NOTE Confidence: 0.817456901073456
00:04:40.368 --> 00:04:43.548 beyond one to two nights or abuse.
NOTE Confidence: 0.817456901073456
00:04:43.550 --> 00:04:46.252 So how do we track sleep objectively
NOTE Confidence: 0.817456901073456
00:04:46.252 --> 00:04:49.298 so that we can get more than one
NOTE Confidence: 0.817456901073456

00:04:49.298 --> 00:04:52.010 to two nights of sleep recording?
NOTE Confidence: 0.817456901073456

00:04:52.010 --> 00:04:54.428 Well, we do have an option.
NOTE Confidence: 0.817456901073456

00:04:54.430 --> 00:04:57.377 I am the currently accepted option for
NOTE Confidence: 0.817456901073456

00:04:57.377 --> 00:04:59.559 clinical Sleep Medicine and research
NOTE Confidence: 0.817456901073456

00:04:59.559 --> 00:05:02.506 is actigraphy anac trigger fee in the
NOTE Confidence: 0.817456901073456

00:05:02.506 --> 00:05:04.907 traditional sense is cleared by the FDA,
NOTE Confidence: 0.817456901073456

00:05:04.910 --> 00:05:07.794 and it uses a wrist worn accelerometer
NOTE Confidence: 0.817456901073456

00:05:07.794 --> 00:05:10.667 to monitor motion during 24 hour period
NOTE Confidence: 0.817456901073456

00:05:10.667 --> 00:05:13.820 with the rationale that we move more than.
NOTE Confidence: 0.817456901073456

00:05:13.820 --> 00:05:14.903 When we're awake,
NOTE Confidence: 0.817456901073456

00:05:14.903 --> 00:05:17.069 then we do when we're asleep.
NOTE Confidence: 0.817456901073456

00:05:17.070 --> 00:05:19.806 So the way this works is you give
NOTE Confidence: 0.817456901073456

00:05:19.806 --> 00:05:21.760 an actigraph to your patient.
NOTE Confidence: 0.817456901073456

00:05:21.760 --> 00:05:23.884 They wear the device and there's
NOTE Confidence: 0.817456901073456

00:05:23.884 --> 00:05:25.721 a piezo electric accelerometer or
NOTE Confidence: 0.817456901073456

00:05:25.721 --> 00:05:27.531 Mens accelerometer in the device

NOTE Confidence: 0.817456901073456
00:05:27.531 --> 00:05:28.617 which collects motion,
NOTE Confidence: 0.817456901073456
00:05:28.620 --> 00:05:30.480 which is then digitized into
NOTE Confidence: 0.817456901073456
00:05:30.480 --> 00:05:32.853 activity counts the data from the
NOTE Confidence: 0.817456901073456
00:05:32.853 --> 00:05:34.200 devices then downloaded.
NOTE Confidence: 0.817456901073456
00:05:34.200 --> 00:05:37.014 And a software package uses an
NOTE Confidence: 0.817456901073456
00:05:37.014 --> 00:05:39.770 algorithm to determine sleep from wake,
NOTE Confidence: 0.817456901073456
00:05:39.770 --> 00:05:42.770 and we like actigraphy because Actigraphy
NOTE Confidence: 0.817456901073456
00:05:42.770 --> 00:05:45.340 performance has been compared to PSG,
NOTE Confidence: 0.817456901073456
00:05:45.340 --> 00:05:47.655 and the findings of that
NOTE Confidence: 0.817456901073456
00:05:47.655 --> 00:05:49.507 performance published in many,
NOTE Confidence: 0.817456901073456
00:05:49.510 --> 00:05:51.594 many research publications, so.
NOTE Confidence: 0.817456901073456
00:05:51.594 --> 00:05:53.157 What's the problem?
NOTE Confidence: 0.817456901073456
00:05:53.160 --> 00:05:55.380 If we have this small, unobtrusive
NOTE Confidence: 0.817456901073456
00:05:55.380 --> 00:05:58.340 way to measure sleep over days to weeks,
NOTE Confidence: 0.817456901073456
00:05:58.340 --> 00:06:00.190 well, there's quite a bit.
NOTE Confidence: 0.817456901073456

00:06:00.190 --> 00:06:01.670 As you can tell.
NOTE Confidence: 0.817456901073456

00:06:01.670 --> 00:06:03.520 So first of all, actigraphy,
NOTE Confidence: 0.817456901073456

00:06:03.520 --> 00:06:05.000 typically just measures movement.
NOTE Confidence: 0.817456901073456

00:06:05.000 --> 00:06:06.644 Some devices measure light.
NOTE Confidence: 0.817456901073456

00:06:06.644 --> 00:06:09.110 The data acquisition methods and storage
NOTE Confidence: 0.817456901073456

00:06:09.177 --> 00:06:11.835 methods are really outdated with actigraphy,
NOTE Confidence: 0.817456901073456

00:06:11.840 --> 00:06:14.880 so before you give the device to somebody,
NOTE Confidence: 0.817456901073456

00:06:14.880 --> 00:06:16.780 you have to initialize it
NOTE Confidence: 0.817456901073456

00:06:16.780 --> 00:06:18.680 and to recover the data.
NOTE Confidence: 0.817456901073456

00:06:18.680 --> 00:06:20.485 You typically have to plug
NOTE Confidence: 0.817456901073456

00:06:20.485 --> 00:06:22.860 it back in via USB ports,
NOTE Confidence: 0.817456901073456

00:06:22.860 --> 00:06:25.520 and so we can't really transmit an.
NOTE Confidence: 0.817456901073456

00:06:25.520 --> 00:06:28.346 Evaluate the data in real time.
NOTE Confidence: 0.817456901073456

00:06:28.350 --> 00:06:30.780 I've even seen researchers male actor
NOTE Confidence: 0.817456901073456

00:06:30.780 --> 00:06:33.429 graphs back and forth to each other,
NOTE Confidence: 0.817456901073456

00:06:33.430 --> 00:06:34.998 which is pretty prehistoric

NOTE Confidence: 0.817456901073456
00:06:34.998 --> 00:06:36.958 in this day and age.
NOTE Confidence: 0.817456901073456
00:06:36.960 --> 00:06:39.396 Always talk about Actigraphy is validated,
NOTE Confidence: 0.817456901073456
00:06:39.400 --> 00:06:41.024 it's validated it's validated,
NOTE Confidence: 0.817456901073456
00:06:41.024 --> 00:06:41.836 and yes,
NOTE Confidence: 0.840707659721375
00:06:41.840 --> 00:06:43.875 it's been compared to polysomnogram
NOTE Confidence: 0.840707659721375
00:06:43.875 --> 00:06:46.730 many times, but it's not that great,
NOTE Confidence: 0.840707659721375
00:06:46.730 --> 00:06:49.130 so it has a high sensitivity
NOTE Confidence: 0.840707659721375
00:06:49.130 --> 00:06:51.610 but a low specificity for sleep,
NOTE Confidence: 0.840707659721375
00:06:51.610 --> 00:06:53.335 which means that the algorithms
NOTE Confidence: 0.840707659721375
00:06:53.335 --> 00:06:55.060 applied to actigraphy data typically
NOTE Confidence: 0.840707659721375
00:06:55.120 --> 00:06:56.899 misinterpret nonmoving wakefulness,
NOTE Confidence: 0.840707659721375
00:06:56.900 --> 00:06:59.484 as sleep, and So what that means is
NOTE Confidence: 0.840707659721375
00:06:59.484 --> 00:07:02.175 these have very high accuracy and
NOTE Confidence: 0.840707659721375
00:07:02.175 --> 00:07:04.635 healthy sleepers during nighttime sleep.
NOTE Confidence: 0.840707659721375
00:07:04.640 --> 00:07:06.292 However, as sleep disruption
NOTE Confidence: 0.840707659721375

00:07:06.292 --> 00:07:07.944 increases throughout the night.
NOTE Confidence: 0.840707659721375

00:07:07.950 --> 00:07:10.296 There's more wake after sleep onset,
NOTE Confidence: 0.840707659721375

00:07:10.300 --> 00:07:12.084 increased sleep onset latency,
NOTE Confidence: 0.840707659721375

00:07:12.084 --> 00:07:15.487 the accuracy of the sleep metrics that are
NOTE Confidence: 0.840707659721375

00:07:15.487 --> 00:07:18.530 output by the software are going to go down.
NOTE Confidence: 0.840707659721375

00:07:18.530 --> 00:07:20.882 And Speaking of software that is
NOTE Confidence: 0.840707659721375

00:07:20.882 --> 00:07:22.450 another pitfall of actigraphy.
NOTE Confidence: 0.840707659721375

00:07:22.450 --> 00:07:24.495 The traditional actigraph software does
NOTE Confidence: 0.840707659721375

00:07:24.495 --> 00:07:26.960 not interface with the electronic health
NOTE Confidence: 0.840707659721375

00:07:26.960 --> 00:07:29.508 record or any other digital health platforms,
NOTE Confidence: 0.840707659721375

00:07:29.510 --> 00:07:32.086 so that makes it difficult to kind
NOTE Confidence: 0.840707659721375

00:07:32.086 --> 00:07:34.500 of track sleep along with
NOTE Confidence: 0.840707659721375

00:07:34.500 --> 00:07:36.954 other health metrics in an easy,
NOTE Confidence: 0.840707659721375

00:07:36.960 --> 00:07:38.094 meaningful, practical way.
NOTE Confidence: 0.840707659721375

00:07:38.094 --> 00:07:39.984 The use of actigraphy requires
NOTE Confidence: 0.840707659721375

00:07:39.984 --> 00:07:42.019 quite a bit of data cleaning.

NOTE Confidence: 0.840707659721375
00:07:42.020 --> 00:07:44.071 Given that I'm in bed intervals need
NOTE Confidence: 0.840707659721375
00:07:44.071 --> 00:07:46.609 to be set for appropriate analysis,
NOTE Confidence: 0.840707659721375
00:07:46.610 --> 00:07:47.615 and this interpretation,
NOTE Confidence: 0.840707659721375
00:07:47.615 --> 00:07:50.397 as well as the set up the patient
NOTE Confidence: 0.840707659721375
00:07:50.397 --> 00:07:53.317 recording even though we have a CPT code.
NOTE Confidence: 0.840707659721375
00:07:53.320 --> 00:07:55.080 This is typically not reimbursed,
NOTE Confidence: 0.840707659721375
00:07:55.080 --> 00:07:57.592 so actigraphy is not going to be practical
NOTE Confidence: 0.840707659721375
00:07:57.592 --> 00:08:00.376 for a clinical workflow in most cases,
NOTE Confidence: 0.840707659721375
00:08:00.380 --> 00:08:03.062 and it's going to be burdensome
NOTE Confidence: 0.840707659721375
00:08:03.062 --> 00:08:04.850 on the research team.
NOTE Confidence: 0.840707659721375
00:08:04.850 --> 00:08:05.218 Additionally,
NOTE Confidence: 0.840707659721375
00:08:05.218 --> 00:08:06.690 actor graphs are expensive.
NOTE Confidence: 0.840707659721375
00:08:06.690 --> 00:08:08.916 There are at least \$800 a device
NOTE Confidence: 0.840707659721375
00:08:08.916 --> 00:08:11.109 for the FDA cleared devices,
NOTE Confidence: 0.840707659721375
00:08:11.110 --> 00:08:13.318 so this is not really practical
NOTE Confidence: 0.840707659721375

00:08:13.318 --> 00:08:14.790 for large population studies,
NOTE Confidence: 0.840707659721375

00:08:14.790 --> 00:08:16.630 and it restricts use clinically,
NOTE Confidence: 0.840707659721375

00:08:16.630 --> 00:08:18.820 particularly if there is a sleep
NOTE Confidence: 0.840707659721375

00:08:18.820 --> 00:08:20.670 clinic in an underserved area.
NOTE Confidence: 0.840707659721375

00:08:20.670 --> 00:08:22.959 One big thing that people don't talk
NOTE Confidence: 0.840707659721375

00:08:22.959 --> 00:08:25.856 about is it these devices are owned by
NOTE Confidence: 0.840707659721375

00:08:25.856 --> 00:08:28.172 the health system where the research
NOTE Confidence: 0.840707659721375

00:08:28.172 --> 00:08:30.979 team they're not owned by the patient,
NOTE Confidence: 0.840707659721375

00:08:30.980 --> 00:08:33.056 so even though we consider actigraphy
NOTE Confidence: 0.840707659721375

00:08:33.056 --> 00:08:35.060 to be longitudinal sleep recording.
NOTE Confidence: 0.840707659721375

00:08:35.060 --> 00:08:37.286 These typically don't go beyond 1
NOTE Confidence: 0.840707659721375

00:08:37.286 --> 00:08:39.642 two weeks as opposed to devices
NOTE Confidence: 0.840707659721375

00:08:39.642 --> 00:08:42.036 that patients might own and use
NOTE Confidence: 0.840707659721375

00:08:42.036 --> 00:08:44.280 themselves that are worn over weeks,
NOTE Confidence: 0.840707659721375

00:08:44.280 --> 00:08:46.564 days, months, even years.
NOTE Confidence: 0.840707659721375

00:08:46.564 --> 00:08:49.419 So despite the strong wording

NOTE Confidence: 0.840707659721375
00:08:49.419 --> 00:08:51.228 that we see here,
NOTE Confidence: 0.840707659721375
00:08:51.230 --> 00:08:53.732 that Actigraphy should be used before
NOTE Confidence: 0.840707659721375
00:08:53.732 --> 00:08:57.740 the MSL T in circadian rhythm disorders.
NOTE Confidence: 0.840707659721375
00:08:57.740 --> 00:09:00.590 What happens when we stop following
NOTE Confidence: 0.840707659721375
00:09:00.590 --> 00:09:04.260 the icst three and start getting real?
NOTE Confidence: 0.840707659721375
00:09:04.260 --> 00:09:06.966 The real world Sleep Medicine clinic
NOTE Confidence: 0.840707659721375
00:09:06.966 --> 00:09:10.061 and research we ask about sleep
NOTE Confidence: 0.840707659721375
00:09:10.061 --> 00:09:11.269 cross sectionally.
NOTE Confidence: 0.840707659721375
00:09:11.270 --> 00:09:12.683 So for example,
NOTE Confidence: 0.840707659721375
00:09:12.683 --> 00:09:15.980 will say how many hours do you
NOTE Confidence: 0.840707659721375
00:09:16.087 --> 00:09:17.830 sleep on average?
NOTE Confidence: 0.840707659721375
00:09:17.830 --> 00:09:18.772 At face value,
NOTE Confidence: 0.840707659721375
00:09:18.772 --> 00:09:21.390 this seems like a very kind of easy,
NOTE Confidence: 0.840707659721375
00:09:21.390 --> 00:09:22.028 simple question,
NOTE Confidence: 0.840707659721375
00:09:22.028 --> 00:09:23.623 but obviously this can be
NOTE Confidence: 0.840707659721375

00:09:23.623 --> 00:09:25.608 interpreted in a multitude of ways.
NOTE Confidence: 0.840707659721375

00:09:25.610 --> 00:09:26.258 For example,
NOTE Confidence: 0.840707659721375

00:09:26.258 --> 00:09:28.850 how many hours do you sleep at night?
NOTE Confidence: 0.840707659721375

00:09:28.850 --> 00:09:31.434 How many hours do you sleep at night,
NOTE Confidence: 0.840707659721375

00:09:31.440 --> 00:09:34.347 plus how many hours do you sleep during naps?
NOTE Confidence: 0.840707659721375

00:09:34.350 --> 00:09:37.158 What time do you go to bed and when
NOTE Confidence: 0.840707659721375

00:09:37.158 --> 00:09:39.860 do you wake up and do the math?
NOTE Confidence: 0.840707659721375

00:09:39.860 --> 00:09:42.492 Is this during the work week during the
NOTE Confidence: 0.840707659721375

00:09:42.492 --> 00:09:45.040 weekend so we can see that this can
NOTE Confidence: 0.840707659721375

00:09:45.040 --> 00:09:47.308 be misconstrued if we use lanja tude?
NOTE Confidence: 0.840707659721375

00:09:47.310 --> 00:09:48.282 No self report?
NOTE Confidence: 0.840707659721375

00:09:48.282 --> 00:09:49.578 With the sleep diary.
NOTE Confidence: 0.840707659721375

00:09:49.580 --> 00:09:51.736 So daily self report recording of sleep.
NOTE Confidence: 0.840707659721375

00:09:51.740 --> 00:09:53.588 That might be a bit better,
NOTE Confidence: 0.840707659721375

00:09:53.590 --> 00:09:55.760 but there's problems with that as well.
NOTE Confidence: 0.844028055667877

00:09:55.760 --> 00:09:57.614 This is burdensome to our patients

NOTE Confidence: 0.844028055667877
00:09:57.614 --> 00:09:58.850 and is oftentimes incomplete,
NOTE Confidence: 0.844028055667877
00:09:58.850 --> 00:10:01.118 or the classic example of people filling
NOTE Confidence: 0.844028055667877
00:10:01.118 --> 00:10:03.373 these out in the waiting room before
NOTE Confidence: 0.844028055667877
00:10:03.373 --> 00:10:05.639 they come in for their PSG MSL T.
NOTE Confidence: 0.844028055667877
00:10:05.640 --> 00:10:07.590 This could be difficult for certain
NOTE Confidence: 0.844028055667877
00:10:07.590 --> 00:10:09.227 populations specifically like the very
NOTE Confidence: 0.844028055667877
00:10:09.227 --> 00:10:11.208 young or the older with cognitive problems.
NOTE Confidence: 0.844028055667877
00:10:11.210 --> 00:10:13.373 And again, even if your patients to
NOTE Confidence: 0.844028055667877
00:10:13.373 --> 00:10:15.536 fill this out, what did they do?
NOTE Confidence: 0.844028055667877
00:10:15.536 --> 00:10:17.390 Fax it to you or FS,
NOTE Confidence: 0.844028055667877
00:10:17.390 --> 00:10:19.286 send it as an email attachment.
NOTE Confidence: 0.844028055667877
00:10:19.290 --> 00:10:22.678 So not really relevant for the technical
NOTE Confidence: 0.844028055667877
00:10:22.678 --> 00:10:25.249 capabilities that we have in 2020.
NOTE Confidence: 0.844028055667877
00:10:25.250 --> 00:10:27.758 Now, so why is this important?
NOTE Confidence: 0.844028055667877
00:10:27.760 --> 00:10:29.428 Does this really affect
NOTE Confidence: 0.844028055667877

00:10:29.428 --> 00:10:30.679 our clinical practice?
NOTE Confidence: 0.844028055667877

00:10:30.680 --> 00:10:32.770 Well, we suspect it does,
NOTE Confidence: 0.844028055667877

00:10:32.770 --> 00:10:35.010 so the American Academy of Sleep Medicine
NOTE Confidence: 0.844028055667877

00:10:35.010 --> 00:10:37.913 did do a systematic review and found
NOTE Confidence: 0.844028055667877

00:10:37.913 --> 00:10:40.253 that the objective information from
NOTE Confidence: 0.844028055667877

00:10:40.253 --> 00:10:42.389 Actigraph recordings is beneficial.
NOTE Confidence: 0.844028055667877

00:10:42.390 --> 00:10:44.425 An provides distinct information over
NOTE Confidence: 0.844028055667877

00:10:44.425 --> 00:10:47.400 sleep logs in a variety of disorders,
NOTE Confidence: 0.844028055667877

00:10:47.400 --> 00:10:50.160 but the evaluation and management.
NOTE Confidence: 0.844028055667877

00:10:50.160 --> 00:10:50.561 Additionally,
NOTE Confidence: 0.844028055667877

00:10:50.561 --> 00:10:52.967 the group from Harvard has already
NOTE Confidence: 0.844028055667877

00:10:52.967 --> 00:10:55.070 asked researchers to stop querying
NOTE Confidence: 0.844028055667877

00:10:55.070 --> 00:10:56.738 self reported sleep duration.
NOTE Confidence: 0.844028055667877

00:10:56.740 --> 00:10:58.790 As you can see here,
NOTE Confidence: 0.844028055667877

00:10:58.790 --> 00:11:00.965 and that's because objective sleep
NOTE Confidence: 0.844028055667877

00:11:00.965 --> 00:11:02.705 recording is also incredibly

NOTE Confidence: 0.844028055667877
00:11:02.705 --> 00:11:04.683 relevant for research because the
NOTE Confidence: 0.844028055667877
00:11:04.683 --> 00:11:06.528 in accuracies that are possible
NOTE Confidence: 0.844028055667877
00:11:06.528 --> 00:11:08.623 with self report sleep duration
NOTE Confidence: 0.844028055667877
00:11:08.623 --> 00:11:10.703 can depend on patient demographics,
NOTE Confidence: 0.844028055667877
00:11:10.710 --> 00:11:13.176 whether or not they have comorbid
NOTE Confidence: 0.844028055667877
00:11:13.176 --> 00:11:13.998 sleep disorders.
NOTE Confidence: 0.844028055667877
00:11:14.000 --> 00:11:16.877 When the question is asked an way,
NOTE Confidence: 0.844028055667877
00:11:16.880 --> 00:11:20.168 the question is asked, so this can lead.
NOTE Confidence: 0.844028055667877
00:11:20.170 --> 00:11:21.676 Tobias in research.
NOTE Confidence: 0.844028055667877
00:11:21.676 --> 00:11:24.186 Another problem with using self
NOTE Confidence: 0.844028055667877
00:11:24.186 --> 00:11:26.634 report sleep duration and research
NOTE Confidence: 0.844028055667877
00:11:26.634 --> 00:11:29.364 is that the whole construct of
NOTE Confidence: 0.844028055667877
00:11:29.364 --> 00:11:31.653 sleep duration as an equivalent
NOTE Confidence: 0.844028055667877
00:11:31.653 --> 00:11:34.718 for sleep health which we know is
NOTE Confidence: 0.844028055667877
00:11:34.718 --> 00:11:36.430 probably not the case,
NOTE Confidence: 0.844028055667877

00:11:36.430 --> 00:11:39.419 and there's growing evidence to support this.

NOTE Confidence: 0.844028055667877

00:11:39.420 --> 00:11:40.276 For example,

NOTE Confidence: 0.844028055667877

00:11:40.276 --> 00:11:41.988 something called intraindividual variability.

NOTE Confidence: 0.844028055667877

00:11:41.990 --> 00:11:44.125 So the variation of sleep

NOTE Confidence: 0.844028055667877

00:11:44.125 --> 00:11:45.833 parameters around the mean,

NOTE Confidence: 0.844028055667877

00:11:45.840 --> 00:11:47.980 which has been shown relevant

NOTE Confidence: 0.844028055667877

00:11:47.980 --> 00:11:50.120 for a variety of outcomes,

NOTE Confidence: 0.844028055667877

00:11:50.120 --> 00:11:51.404 including psychiatric, metabolic,

NOTE Confidence: 0.844028055667877

00:11:51.404 --> 00:11:52.260 and cardiovascular.

NOTE Confidence: 0.844028055667877

00:11:52.260 --> 00:11:54.410 This is going to require

NOTE Confidence: 0.844028055667877

00:11:54.410 --> 00:11:55.700 longitudinal tracking which.

NOTE Confidence: 0.844028055667877

00:11:55.700 --> 00:11:59.165 Is difficult to do with self report and so

NOTE Confidence: 0.844028055667877

00:11:59.165 --> 00:12:02.886 a passive objective method is required.

NOTE Confidence: 0.844028055667877

00:12:02.890 --> 00:12:03.343 Additionally,

NOTE Confidence: 0.844028055667877

00:12:03.343 --> 00:12:06.061 as we said that sleep duration

NOTE Confidence: 0.844028055667877

00:12:06.061 --> 00:12:09.246 doesn't equate to sleep health eh 7

NOTE Confidence: 0.844028055667877

00:12:09.246 --> 00:12:11.436 domain definition has been proposed,

NOTE Confidence: 0.844028055667877

00:12:11.440 --> 00:12:14.247 and that's a combination of both self

NOTE Confidence: 0.844028055667877

00:12:14.247 --> 00:12:16.839 report and primarily objective measures,

NOTE Confidence: 0.844028055667877

00:12:16.840 --> 00:12:19.090 including in addition to duration,

NOTE Confidence: 0.844028055667877

00:12:19.090 --> 00:12:19.990 continuity, timing,

NOTE Confidence: 0.844028055667877

00:12:19.990 --> 00:12:21.340 rhythmicity regularity and

NOTE Confidence: 0.844028055667877

00:12:21.340 --> 00:12:23.140 subjective sleepiness and quality,

NOTE Confidence: 0.844028055667877

00:12:23.140 --> 00:12:26.740 as well as a composite of extreme values.

NOTE Confidence: 0.844028055667877

00:12:26.740 --> 00:12:28.540 And when you combine,

NOTE Confidence: 0.844028055667877

00:12:28.540 --> 00:12:30.790 combine all seven domains an.

NOTE Confidence: 0.844028055667877

00:12:30.790 --> 00:12:31.245 Additionally,

NOTE Confidence: 0.844028055667877

00:12:31.245 --> 00:12:33.975 the number of composite extreme values.

NOTE Confidence: 0.844028055667877

00:12:33.980 --> 00:12:36.716 We can see that this has a much

NOTE Confidence: 0.844028055667877

00:12:36.716 --> 00:12:38.915 bigger impact on mortality then

NOTE Confidence: 0.844028055667877

00:12:38.915 --> 00:12:40.827 just sleep duration alone,

NOTE Confidence: 0.844028055667877

00:12:40.830 --> 00:12:43.158 which I don't know if you
NOTE Confidence: 0.844028055667877

00:12:43.158 --> 00:12:45.260 can see my cursor here,
NOTE Confidence: 0.844028055667877

00:12:45.260 --> 00:12:47.906 but here are the seven domains combined
NOTE Confidence: 0.844028055667877

00:12:47.906 --> 00:12:51.307 as well as the number of extreme values,
NOTE Confidence: 0.844028055667877

00:12:51.310 --> 00:12:53.760 and then we have sleep duration is
NOTE Confidence: 0.844028055667877

00:12:53.760 --> 00:12:56.861 all the way over here when used as
NOTE Confidence: 0.844028055667877

00:12:56.861 --> 00:12:59.385 an isolated sleep variable to predict
NOTE Confidence: 0.844028055667877

00:12:59.385 --> 00:13:02.187 mortality in a random forest model.
NOTE Confidence: 0.844028055667877

00:13:02.190 --> 00:13:04.500 So it seems like longitudinal objective
NOTE Confidence: 0.844028055667877

00:13:04.500 --> 00:13:06.660 sleep measurements are pretty important.
NOTE Confidence: 0.844028055667877

00:13:06.660 --> 00:13:08.862 So if we can't use actigraphy
NOTE Confidence: 0.844028055667877

00:13:08.862 --> 00:13:10.330 because of the limitations,
NOTE Confidence: 0.844028055667877

00:13:10.330 --> 00:13:11.218 what are options?
NOTE Confidence: 0.844028055667877

00:13:11.218 --> 00:13:13.835 It seems like we sure have a lot
NOTE Confidence: 0.844028055667877

00:13:13.835 --> 00:13:16.200 with consumer sleep tracking technology.
NOTE Confidence: 0.844028055667877

00:13:16.200 --> 00:13:18.040 We have wrist worn devices,

NOTE Confidence: 0.844028055667877

00:13:18.040 --> 00:13:20.976 as you can see here from a variety

NOTE Confidence: 0.844028055667877

00:13:20.976 --> 00:13:21.710 of manufacturers.

NOTE Confidence: 0.831784546375275

00:13:21.710 --> 00:13:23.530 More and more rings are

NOTE Confidence: 0.831784546375275

00:13:23.530 --> 00:13:25.740 coming on to the market dry,

NOTE Confidence: 0.831784546375275

00:13:25.740 --> 00:13:28.380 e.g headbands mirabal's that are

NOTE Confidence: 0.831784546375275

00:13:28.380 --> 00:13:32.409 either at the bedside or under the bed.

NOTE Confidence: 0.831784546375275

00:13:32.410 --> 00:13:34.657 So before we can really talk about

NOTE Confidence: 0.831784546375275

00:13:34.657 --> 00:13:36.429 the possibilities and the problems,

NOTE Confidence: 0.831784546375275

00:13:36.430 --> 00:13:38.440 that is consumer sleep technologies hold.

NOTE Confidence: 0.831784546375275

00:13:38.440 --> 00:13:41.121 We have to understand a little bit

NOTE Confidence: 0.831784546375275

00:13:41.121 --> 00:13:43.628 more about how they work or how

NOTE Confidence: 0.831784546375275

00:13:43.628 --> 00:13:46.100 do we get from signal to sleep.

NOTE Confidence: 0.831784546375275

00:13:46.100 --> 00:13:48.836 And I'm not sure I can't see everybody,

NOTE Confidence: 0.831784546375275

00:13:48.840 --> 00:13:51.227 so it's hard to know Peoples ages.

NOTE Confidence: 0.831784546375275

00:13:51.230 --> 00:13:53.282 But for those of you that

NOTE Confidence: 0.831784546375275

00:13:53.282 --> 00:13:54.308 remember Schoolhouse Rock,
NOTE Confidence: 0.831784546375275
00:13:54.310 --> 00:13:56.020 the best schoolhouse rock is.
NOTE Confidence: 0.831784546375275
00:13:56.020 --> 00:13:58.407 How does a bill become a law?
NOTE Confidence: 0.831784546375275
00:13:58.410 --> 00:14:00.120 And here we have Bill,
NOTE Confidence: 0.831784546375275
00:14:00.120 --> 00:14:02.856 and he's just sitting here on Capitol Hill.
NOTE Confidence: 0.831784546375275
00:14:02.860 --> 00:14:05.938 And just like a bill, is not a law.
NOTE Confidence: 0.831784546375275
00:14:05.938 --> 00:14:06.280 Smartwatches,
NOTE Confidence: 0.831784546375275
00:14:06.280 --> 00:14:08.667 rings etc aren't direct measures of sleep.
NOTE Confidence: 0.831784546375275
00:14:08.670 --> 00:14:11.406 There are a bunch of steps in between,
NOTE Confidence: 0.831784546375275
00:14:11.410 --> 00:14:13.120 so this is an oversimplification,
NOTE Confidence: 0.831784546375275
00:14:13.120 --> 00:14:15.196 but this does give you some
NOTE Confidence: 0.831784546375275
00:14:15.196 --> 00:14:16.580 idea about how these.
NOTE Confidence: 0.831784546375275
00:14:16.580 --> 00:14:17.296 Actually work,
NOTE Confidence: 0.831784546375275
00:14:17.296 --> 00:14:19.444 so your device is going to
NOTE Confidence: 0.831784546375275
00:14:19.444 --> 00:14:21.548 or most risk form devices.
NOTE Confidence: 0.831784546375275
00:14:21.550 --> 00:14:23.530 At least they're going to typically

NOTE Confidence: 0.831784546375275

00:14:23.530 --> 00:14:25.750 include a Tri axial accelerometer,

NOTE Confidence: 0.831784546375275

00:14:25.750 --> 00:14:28.042 which is going to record motion

NOTE Confidence: 0.831784546375275

00:14:28.042 --> 00:14:30.207 in three directions, XY and Z,

NOTE Confidence: 0.831784546375275

00:14:30.207 --> 00:14:33.089 and that's going to give you raw signal

NOTE Confidence: 0.831784546375275

00:14:33.089 --> 00:14:36.057 to the motion we see pictured here,

NOTE Confidence: 0.831784546375275

00:14:36.060 --> 00:14:38.594 which is actually from an Apple Watch

NOTE Confidence: 0.831784546375275

00:14:38.594 --> 00:14:41.029 and then optical photoplus Mogra Fi,

NOTE Confidence: 0.831784546375275

00:14:41.030 --> 00:14:42.940 and that is a visual,

NOTE Confidence: 0.831784546375275

00:14:42.940 --> 00:14:45.607 light based way to estimate blood volume,

NOTE Confidence: 0.831784546375275

00:14:45.610 --> 00:14:47.565 which is then converted into

NOTE Confidence: 0.831784546375275

00:14:47.565 --> 00:14:48.738 pulse Anna variety.

NOTE Confidence: 0.831784546375275

00:14:48.740 --> 00:14:50.420 Of computed features from pulse,

NOTE Confidence: 0.831784546375275

00:14:50.420 --> 00:14:52.550 including things like heart rate variability

NOTE Confidence: 0.831784546375275

00:14:52.550 --> 00:14:55.119 and then your motion and your heart rate.

NOTE Confidence: 0.831784546375275

00:14:55.120 --> 00:14:57.535 Features are going to go into an

NOTE Confidence: 0.831784546375275

00:14:57.535 --> 00:15:00.066 algorithm which is going to even be there
NOTE Confidence: 0.831784546375275

00:15:00.066 --> 00:15:02.849 through an app or a cloud based server,
NOTE Confidence: 0.831784546375275

00:15:02.850 --> 00:15:05.195 and that algorithm is typically black box.
NOTE Confidence: 0.831784546375275

00:15:05.200 --> 00:15:07.630 As you can see from the figure and then
NOTE Confidence: 0.831784546375275

00:15:07.630 --> 00:15:10.185 the sleep information is returned to the
NOTE Confidence: 0.831784546375275

00:15:10.185 --> 00:15:12.930 user both visually and in summary metrics.
NOTE Confidence: 0.831784546375275

00:15:12.930 --> 00:15:16.330 As you can see in the example below.
NOTE Confidence: 0.831784546375275

00:15:16.330 --> 00:15:19.714 So it's a myth that your watch track sleep,
NOTE Confidence: 0.831784546375275

00:15:19.720 --> 00:15:22.520 but what the truth is is that algorithms
NOTE Confidence: 0.831784546375275

00:15:22.520 --> 00:15:24.619 estimate sleep from wearable sensor,
NOTE Confidence: 0.831784546375275

00:15:24.620 --> 00:15:25.376 acquired physiological
NOTE Confidence: 0.831784546375275

00:15:25.376 --> 00:15:26.888 signals and arrived features.
NOTE Confidence: 0.831784546375275

00:15:26.890 --> 00:15:29.398 But sometimes that's a bit difficult
NOTE Confidence: 0.831784546375275

00:15:29.398 --> 00:15:31.800 to discuss with their patients.
NOTE Confidence: 0.831784546375275

00:15:31.800 --> 00:15:34.218 Now, these algorithms that estimate sleep.
NOTE Confidence: 0.831784546375275

00:15:34.220 --> 00:15:36.230 Where do they come from?

NOTE Confidence: 0.831784546375275

00:15:36.230 --> 00:15:38.736 So let's start by taking a look

NOTE Confidence: 0.831784546375275

00:15:38.736 --> 00:15:40.670 at our traditional actigraphy,

NOTE Confidence: 0.831784546375275

00:15:40.670 --> 00:15:42.685 so the algorithms that are

NOTE Confidence: 0.831784546375275

00:15:42.685 --> 00:15:44.700 used by FDA cleared ACTIGRAPHY,

NOTE Confidence: 0.831784546375275

00:15:44.700 --> 00:15:47.202 and the associated software typically are

NOTE Confidence: 0.831784546375275

00:15:47.202 --> 00:15:50.339 ones that are more than 2025 years old.

NOTE Confidence: 0.831784546375275

00:15:50.340 --> 00:15:53.156 So on the top left you can see

NOTE Confidence: 0.831784546375275

00:15:53.156 --> 00:15:55.169 the Respiroics actor algorithm,

NOTE Confidence: 0.831784546375275

00:15:55.170 --> 00:15:58.330 and on the bottom right that's the cool

NOTE Confidence: 0.831784546375275

00:15:58.330 --> 00:16:00.820 Kripke algorithm in the Respiroics Act.

NOTE Confidence: 0.831784546375275

00:16:00.820 --> 00:16:02.880 Aware Algorithm E sub zeros

NOTE Confidence: 0.831784546375275

00:16:02.880 --> 00:16:04.528 the epic being scored.

NOTE Confidence: 0.831784546375275

00:16:04.530 --> 00:16:06.200 And same with cold Kripke,

NOTE Confidence: 0.831784546375275

00:16:06.200 --> 00:16:07.870 we have a sub zero,

NOTE Confidence: 0.831784546375275

00:16:07.870 --> 00:16:10.208 so those are the epic of interest.

NOTE Confidence: 0.831784546375275

00:16:10.210 --> 00:16:12.702 And then there's a weighted sum and
NOTE Confidence: 0.831784546375275

00:16:12.702 --> 00:16:14.751 the negative numbers are the epochs
NOTE Confidence: 0.831784546375275

00:16:14.751 --> 00:16:16.886 that are before the epic at hand,
NOTE Confidence: 0.831784546375275

00:16:16.890 --> 00:16:18.600 being scored and the positive
NOTE Confidence: 0.831784546375275

00:16:18.600 --> 00:16:20.690 numbers or the epics after the
NOTE Confidence: 0.831784546375275

00:16:20.690 --> 00:16:22.909 epic being scored and you can see
NOTE Confidence: 0.831784546375275

00:16:22.909 --> 00:16:24.598 these received lesser weights and
NOTE Confidence: 0.831784546375275

00:16:24.598 --> 00:16:26.901 then if the sum crosses a threshold
NOTE Confidence: 0.813893139362335

00:16:26.910 --> 00:16:28.580 it's going to get scored.
NOTE Confidence: 0.813893139362335

00:16:28.580 --> 00:16:30.750 That epic is going to get Squared's
NOTE Confidence: 0.813893139362335

00:16:30.750 --> 00:16:33.155 wake and if it is below that
NOTE Confidence: 0.813893139362335

00:16:33.155 --> 00:16:35.255 threshold it'll get scored as sleep.
NOTE Confidence: 0.813893139362335

00:16:35.260 --> 00:16:36.409 So weighted sounds.
NOTE Confidence: 0.813893139362335

00:16:36.409 --> 00:16:38.324 Now how is this changed?
NOTE Confidence: 0.813893139362335

00:16:38.330 --> 00:16:40.694 So we use much more sophisticated
NOTE Confidence: 0.813893139362335

00:16:40.694 --> 00:16:41.876 methods to classify,

NOTE Confidence: 0.813893139362335
00:16:41.880 --> 00:16:44.645 sleep and wake from wearable sensor data.
NOTE Confidence: 0.813893139362335
00:16:44.650 --> 00:16:46.882 At this point in time an I worked
NOTE Confidence: 0.813893139362335
00:16:46.882 --> 00:16:49.163 with a couple mathematicians at
NOTE Confidence: 0.813893139362335
00:16:49.163 --> 00:16:51.359 University of Michigan Humane,
NOTE Confidence: 0.813893139362335
00:16:51.360 --> 00:16:53.652 Olivia Walsh and Danny Forger and
NOTE Confidence: 0.813893139362335
00:16:53.652 --> 00:16:56.451 we wanted to know if we could
NOTE Confidence: 0.813893139362335
00:16:56.451 --> 00:16:58.436 actually make our own algorithms
NOTE Confidence: 0.813893139362335
00:16:58.436 --> 00:17:00.870 to train models to classify sleep
NOTE Confidence: 0.813893139362335
00:17:00.870 --> 00:17:03.654 versus wake from an off the shelf
NOTE Confidence: 0.813893139362335
00:17:03.654 --> 00:17:05.874 consumer sleep technology and we
NOTE Confidence: 0.813893139362335
00:17:05.874 --> 00:17:08.395 actually use the Apple Watch and
NOTE Confidence: 0.813893139362335
00:17:08.395 --> 00:17:10.719 the reason was is that was the.
NOTE Confidence: 0.813893139362335
00:17:10.720 --> 00:17:13.416 Only one that we could get our hands
NOTE Confidence: 0.813893139362335
00:17:13.416 --> 00:17:16.270 on where we had access to the motion.
NOTE Confidence: 0.813893139362335
00:17:16.270 --> 00:17:18.028 An heart rate data for modeling
NOTE Confidence: 0.813893139362335

00:17:18.028 --> 00:17:20.002 purposes and this was funded by
NOTE Confidence: 0.813893139362335

00:17:20.002 --> 00:17:21.486 our athletics Department because
NOTE Confidence: 0.813893139362335

00:17:21.486 --> 00:17:23.755 they are very interested in sleep
NOTE Confidence: 0.813893139362335

00:17:23.755 --> 00:17:25.580 and sleep technology to improve
NOTE Confidence: 0.813893139362335

00:17:25.580 --> 00:17:26.675 recovery and performance,
NOTE Confidence: 0.813893139362335

00:17:26.680 --> 00:17:29.109 and for those of you interested in
NOTE Confidence: 0.813893139362335

00:17:29.109 --> 00:17:31.370 college basketball, it was pretty fun.
NOTE Confidence: 0.813893139362335

00:17:31.370 --> 00:17:33.320 Because Jordan Poole and Isaiah
NOTE Confidence: 0.813893139362335

00:17:33.320 --> 00:17:35.356 Livers did the UI for our app.
NOTE Confidence: 0.813893139362335

00:17:35.360 --> 00:17:37.652 So really neat project that we're
NOTE Confidence: 0.813893139362335

00:17:37.652 --> 00:17:40.099 grateful we have the funding for.
NOTE Confidence: 0.813893139362335

00:17:40.100 --> 00:17:42.620 And what we did is we had people
NOTE Confidence: 0.813893139362335

00:17:42.620 --> 00:17:45.302 wear Apple Watch is for a seven
NOTE Confidence: 0.813893139362335

00:17:45.302 --> 00:17:46.484 day ambulatory period,
NOTE Confidence: 0.813893139362335

00:17:46.490 --> 00:17:48.919 and the reason we use that ambulatory
NOTE Confidence: 0.813893139362335

00:17:48.919 --> 00:17:50.749 period is Danny Anna Livia.

NOTE Confidence: 0.813893139362335
00:17:50.750 --> 00:17:51.809 They're computational biologists
NOTE Confidence: 0.813893139362335
00:17:51.809 --> 00:17:53.927 that are focused on the modeling
NOTE Confidence: 0.813893139362335
00:17:53.927 --> 00:17:55.370 of the circadian Clock,
NOTE Confidence: 0.813893139362335
00:17:55.370 --> 00:17:58.282 and there is a very well validated
NOTE Confidence: 0.813893139362335
00:17:58.282 --> 00:18:00.244 differential equations model that you
NOTE Confidence: 0.813893139362335
00:18:00.244 --> 00:18:02.505 can pass activity through to get a
NOTE Confidence: 0.813893139362335
00:18:02.505 --> 00:18:04.946 Clock proxy that we used as an input,
NOTE Confidence: 0.813893139362335
00:18:04.950 --> 00:18:06.834 and then on the final night
NOTE Confidence: 0.813893139362335
00:18:06.834 --> 00:18:08.860 of this seven day recording,
NOTE Confidence: 0.813893139362335
00:18:08.860 --> 00:18:12.082 we had our subjects come in and they slept.
NOTE Confidence: 0.813893139362335
00:18:12.090 --> 00:18:14.275 Simultaneously with the Apple Watch
NOTE Confidence: 0.813893139362335
00:18:14.275 --> 00:18:16.023 and synchronized with Polysomnogram,
NOTE Confidence: 0.813893139362335
00:18:16.030 --> 00:18:19.096 and we obtained the rock celebration data.
NOTE Confidence: 0.813893139362335
00:18:19.100 --> 00:18:22.019 And at PPG heart rate from their
NOTE Confidence: 0.813893139362335
00:18:22.019 --> 00:18:24.790 Apple Watch on that same night,
NOTE Confidence: 0.813893139362335

00:18:24.790 --> 00:18:27.394 we use that Clock proxy feature as
NOTE Confidence: 0.813893139362335

00:18:27.394 --> 00:18:29.876 well as activity counts derived from
NOTE Confidence: 0.813893139362335

00:18:29.876 --> 00:18:32.456 the acceleration and PPG heart rate
NOTE Confidence: 0.813893139362335

00:18:32.456 --> 00:18:34.950 and arrived standard deviation of
NOTE Confidence: 0.813893139362335

00:18:34.950 --> 00:18:37.926 heart rate to train algorithms against
NOTE Confidence: 0.813893139362335

00:18:37.930 --> 00:18:40.996 scored PSG to classify wake versus sleep,
NOTE Confidence: 0.813893139362335

00:18:41.000 --> 00:18:44.094 and we use regular old logistic regression.
NOTE Confidence: 0.813893139362335

00:18:44.100 --> 00:18:46.380 As well as machine learning
NOTE Confidence: 0.813893139362335

00:18:46.380 --> 00:18:48.204 techniques for our classifier,
NOTE Confidence: 0.813893139362335

00:18:48.210 --> 00:18:52.780 I'm not going to go into the details of that,
NOTE Confidence: 0.813893139362335

00:18:52.780 --> 00:18:55.174 but our final algorithm performed as
NOTE Confidence: 0.813893139362335

00:18:55.174 --> 00:18:57.818 well as actigraphy or what's been
NOTE Confidence: 0.813893139362335

00:18:57.818 --> 00:18:59.770 historically cited for actigraphy
NOTE Confidence: 0.813893139362335

00:18:59.770 --> 00:19:02.282 in regards to sensitivity and
NOTE Confidence: 0.813893139362335

00:19:02.282 --> 00:19:04.210 even improved with specificity.
NOTE Confidence: 0.813893139362335

00:19:04.210 --> 00:19:07.045 But you guys can read about that

NOTE Confidence: 0.813893139362335
00:19:07.045 --> 00:19:08.260 in the paper.
NOTE Confidence: 0.813893139362335
00:19:08.260 --> 00:19:11.240 But I do wanna show you is that there are
NOTE Confidence: 0.813893139362335
00:19:11.314 --> 00:19:14.146 a few other groups that have done this.
NOTE Confidence: 0.813893139362335
00:19:14.150 --> 00:19:16.686 When the access to raw signal from consumer
NOTE Confidence: 0.813893139362335
00:19:16.686 --> 00:19:18.399 sleep technologies to been iaccessible,
NOTE Confidence: 0.813893139362335
00:19:18.400 --> 00:19:20.356 so Zang used a Microsoft Band,
NOTE Confidence: 0.813893139362335
00:19:20.360 --> 00:19:20.683 Roberts,
NOTE Confidence: 0.813893139362335
00:19:20.683 --> 00:19:22.298 used an Apple Watch Ann
NOTE Confidence: 0.813893139362335
00:19:22.298 --> 00:19:24.280 Beattie at all used to Fitbit.
NOTE Confidence: 0.813893139362335
00:19:24.280 --> 00:19:26.248 I believe they worked with Fitbit,
NOTE Confidence: 0.813893139362335
00:19:26.250 --> 00:19:29.190 so they can have access to that data and I
NOTE Confidence: 0.813893139362335
00:19:29.260 --> 00:19:32.124 won't go through all the details of this.
NOTE Confidence: 0.813893139362335
00:19:32.130 --> 00:19:34.514 But what I want you to kind of
NOTE Confidence: 0.813893139362335
00:19:34.514 --> 00:19:36.599 recognize is the breath of the
NOTE Confidence: 0.813893139362335
00:19:36.599 --> 00:19:38.019 features that are used.
NOTE Confidence: 0.839968085289001

00:19:38.020 --> 00:19:40.330 So we went to previous algorithms with.
NOTE Confidence: 0.839968085289001

00:19:40.330 --> 00:19:42.892 FDA cleared actigraphy that were just
NOTE Confidence: 0.839968085289001

00:19:42.892 --> 00:19:45.520 using weighted sums of activity counts
NOTE Confidence: 0.839968085289001

00:19:45.520 --> 00:19:48.460 to a variety of features from motion,
NOTE Confidence: 0.839968085289001

00:19:48.460 --> 00:19:51.456 an heart rate, an various computed features.
NOTE Confidence: 0.839968085289001

00:19:51.460 --> 00:19:54.449 As you can see here and then,
NOTE Confidence: 0.839968085289001

00:19:54.450 --> 00:19:56.715 these are going into machine
NOTE Confidence: 0.839968085289001

00:19:56.715 --> 00:19:58.980 learning algorithms to train their
NOTE Confidence: 0.839968085289001

00:19:59.051 --> 00:20:01.289 capability to predict sleep and wake
NOTE Confidence: 0.839968085289001

00:20:01.289 --> 00:20:04.299 so much as this is changed overtime,
NOTE Confidence: 0.839968085289001

00:20:04.300 --> 00:20:06.345 and we're really looking at
NOTE Confidence: 0.839968085289001

00:20:06.345 --> 00:20:07.981 different sleep wake classifiers
NOTE Confidence: 0.839968085289001

00:20:07.981 --> 00:20:10.337 that were previously accustomed to.
NOTE Confidence: 0.839968085289001

00:20:10.340 --> 00:20:12.559 But what everyone wants to know is
NOTE Confidence: 0.839968085289001

00:20:12.559 --> 00:20:14.796 what about the algorithms that are
NOTE Confidence: 0.839968085289001

00:20:14.796 --> 00:20:16.831 actually associated with the apps

NOTE Confidence: 0.839968085289001

00:20:16.831 --> 00:20:19.815 that come with the devices that your

NOTE Confidence: 0.839968085289001

00:20:19.815 --> 00:20:22.306 patients or research subjects actually use.

NOTE Confidence: 0.839968085289001

00:20:22.306 --> 00:20:24.622 So these these algorithms that other

NOTE Confidence: 0.839968085289001

00:20:24.622 --> 00:20:26.983 people have come up with aren't

NOTE Confidence: 0.839968085289001

00:20:26.983 --> 00:20:29.245 typically available in a usable way.

NOTE Confidence: 0.839968085289001

00:20:29.250 --> 00:20:31.180 Ours is open source which

NOTE Confidence: 0.839968085289001

00:20:31.180 --> 00:20:33.110 can be obtained from GitHub,

NOTE Confidence: 0.839968085289001

00:20:33.110 --> 00:20:34.702 but it's not enough.

NOTE Confidence: 0.839968085289001

00:20:34.702 --> 00:20:36.294 Closed app right now,

NOTE Confidence: 0.839968085289001

00:20:36.300 --> 00:20:39.012 so the problem is we don't really know

NOTE Confidence: 0.839968085289001

00:20:39.012 --> 00:20:41.758 the the apps that are available now

NOTE Confidence: 0.839968085289001

00:20:41.758 --> 00:20:44.674 and be associated with the CST's that

NOTE Confidence: 0.839968085289001

00:20:44.674 --> 00:20:47.218 are available on the market market.

NOTE Confidence: 0.839968085289001

00:20:47.220 --> 00:20:49.155 We don't really have details

NOTE Confidence: 0.839968085289001

00:20:49.155 --> 00:20:51.510 about the features that are used,

NOTE Confidence: 0.839968085289001

00:20:51.510 --> 00:20:53.460 the populations that the algorithms
NOTE Confidence: 0.839968085289001

00:20:53.460 --> 00:20:56.166 were trained on, or the methodology.
NOTE Confidence: 0.839968085289001

00:20:56.166 --> 00:20:58.214 So it's pretty unclear.
NOTE Confidence: 0.839968085289001

00:20:58.220 --> 00:21:01.111 Which makes us dependent on the already
NOTE Confidence: 0.839968085289001

00:21:01.111 --> 00:21:03.899 processed sleep stage output from these
NOTE Confidence: 0.839968085289001

00:21:03.899 --> 00:21:06.354 devices and their associated algorithms.
NOTE Confidence: 0.839968085289001

00:21:06.360 --> 00:21:08.164 So the question is,
NOTE Confidence: 0.839968085289001

00:21:08.164 --> 00:21:10.419 how good is this data?
NOTE Confidence: 0.839968085289001

00:21:10.420 --> 00:21:12.680 Which brings us to the
NOTE Confidence: 0.839968085289001

00:21:12.680 --> 00:21:14.488 question on everybody's mind,
NOTE Confidence: 0.839968085289001

00:21:14.490 --> 00:21:15.792 which is validation.
NOTE Confidence: 0.839968085289001

00:21:15.792 --> 00:21:19.328 And this is the position statement that the
NOTE Confidence: 0.839968085289001

00:21:19.328 --> 00:21:22.310 American Academy of Sleep Medicine put forth
NOTE Confidence: 0.839968085289001

00:21:22.310 --> 00:21:25.338 in regards to consumer sleep technology.
NOTE Confidence: 0.839968085289001

00:21:25.340 --> 00:21:27.854 And you can see that we
NOTE Confidence: 0.839968085289001

00:21:27.854 --> 00:21:29.980 talk about validation a lot.

NOTE Confidence: 0.839968085289001
00:21:29.980 --> 00:21:32.626 So what is this validation that's so
NOTE Confidence: 0.839968085289001
00:21:32.626 --> 00:21:35.049 important for consumer sleep technologies?
NOTE Confidence: 0.839968085289001
00:21:35.050 --> 00:21:37.160 So what's validation in general?
NOTE Confidence: 0.839968085289001
00:21:37.160 --> 00:21:39.270 So validation is the act,
NOTE Confidence: 0.839968085289001
00:21:39.270 --> 00:21:39.692 process,
NOTE Confidence: 0.839968085289001
00:21:39.692 --> 00:21:41.380 or instance of validating,
NOTE Confidence: 0.839968085289001
00:21:41.380 --> 00:21:43.575 especially the determination of the
NOTE Confidence: 0.839968085289001
00:21:43.575 --> 00:21:46.490 degree of the validity of a device.
NOTE Confidence: 0.839968085289001
00:21:46.490 --> 00:21:47.651 So what's validity,
NOTE Confidence: 0.839968085289001
00:21:47.651 --> 00:21:50.360 the quality or state of being valid,
NOTE Confidence: 0.839968085289001
00:21:50.360 --> 00:21:53.456 such as the quality of being well grounded,
NOTE Confidence: 0.839968085289001
00:21:53.460 --> 00:21:55.670 sound or correct in regards
NOTE Confidence: 0.839968085289001
00:21:55.670 --> 00:21:58.750 to a new method of testing?
NOTE Confidence: 0.839968085289001
00:21:58.750 --> 00:22:01.492 So how do we validate consumer
NOTE Confidence: 0.839968085289001
00:22:01.492 --> 00:22:02.406 sleep technologies?
NOTE Confidence: 0.839968085289001

00:22:02.410 --> 00:22:05.518 So there was a group that was
NOTE Confidence: 0.839968085289001

00:22:05.518 --> 00:22:07.889 formed to discuss just that.
NOTE Confidence: 0.839968085289001

00:22:07.890 --> 00:22:10.788 An last year there was a manuscript
NOTE Confidence: 0.839968085289001

00:22:10.788 --> 00:22:13.091 that described the outcomes of
NOTE Confidence: 0.839968085289001

00:22:13.091 --> 00:22:15.546 that discussion and made some
NOTE Confidence: 0.839968085289001

00:22:15.546 --> 00:22:18.398 recommendations on how to quote unquote,
NOTE Confidence: 0.839968085289001

00:22:18.400 --> 00:22:18.835 validate,
NOTE Confidence: 0.839968085289001

00:22:18.835 --> 00:22:21.010 consumer sleep technologies which might
NOTE Confidence: 0.839968085289001

00:22:21.010 --> 00:22:23.293 be better described as determining
NOTE Confidence: 0.839968085289001

00:22:23.293 --> 00:22:25.708 performance in a specific situation,
NOTE Confidence: 0.839968085289001

00:22:25.710 --> 00:22:29.910 but will use the term validation for now.
NOTE Confidence: 0.839968085289001

00:22:29.910 --> 00:22:33.022 So PSG was cited as the gold standard
NOTE Confidence: 0.839968085289001

00:22:33.022 --> 00:22:36.000 to which the CST must be compared,
NOTE Confidence: 0.839968085289001

00:22:36.000 --> 00:22:38.835 so not actigraphy as the sole competitor
NOTE Confidence: 0.839968085289001

00:22:38.835 --> 00:22:41.680 must be. Sleep is defined by PSG.
NOTE Confidence: 0.839968085289001

00:22:41.680 --> 00:22:44.529 The scoring of PSG should be manual,

NOTE Confidence: 0.839968085289001
00:22:44.530 --> 00:22:45.340 not automated,
NOTE Confidence: 0.839968085289001
00:22:45.340 --> 00:22:48.175 right 'cause it's not just PSG signal,
NOTE Confidence: 0.839968085289001
00:22:48.180 --> 00:22:50.616 that's ground truth, it's scored PSG.
NOTE Confidence: 0.839968085289001
00:22:50.620 --> 00:22:53.860 That is our ground truth or gold standard,
NOTE Confidence: 0.839968085289001
00:22:53.860 --> 00:22:54.836 ideally double,
NOTE Confidence: 0.839968085289001
00:22:54.836 --> 00:22:57.276 scored portable PSG is acceptable
NOTE Confidence: 0.839968085289001
00:22:57.276 --> 00:22:59.200 as compared to full.
NOTE Confidence: 0.839968085289001
00:22:59.200 --> 00:23:01.657 These protocols also cited that the CS
NOTE Confidence: 0.839968085289001
00:23:01.657 --> 00:23:04.608 team needs to be recorded simultaneously.
NOTE Confidence: 0.839968085289001
00:23:04.610 --> 00:23:07.676 Obviously with the PSG so that you're
NOTE Confidence: 0.839968085289001
00:23:07.676 --> 00:23:09.807 comparing the same time interval
NOTE Confidence: 0.839968085289001
00:23:09.807 --> 00:23:12.743 on PSG to the same time in revolt
NOTE Confidence: 0.855865478515625
00:23:12.831 --> 00:23:15.909 that was scored by the Consumer
NOTE Confidence: 0.855865478515625
00:23:15.909 --> 00:23:17.448 sleep technology algorithm.
NOTE Confidence: 0.855865478515625
00:23:17.450 --> 00:23:19.585 Additionally, it was recommended that
NOTE Confidence: 0.855865478515625

00:23:19.585 --> 00:23:22.633 Epic by epic data from the Consumer
NOTE Confidence: 0.855865478515625

00:23:22.633 --> 00:23:24.733 Sleep technology outputs be sought
NOTE Confidence: 0.855865478515625

00:23:24.733 --> 00:23:27.628 out for the epic by epic analysis,
NOTE Confidence: 0.855865478515625

00:23:27.630 --> 00:23:30.970 and I just want to go into a little bit
NOTE Confidence: 0.855865478515625

00:23:31.063 --> 00:23:34.405 more detail about why that's important.
NOTE Confidence: 0.855865478515625

00:23:34.410 --> 00:23:36.954 So whenever you're reading a consumer
NOTE Confidence: 0.855865478515625

00:23:36.954 --> 00:23:38.650 sleep technology validation paper,
NOTE Confidence: 0.855865478515625

00:23:38.650 --> 00:23:40.110 you're aware of this,
NOTE Confidence: 0.855865478515625

00:23:40.110 --> 00:23:42.859 but what an epic by epic analysis
NOTE Confidence: 0.855865478515625

00:23:42.859 --> 00:23:45.715 is is that you're comparing the
NOTE Confidence: 0.855865478515625

00:23:45.715 --> 00:23:48.420 same 32nd increment of stage sleep.
NOTE Confidence: 0.855865478515625

00:23:48.420 --> 00:23:50.815 By the Consumer sleep technology
NOTE Confidence: 0.855865478515625

00:23:50.815 --> 00:23:53.210 algorithm to that exact 30
NOTE Confidence: 0.855865478515625

00:23:53.297 --> 00:23:55.447 seconds in time of polysomnogram
NOTE Confidence: 0.855865478515625

00:23:55.447 --> 00:23:58.580 that was scored by a technician.
NOTE Confidence: 0.855865478515625

00:23:58.580 --> 00:24:01.195 So you're comparing simultaneous data

NOTE Confidence: 0.855865478515625

00:24:01.195 --> 00:24:05.346 in the same increment of time and that

NOTE Confidence: 0.855865478515625

00:24:05.346 --> 00:24:07.751 supposed to comparing summary data

NOTE Confidence: 0.855865478515625

00:24:07.751 --> 00:24:11.168 over the course of the night to each.

NOTE Confidence: 0.855865478515625

00:24:11.170 --> 00:24:14.074 So how do you analyze these

NOTE Confidence: 0.855865478515625

00:24:14.074 --> 00:24:16.010 epic by epic comparisons?

NOTE Confidence: 0.855865478515625

00:24:16.010 --> 00:24:18.938 This takes us back to college

NOTE Confidence: 0.855865478515625

00:24:18.938 --> 00:24:20.402 or medical school.

NOTE Confidence: 0.855865478515625

00:24:20.410 --> 00:24:23.706 4 by 4 tables where the typical use

NOTE Confidence: 0.855865478515625

00:24:23.706 --> 00:24:26.681 was assessing a new test against a

NOTE Confidence: 0.855865478515625

00:24:26.681 --> 00:24:29.590 gold standard for disease of interest.

NOTE Confidence: 0.855865478515625

00:24:29.590 --> 00:24:32.272 But in the context of validating

NOTE Confidence: 0.855865478515625

00:24:32.272 --> 00:24:34.390 consumer sleep technologies against PSG,

NOTE Confidence: 0.855865478515625

00:24:34.390 --> 00:24:37.253 sleep is the outcome of interest and

NOTE Confidence: 0.855865478515625

00:24:37.253 --> 00:24:40.078 the population is actually not people.

NOTE Confidence: 0.855865478515625

00:24:40.080 --> 00:24:42.696 It's the 32nd FX at hand.

NOTE Confidence: 0.855865478515625

00:24:42.700 --> 00:24:44.880 So how does that look?
NOTE Confidence: 0.855865478515625

00:24:44.880 --> 00:24:49.250 So let's look at our 4 by 4 table here.
NOTE Confidence: 0.855865478515625

00:24:49.250 --> 00:24:51.920 So we have horizontally or gold
NOTE Confidence: 0.855865478515625

00:24:51.920 --> 00:24:54.100 standard which is scored PSG.
NOTE Confidence: 0.855865478515625

00:24:54.100 --> 00:24:56.940 And then vertically we have the new test
NOTE Confidence: 0.855865478515625

00:24:56.940 --> 00:25:00.050 which is the output of the CST algorithm.
NOTE Confidence: 0.855865478515625

00:25:00.050 --> 00:25:02.666 So if you have a CST epic that
NOTE Confidence: 0.855865478515625

00:25:02.666 --> 00:25:05.034 is scored as sleep and that
NOTE Confidence: 0.855865478515625

00:25:05.034 --> 00:25:07.482 same epic is actually PSG sleep,
NOTE Confidence: 0.855865478515625

00:25:07.490 --> 00:25:10.094 that's going to be a true positive.
NOTE Confidence: 0.855865478515625

00:25:10.100 --> 00:25:12.892 If you have CST output for a given
NOTE Confidence: 0.855865478515625

00:25:12.892 --> 00:25:15.298 30 seconds that scored his wake,
NOTE Confidence: 0.855865478515625

00:25:15.300 --> 00:25:16.692 but it's actually sleep,
NOTE Confidence: 0.855865478515625

00:25:16.692 --> 00:25:19.400 that would be considered a false negative.
NOTE Confidence: 0.855865478515625

00:25:19.400 --> 00:25:21.626 If you have a PSG wake,
NOTE Confidence: 0.855865478515625

00:25:21.630 --> 00:25:24.304 epic that the CST interprets is sleep.

NOTE Confidence: 0.855865478515625

00:25:24.310 --> 00:25:26.998 That's going to be a false positive,

NOTE Confidence: 0.855865478515625

00:25:27.000 --> 00:25:30.249 and if you have a CST epic or CST

NOTE Confidence: 0.855865478515625

00:25:30.249 --> 00:25:32.687 scored Wake Epic, that's actually wake.

NOTE Confidence: 0.855865478515625

00:25:32.687 --> 00:25:34.482 That's going to be considered

NOTE Confidence: 0.855865478515625

00:25:34.482 --> 00:25:35.830 a true negative.

NOTE Confidence: 0.855865478515625

00:25:35.830 --> 00:25:38.128 And again, these are true positive,

NOTE Confidence: 0.855865478515625

00:25:38.130 --> 00:25:38.900 false positive,

NOTE Confidence: 0.855865478515625

00:25:38.900 --> 00:25:39.670 false negative,

NOTE Confidence: 0.855865478515625

00:25:39.670 --> 00:25:40.440 true negative,

NOTE Confidence: 0.855865478515625

00:25:40.440 --> 00:25:43.128 because the outcome of interest is sleep,

NOTE Confidence: 0.855865478515625

00:25:43.130 --> 00:25:46.577 so the negative state is not sleep or wake,

NOTE Confidence: 0.855865478515625

00:25:46.580 --> 00:25:49.700 and so then you can derive sensitivity and

NOTE Confidence: 0.855865478515625

00:25:49.700 --> 00:25:52.337 specificity from this epic by epic analysis.

NOTE Confidence: 0.855865478515625

00:25:52.340 --> 00:25:54.656 So sensitivity here is the fraction

NOTE Confidence: 0.855865478515625

00:25:54.656 --> 00:25:55.814 of PSG sleep.

NOTE Confidence: 0.855865478515625

00:25:55.820 --> 00:25:57.860 Epics that are correctly designated
NOTE Confidence: 0.855865478515625

00:25:57.860 --> 00:26:00.826 as sleep by the CST while specificity
NOTE Confidence: 0.855865478515625

00:26:00.826 --> 00:26:03.787 is the fraction of PSG wake ethics
NOTE Confidence: 0.855865478515625

00:26:03.787 --> 00:26:06.738 that are correctly designated as wake
NOTE Confidence: 0.855865478515625

00:26:06.738 --> 00:26:09.188 by the Consumer sleep technology.
NOTE Confidence: 0.855865478515625

00:26:09.190 --> 00:26:11.446 Oftentimes will also get a report
NOTE Confidence: 0.855865478515625

00:26:11.446 --> 00:26:13.410 on accuracy and what accuracy
NOTE Confidence: 0.855865478515625

00:26:13.410 --> 00:26:14.970 is in this setting.
NOTE Confidence: 0.855865478515625

00:26:14.970 --> 00:26:17.595 Is is the number of epochs correctly
NOTE Confidence: 0.855865478515625

00:26:17.595 --> 00:26:20.105 identified by the CST as a correct
NOTE Confidence: 0.855865478515625

00:26:20.105 --> 00:26:22.067 state divided by all the epics
NOTE Confidence: 0.855865478515625

00:26:22.137 --> 00:26:23.889 being considered and accuracy
NOTE Confidence: 0.855865478515625

00:26:23.889 --> 00:26:26.517 can be very deceiving and healthy
NOTE Confidence: 0.855865478515625

00:26:26.520 --> 00:26:28.176 sleepers because these studies
NOTE Confidence: 0.855865478515625

00:26:28.176 --> 00:26:30.660 typically take place at night and
NOTE Confidence: 0.855865478515625

00:26:30.729 --> 00:26:33.060 what a healthy sleepers do at night,

NOTE Confidence: 0.855865478515625
00:26:33.060 --> 00:26:34.985 they sleep and they have
NOTE Confidence: 0.855865478515625
00:26:34.985 --> 00:26:36.140 high sleep efficiency.
NOTE Confidence: 0.855865478515625
00:26:36.140 --> 00:26:38.486 So say you have an algorithm
NOTE Confidence: 0.855865478515625
00:26:38.486 --> 00:26:39.659 and the developers.
NOTE Confidence: 0.855865478515625
00:26:39.660 --> 00:26:42.444 They just want to have a startup company,
NOTE Confidence: 0.863162815570831
00:26:42.450 --> 00:26:44.900 so the algorithm goes through and scores.
NOTE Confidence: 0.863162815570831
00:26:44.900 --> 00:26:47.492 Everything is sleep if you test it algorithm
NOTE Confidence: 0.863162815570831
00:26:47.492 --> 00:26:50.310 in the lab and you determine accuracy in
NOTE Confidence: 0.863162815570831
00:26:50.310 --> 00:26:52.920 somebody with a sleep efficiency of 90%,
NOTE Confidence: 0.863162815570831
00:26:52.920 --> 00:26:55.718 the accuracy is going to be 90% despite
NOTE Confidence: 0.863162815570831
00:26:55.718 --> 00:26:58.154 the fact that the algorithm was arbitrary.
NOTE Confidence: 0.863162815570831
00:26:58.160 --> 00:27:01.240 So that can be a very deceiving
NOTE Confidence: 0.863162815570831
00:27:01.240 --> 00:27:03.410 metric in these studies.
NOTE Confidence: 0.863162815570831
00:27:03.410 --> 00:27:05.606 So how does performance of consumer
NOTE Confidence: 0.863162815570831
00:27:05.606 --> 00:27:07.070 sleep technologies look overall?
NOTE Confidence: 0.863162815570831

00:27:07.070 --> 00:27:09.576 So in the left panel you'll see
NOTE Confidence: 0.863162815570831

00:27:09.576 --> 00:27:11.663 sensitivity and in the right
NOTE Confidence: 0.863162815570831

00:27:11.663 --> 00:27:13.527 panel you'll see specificity.
NOTE Confidence: 0.863162815570831

00:27:13.530 --> 00:27:16.548 And the black bars here are
NOTE Confidence: 0.863162815570831

00:27:16.548 --> 00:27:18.057 consumer sleep technology,
NOTE Confidence: 0.863162815570831

00:27:18.060 --> 00:27:20.575 wearable devices and then the
NOTE Confidence: 0.863162815570831

00:27:20.575 --> 00:27:23.090 Gray bars are standard actigraphy,
NOTE Confidence: 0.863162815570831

00:27:23.090 --> 00:27:26.102 so CST's tend to have sensitivity
NOTE Confidence: 0.863162815570831

00:27:26.102 --> 00:27:27.608 greater than 90%.
NOTE Confidence: 0.863162815570831

00:27:27.610 --> 00:27:29.818 Pretty similar to Actigraphy,
NOTE Confidence: 0.863162815570831

00:27:29.818 --> 00:27:32.578 and specificity's that are more
NOTE Confidence: 0.863162815570831

00:27:32.578 --> 00:27:35.157 widely ranging about 30 to 60%.
NOTE Confidence: 0.863162815570831

00:27:35.160 --> 00:27:38.178 So again, similar to standard Actigraphy,
NOTE Confidence: 0.863162815570831

00:27:38.180 --> 00:27:40.094 sometimes outperforming and
NOTE Confidence: 0.863162815570831

00:27:40.094 --> 00:27:41.370 sometimes underperforming.
NOTE Confidence: 0.863162815570831

00:27:41.370 --> 00:27:43.438 So, just like actigraphy,

NOTE Confidence: 0.863162815570831

00:27:43.438 --> 00:27:45.506 these consumer sleep technologies

NOTE Confidence: 0.863162815570831

00:27:45.506 --> 00:27:48.198 overall tend to not miss any sleep,

NOTE Confidence: 0.863162815570831

00:27:48.200 --> 00:27:50.430 but they may misclassify awake

NOTE Confidence: 0.863162815570831

00:27:50.430 --> 00:27:53.200 during the sleep period and sleep,

NOTE Confidence: 0.863162815570831

00:27:53.200 --> 00:27:54.856 which results overall,

NOTE Confidence: 0.863162815570831

00:27:54.856 --> 00:27:58.168 and an overestimation of sleep and

NOTE Confidence: 0.863162815570831

00:27:58.168 --> 00:28:01.022 decreased accuracy when people have more

NOTE Confidence: 0.863162815570831

00:28:01.022 --> 00:28:04.240 wake during the time in bed period.

NOTE Confidence: 0.863162815570831

00:28:04.240 --> 00:28:08.170 So if we have validation, are we good to go?

NOTE Confidence: 0.863162815570831

00:28:08.170 --> 00:28:10.592 I mean based on this American Academy

NOTE Confidence: 0.863162815570831

00:28:10.592 --> 00:28:12.890 of Sleep Medicine position statement,

NOTE Confidence: 0.863162815570831

00:28:12.890 --> 00:28:15.634 this is really the main barrier, Sir.

NOTE Confidence: 0.863162815570831

00:28:15.634 --> 00:28:17.998 I'm just checking my time here.

NOTE Confidence: 0.863162815570831

00:28:18.000 --> 00:28:20.352 So once a consumer sleep technology

NOTE Confidence: 0.863162815570831

00:28:20.352 --> 00:28:21.136 is validated,

NOTE Confidence: 0.863162815570831

00:28:21.140 --> 00:28:23.906 can we start implementing it in
NOTE Confidence: 0.863162815570831

00:28:23.906 --> 00:28:25.750 clinical practice and research?
NOTE Confidence: 0.863162815570831

00:28:25.750 --> 00:28:26.375 Well,
NOTE Confidence: 0.863162815570831

00:28:26.375 --> 00:28:30.125 there unfortunately a lot of threats
NOTE Confidence: 0.863162815570831

00:28:30.125 --> 00:28:33.943 to extrapolation of these in lab
NOTE Confidence: 0.863162815570831

00:28:33.943 --> 00:28:37.013 validation studies to the real
NOTE Confidence: 0.863162815570831

00:28:37.013 --> 00:28:39.378 life environment. Quite a few.
NOTE Confidence: 0.863162815570831

00:28:39.378 --> 00:28:41.634 So for example we have problems
NOTE Confidence: 0.863162815570831

00:28:41.634 --> 00:28:43.398 with our ground truth,
NOTE Confidence: 0.863162815570831

00:28:43.400 --> 00:28:45.535 so these algorithms are trained
NOTE Confidence: 0.863162815570831

00:28:45.535 --> 00:28:48.083 to predict sleep as defined by
NOTE Confidence: 0.863162815570831

00:28:48.083 --> 00:28:50.129 scored PSG and is squared PSG.
NOTE Confidence: 0.863162815570831

00:28:50.130 --> 00:28:51.718 Really a gold standard.
NOTE Confidence: 0.863162815570831

00:28:51.718 --> 00:28:54.490 It is our best gold standard now,
NOTE Confidence: 0.863162815570831

00:28:54.490 --> 00:28:58.045 but there are a lot of problems with it.
NOTE Confidence: 0.863162815570831

00:28:58.050 --> 00:29:02.010 How many people do we need to score the PSG?

NOTE Confidence: 0.863162815570831
00:29:02.010 --> 00:29:03.990 What is an experienced technologist?
NOTE Confidence: 0.863162815570831
00:29:03.990 --> 00:29:06.550 We know that even good RP SG teams
NOTE Confidence: 0.863162815570831
00:29:06.550 --> 00:29:08.759 have imperfect interscore reliability.
NOTE Confidence: 0.863162815570831
00:29:08.760 --> 00:29:09.470 So again,
NOTE Confidence: 0.863162815570831
00:29:09.470 --> 00:29:11.245 making her ground truth not
NOTE Confidence: 0.863162815570831
00:29:11.245 --> 00:29:11.955 necessarily perfect.
NOTE Confidence: 0.863162815570831
00:29:11.960 --> 00:29:13.765 Automated scoring is something that
NOTE Confidence: 0.863162815570831
00:29:13.765 --> 00:29:15.972 could be beneficial in the future
NOTE Confidence: 0.863162815570831
00:29:15.972 --> 00:29:18.018 to make this more more systematic.
NOTE Confidence: 0.863162815570831
00:29:18.020 --> 00:29:20.150 And you know we have differences
NOTE Confidence: 0.863162815570831
00:29:20.150 --> 00:29:20.860 in laboratory,
NOTE Confidence: 0.863162815570831
00:29:20.860 --> 00:29:23.708 we might have better quality of our data,
NOTE Confidence: 0.863162815570831
00:29:23.710 --> 00:29:25.747 but out of center is going to
NOTE Confidence: 0.863162815570831
00:29:25.747 --> 00:29:28.447 allow us to have subject sleep in
NOTE Confidence: 0.863162815570831
00:29:28.447 --> 00:29:29.758 the home environment,
NOTE Confidence: 0.863162815570831

00:29:29.760 --> 00:29:32.370 which may be more reflective
NOTE Confidence: 0.863162815570831

00:29:32.370 --> 00:29:33.936 of sleep overtime.
NOTE Confidence: 0.863162815570831

00:29:33.940 --> 00:29:36.015 Another problem with the current
NOTE Confidence: 0.863162815570831

00:29:36.015 --> 00:29:38.881 validation processes we have it is we
NOTE Confidence: 0.863162815570831

00:29:38.881 --> 00:29:41.059 don't really consider the fact that
NOTE Confidence: 0.863162815570831

00:29:41.059 --> 00:29:42.836 these consumer sleep technologies
NOTE Confidence: 0.863162815570831

00:29:42.836 --> 00:29:45.296 are probably measuring an entirely
NOTE Confidence: 0.863162815570831

00:29:45.296 --> 00:29:47.163 different construct of sleep.
NOTE Confidence: 0.863162815570831

00:29:47.163 --> 00:29:50.227 So in addition to the fact that with
NOTE Confidence: 0.863162815570831

00:29:50.227 --> 00:29:53.476 the CST you have an algorithm that's
NOTE Confidence: 0.863162815570831

00:29:53.476 --> 00:29:57.048 determining the state as opposed to a person,
NOTE Confidence: 0.863162815570831

00:29:57.050 --> 00:29:59.410 we're also measuring entirely different
NOTE Confidence: 0.863162815570831

00:29:59.410 --> 00:30:01.298 physiological metrics with the
NOTE Confidence: 0.863162815570831

00:30:01.298 --> 00:30:02.988 consumer sleep technology typically
NOTE Confidence: 0.863162815570831

00:30:02.988 --> 00:30:05.669 being based in motion and heart rate.
NOTE Confidence: 0.863162815570831

00:30:05.670 --> 00:30:08.694 And a PSG being based in EG.

NOTE Confidence: 0.863162815570831
00:30:08.700 --> 00:30:11.358 And we accept these different contract
NOTE Confidence: 0.863162815570831
00:30:11.358 --> 00:30:14.329 the constructs for sleep logs versus PSG,
NOTE Confidence: 0.863162815570831
00:30:14.330 --> 00:30:17.558 but we don't practice graffiti and
NOTE Confidence: 0.863162815570831
00:30:17.558 --> 00:30:19.710 consumer sleep technologies which
NOTE Confidence: 0.787396430969238
00:30:19.789 --> 00:30:22.834 we hold for this to the same
NOTE Confidence: 0.787396430969238
00:30:22.834 --> 00:30:24.139 standard as polysomnogram.
NOTE Confidence: 0.787396430969238
00:30:24.140 --> 00:30:26.405 Another problem with taking those
NOTE Confidence: 0.787396430969238
00:30:26.405 --> 00:30:29.082 validation studies done in the lab
NOTE Confidence: 0.787396430969238
00:30:29.082 --> 00:30:31.116 and extrapolating them to use in
NOTE Confidence: 0.787396430969238
00:30:31.116 --> 00:30:33.767 the wild is that I'm in bed issue,
NOTE Confidence: 0.787396430969238
00:30:33.770 --> 00:30:35.562 which is another under
NOTE Confidence: 0.787396430969238
00:30:35.562 --> 00:30:37.354 recognized threat to validity.
NOTE Confidence: 0.787396430969238
00:30:37.360 --> 00:30:40.244 And when these studies are done in
NOTE Confidence: 0.787396430969238
00:30:40.244 --> 00:30:43.882 the sleep lab that I'm in bed is set
NOTE Confidence: 0.787396430969238
00:30:43.882 --> 00:30:46.630 manually by lights out to lights on.
NOTE Confidence: 0.787396430969238

00:30:46.630 --> 00:30:49.416 However, that there not is not how
NOTE Confidence: 0.787396430969238

00:30:49.416 --> 00:30:52.267 these devices work when used in reality.
NOTE Confidence: 0.787396430969238

00:30:52.270 --> 00:30:55.518 So previously with some of the older
NOTE Confidence: 0.787396430969238

00:30:55.518 --> 00:30:57.658 consumer sleep technologies you did
NOTE Confidence: 0.787396430969238

00:30:57.658 --> 00:31:00.330 had to put the device into sleep mode.
NOTE Confidence: 0.787396430969238

00:31:00.330 --> 00:31:02.670 So then the sleep detection
NOTE Confidence: 0.787396430969238

00:31:02.670 --> 00:31:04.542 classifiers would be diploid.
NOTE Confidence: 0.787396430969238

00:31:04.550 --> 00:31:07.136 However, now this is all passive,
NOTE Confidence: 0.787396430969238

00:31:07.140 --> 00:31:10.150 so even if you have a consumer
NOTE Confidence: 0.787396430969238

00:31:10.150 --> 00:31:11.937 sleep technology algorithm that
NOTE Confidence: 0.787396430969238

00:31:11.937 --> 00:31:14.457 performs awesome in the sleep lab,
NOTE Confidence: 0.787396430969238

00:31:14.460 --> 00:31:16.615 you have high sensitivity without
NOTE Confidence: 0.787396430969238

00:31:16.615 --> 00:31:18.339 sacrificing too much specificity.
NOTE Confidence: 0.787396430969238

00:31:18.340 --> 00:31:20.926 If that time in bed detection
NOTE Confidence: 0.787396430969238

00:31:20.926 --> 00:31:22.219 algorithm isn't good,
NOTE Confidence: 0.787396430969238

00:31:22.220 --> 00:31:24.866 those sleep wait classifiers are not

NOTE Confidence: 0.787396430969238

00:31:24.866 --> 00:31:28.259 going to be deployed at the correct time,

NOTE Confidence: 0.787396430969238

00:31:28.260 --> 00:31:31.375 and that's going to result in sleep

NOTE Confidence: 0.787396430969238

00:31:31.375 --> 00:31:33.430 summary metrics that are off.

NOTE Confidence: 0.787396430969238

00:31:33.430 --> 00:31:35.130 So real world utility.

NOTE Confidence: 0.787396430969238

00:31:35.130 --> 00:31:36.405 Of the consumer,

NOTE Confidence: 0.787396430969238

00:31:36.410 --> 00:31:38.768 sleep technology is not only based

NOTE Confidence: 0.787396430969238

00:31:38.768 --> 00:31:41.258 on the performance of the sleep

NOTE Confidence: 0.787396430969238

00:31:41.258 --> 00:31:43.784 classifier into sleep lab against PSG,

NOTE Confidence: 0.787396430969238

00:31:43.790 --> 00:31:46.154 but also if those algorithms are

NOTE Confidence: 0.787396430969238

00:31:46.154 --> 00:31:48.300 deployed in the correct window,

NOTE Confidence: 0.787396430969238

00:31:48.300 --> 00:31:51.960 which is something that's really study.

NOTE Confidence: 0.787396430969238

00:31:51.960 --> 00:31:53.247 What about environment?

NOTE Confidence: 0.787396430969238

00:31:53.247 --> 00:31:55.821 So we have our external environment

NOTE Confidence: 0.787396430969238

00:31:55.821 --> 00:31:57.919 and things that are not going

NOTE Confidence: 0.787396430969238

00:31:57.919 --> 00:31:59.860 to be problems in the lab.

NOTE Confidence: 0.787396430969238

00:31:59.860 --> 00:32:01.740 For example, bed partners, pets.
NOTE Confidence: 0.787396430969238

00:32:01.740 --> 00:32:04.827 Those aren't going to be in the labs when
NOTE Confidence: 0.787396430969238

00:32:04.827 --> 00:32:08.086 the sleep period is placed, so most CST.
NOTE Confidence: 0.787396430969238

00:32:08.086 --> 00:32:09.896 PSG comparison studies are going
NOTE Confidence: 0.787396430969238

00:32:09.896 --> 00:32:12.260 to be during the night time,
NOTE Confidence: 0.787396430969238

00:32:12.260 --> 00:32:14.899 so not during naps dot during daytime.
NOTE Confidence: 0.787396430969238

00:32:14.900 --> 00:32:16.400 Sleep in shift workers,
NOTE Confidence: 0.787396430969238

00:32:16.400 --> 00:32:17.900 not during this time.
NOTE Confidence: 0.787396430969238

00:32:17.900 --> 00:32:19.408 Sleep and circadian rhythm,
NOTE Confidence: 0.787396430969238

00:32:19.408 --> 00:32:20.539 sleep wake disorders,
NOTE Confidence: 0.787396430969238

00:32:20.540 --> 00:32:22.048 and these are situations.
NOTE Confidence: 0.787396430969238

00:32:22.048 --> 00:32:25.099 Where we can really benefit from lanja tude.
NOTE Confidence: 0.787396430969238

00:32:25.100 --> 00:32:26.225 No sleep tracking.
NOTE Confidence: 0.787396430969238

00:32:26.225 --> 00:32:26.600 Additionally,
NOTE Confidence: 0.787396430969238

00:32:26.600 --> 00:32:28.475 things like substance use alcohol,
NOTE Confidence: 0.787396430969238

00:32:28.480 --> 00:32:30.825 most people aren't going to use alcohol

NOTE Confidence: 0.787396430969238

00:32:30.825 --> 00:32:33.676 or drugs if they are enrolled in his

NOTE Confidence: 0.787396430969238

00:32:33.676 --> 00:32:35.940 study of their scent tracking device

NOTE Confidence: 0.787396430969238

00:32:35.940 --> 00:32:38.887 against PSG is often times these are

NOTE Confidence: 0.787396430969238

00:32:38.887 --> 00:32:40.999 exclusion criteria's for the study,

NOTE Confidence: 0.787396430969238

00:32:40.999 --> 00:32:43.537 so this might change the performance

NOTE Confidence: 0.787396430969238

00:32:43.537 --> 00:32:45.930 when we look at these devices.

NOTE Confidence: 0.787396430969238

00:32:45.930 --> 00:32:47.880 In the real world and the

NOTE Confidence: 0.787396430969238

00:32:47.880 --> 00:32:49.180 other thing is reliability,

NOTE Confidence: 0.787396430969238

00:32:49.180 --> 00:32:50.805 so we've already said that

NOTE Confidence: 0.787396430969238

00:32:50.805 --> 00:32:52.430 the beauty of these devices,

NOTE Confidence: 0.787396430969238

00:32:52.430 --> 00:32:53.267 their whole need,

NOTE Confidence: 0.787396430969238

00:32:53.267 --> 00:32:56.050 is the fact that they can be used night

NOTE Confidence: 0.787396430969238

00:32:56.050 --> 00:32:57.960 after night after night overtime.

NOTE Confidence: 0.787396430969238

00:32:57.960 --> 00:33:00.081 And we don't know if the performance

NOTE Confidence: 0.787396430969238

00:33:00.081 --> 00:33:01.720 is reliable overtime given the

NOTE Confidence: 0.787396430969238

00:33:01.720 --> 00:33:02.725 validation studies typically
NOTE Confidence: 0.787396430969238

00:33:02.725 --> 00:33:04.780 only take place over one night,
NOTE Confidence: 0.787396430969238

00:33:04.780 --> 00:33:06.405 and there's a possibility that
NOTE Confidence: 0.787396430969238

00:33:06.405 --> 00:33:08.360 overtime the sensors aren't as good.
NOTE Confidence: 0.787396430969238

00:33:08.360 --> 00:33:11.706 That's something we don't know as well.
NOTE Confidence: 0.787396430969238

00:33:11.710 --> 00:33:14.328 We also can't verify what we don't
NOTE Confidence: 0.787396430969238

00:33:14.328 --> 00:33:16.372 understand and many consumer sleep
NOTE Confidence: 0.787396430969238

00:33:16.372 --> 00:33:18.487 trackers come out with these
NOTE Confidence: 0.787396430969238

00:33:18.487 --> 00:33:21.105 numbers or scores that they don't
NOTE Confidence: 0.787396430969238

00:33:21.105 --> 00:33:22.809 disclose the definition of.
NOTE Confidence: 0.787396430969238

00:33:22.810 --> 00:33:25.218 And I know our patients really like
NOTE Confidence: 0.787396430969238

00:33:25.218 --> 00:33:27.568 these an you know this manufacture
NOTE Confidence: 0.787396430969238

00:33:27.568 --> 00:33:30.058 on the right probably should get
NOTE Confidence: 0.787396430969238

00:33:30.058 --> 00:33:32.842 the Nobel Peace Prize because they
NOTE Confidence: 0.787396430969238

00:33:32.842 --> 00:33:35.132 somehow know what an individual's
NOTE Confidence: 0.787396430969238

00:33:35.140 --> 00:33:36.752 exact sleep need is.

NOTE Confidence: 0.787396430969238
00:33:36.752 --> 00:33:39.170 Here cited at 6 hours and
NOTE Confidence: 0.864160060882568
00:33:39.263 --> 00:33:41.717 51 minutes so we don't know.
NOTE Confidence: 0.864160060882568
00:33:41.720 --> 00:33:44.110 The algorithms behind these metrics
NOTE Confidence: 0.864160060882568
00:33:44.110 --> 00:33:47.874 there's really no way we can compare them
NOTE Confidence: 0.864160060882568
00:33:47.874 --> 00:33:50.884 to anything that is based in science.
NOTE Confidence: 0.864160060882568
00:33:50.890 --> 00:33:53.886 Population is also a big problem here,
NOTE Confidence: 0.864160060882568
00:33:53.890 --> 00:33:56.344 so once a consumer sleep technology
NOTE Confidence: 0.864160060882568
00:33:56.344 --> 00:33:59.449 is validated in a certain age group,
NOTE Confidence: 0.864160060882568
00:33:59.450 --> 00:34:01.545 that doesn't mean that that
NOTE Confidence: 0.864160060882568
00:34:01.545 --> 00:34:03.221 performance will translate to
NOTE Confidence: 0.864160060882568
00:34:03.221 --> 00:34:05.423 different age groups or individuals
NOTE Confidence: 0.864160060882568
00:34:05.423 --> 00:34:07.573 with other comorbid sleep disorders,
NOTE Confidence: 0.864160060882568
00:34:07.580 --> 00:34:09.612 particularly as we've seen
NOTE Confidence: 0.864160060882568
00:34:09.612 --> 00:34:11.644 in hypersomnia and insomnia.
NOTE Confidence: 0.864160060882568
00:34:11.650 --> 00:34:14.296 We also don't know if heart conditions
NOTE Confidence: 0.864160060882568

00:34:14.296 --> 00:34:16.376 or certain medications could potentially
NOTE Confidence: 0.864160060882568

00:34:16.376 --> 00:34:18.576 be problematic given that these
NOTE Confidence: 0.864160060882568

00:34:18.576 --> 00:34:21.039 algorithms are highly dependent on heart
NOTE Confidence: 0.864160060882568

00:34:21.039 --> 00:34:23.958 rate and derived metrics from the heart rate,
NOTE Confidence: 0.864160060882568

00:34:23.958 --> 00:34:25.550 like heart rate variability.
NOTE Confidence: 0.864160060882568

00:34:25.550 --> 00:34:27.134 Additionally, user also algorithms
NOTE Confidence: 0.864160060882568

00:34:27.134 --> 00:34:29.114 that are based in motion,
NOTE Confidence: 0.864160060882568

00:34:29.120 --> 00:34:31.802 so how about individuals with spinal
NOTE Confidence: 0.864160060882568

00:34:31.802 --> 00:34:33.590 cord injuries strokes patients
NOTE Confidence: 0.864160060882568

00:34:33.666 --> 00:34:35.066 in the ICU who sleep?
NOTE Confidence: 0.864160060882568

00:34:35.070 --> 00:34:36.982 We'd like to track.
NOTE Confidence: 0.864160060882568

00:34:36.982 --> 00:34:39.850 We probably can't extrapolate the performance
NOTE Confidence: 0.864160060882568

00:34:39.931 --> 00:34:42.724 data that we see to these individuals.
NOTE Confidence: 0.864160060882568

00:34:42.730 --> 00:34:45.178 Now, problems with accuracy can even
NOTE Confidence: 0.864160060882568

00:34:45.178 --> 00:34:47.749 or validity can even extend past.
NOTE Confidence: 0.864160060882568

00:34:47.750 --> 00:34:49.835 Just looking at in accuracies

NOTE Confidence: 0.864160060882568
00:34:49.835 --> 00:34:51.503 in the device output.
NOTE Confidence: 0.864160060882568
00:34:51.510 --> 00:34:54.406 So this is a patient of mine who
NOTE Confidence: 0.864160060882568
00:34:54.406 --> 00:34:57.481 wore an Apple Watch the same night
NOTE Confidence: 0.864160060882568
00:34:57.481 --> 00:35:00.290 of his home sleep apnea test.
NOTE Confidence: 0.864160060882568
00:35:00.290 --> 00:35:01.060 I'm sorry,
NOTE Confidence: 0.864160060882568
00:35:01.060 --> 00:35:04.140 trying to get everything on one page so
NOTE Confidence: 0.864160060882568
00:35:04.226 --> 00:35:07.390 you can't see these oximetry values here,
NOTE Confidence: 0.864160060882568
00:35:07.390 --> 00:35:10.036 but with these high pop Mia's
NOTE Confidence: 0.864160060882568
00:35:10.036 --> 00:35:12.808 he's desatting as low as 88% and.
NOTE Confidence: 0.864160060882568
00:35:12.808 --> 00:35:14.798 None of these were captured
NOTE Confidence: 0.864160060882568
00:35:14.798 --> 00:35:17.170 by his Apple Watch oximeter,
NOTE Confidence: 0.864160060882568
00:35:17.170 --> 00:35:19.492 and this is an individual with
NOTE Confidence: 0.864160060882568
00:35:19.492 --> 00:35:22.541 dark skin and we now know that
NOTE Confidence: 0.864160060882568
00:35:22.541 --> 00:35:24.906 these pulse oximetry in general,
NOTE Confidence: 0.864160060882568
00:35:24.910 --> 00:35:26.630 and these pulse oximeters,
NOTE Confidence: 0.864160060882568

00:35:26.630 --> 00:35:27.920 particularly on CST,
NOTE Confidence: 0.864160060882568

00:35:27.920 --> 00:35:31.360 which were unsure of the general accuracy of,
NOTE Confidence: 0.864160060882568

00:35:31.360 --> 00:35:34.944 could be discrepant an that could augment.
NOTE Confidence: 0.864160060882568

00:35:34.950 --> 00:35:36.942 Problems that we see are ready
NOTE Confidence: 0.864160060882568

00:35:36.942 --> 00:35:39.193 with P in individuals with poor
NOTE Confidence: 0.864160060882568

00:35:39.193 --> 00:35:40.897 social determinants of health.
NOTE Confidence: 0.864160060882568

00:35:40.900 --> 00:35:42.920 If were collecting massive amounts
NOTE Confidence: 0.864160060882568

00:35:42.920 --> 00:35:45.336 of data from these devices and
NOTE Confidence: 0.864160060882568

00:35:45.336 --> 00:35:47.597 using this as a basis for research,
NOTE Confidence: 0.864160060882568

00:35:47.600 --> 00:35:50.440 we might augment some major
NOTE Confidence: 0.864160060882568

00:35:50.440 --> 00:35:51.576 health disparities.
NOTE Confidence: 0.864160060882568

00:35:51.580 --> 00:35:52.627 Now another problem,
NOTE Confidence: 0.864160060882568

00:35:52.627 --> 00:35:54.721 when we compare a consumer sleep
NOTE Confidence: 0.864160060882568

00:35:54.721 --> 00:35:56.353 technology to polysomnogram and
NOTE Confidence: 0.864160060882568

00:35:56.353 --> 00:35:58.398 there's some performance metrics cited,
NOTE Confidence: 0.864160060882568

00:35:58.400 --> 00:36:01.060 it takes time to do the study.

NOTE Confidence: 0.864160060882568
00:36:01.060 --> 00:36:02.998 Then the studies written up and
NOTE Confidence: 0.864160060882568
00:36:02.998 --> 00:36:05.312 it goes through a peer review
NOTE Confidence: 0.864160060882568
00:36:05.312 --> 00:36:06.737 process for publication,
NOTE Confidence: 0.864160060882568
00:36:06.740 --> 00:36:08.640 and then someone will say,
NOTE Confidence: 0.864160060882568
00:36:08.640 --> 00:36:09.548 Oh yes,
NOTE Confidence: 0.864160060882568
00:36:09.548 --> 00:36:12.726 that device has been validated against PSG.
NOTE Confidence: 0.864160060882568
00:36:12.730 --> 00:36:13.209 Um,
NOTE Confidence: 0.864160060882568
00:36:13.209 --> 00:36:15.604 that performance metrics that are
NOTE Confidence: 0.864160060882568
00:36:15.604 --> 00:36:18.335 output from that study are going
NOTE Confidence: 0.864160060882568
00:36:18.335 --> 00:36:20.537 to be specific to the sensors
NOTE Confidence: 0.864160060882568
00:36:20.537 --> 00:36:23.029 of the device that was used,
NOTE Confidence: 0.864160060882568
00:36:23.030 --> 00:36:25.604 plus the algorithm of the current
NOTE Confidence: 0.864160060882568
00:36:25.604 --> 00:36:27.320 firmware and software iteration,
NOTE Confidence: 0.864160060882568
00:36:27.320 --> 00:36:29.888 and these are things that change,
NOTE Confidence: 0.864160060882568
00:36:29.890 --> 00:36:32.886 and they change with actigraphy as well,
NOTE Confidence: 0.864160060882568

00:36:32.890 --> 00:36:35.040 so that's not something you,
NOTE Confidence: 0.864160060882568

00:36:35.040 --> 00:36:36.752 but oftentimes with consumer
NOTE Confidence: 0.864160060882568

00:36:36.752 --> 00:36:37.608 sleep technologies,
NOTE Confidence: 0.864160060882568

00:36:37.610 --> 00:36:40.620 the hardware of the device is updated.
NOTE Confidence: 0.864160060882568

00:36:40.620 --> 00:36:43.616 There's new models that come out or.
NOTE Confidence: 0.864160060882568

00:36:43.620 --> 00:36:45.944 They could spend all this time on
NOTE Confidence: 0.864160060882568

00:36:45.944 --> 00:36:47.973 a validation study and the company
NOTE Confidence: 0.864160060882568

00:36:47.973 --> 00:36:50.213 goes out of business and so that's
NOTE Confidence: 0.864160060882568

00:36:50.279 --> 00:36:51.983 another threat to generalizing
NOTE Confidence: 0.864160060882568

00:36:51.983 --> 00:36:54.113 the results of these studies.
NOTE Confidence: 0.864160060882568

00:36:54.120 --> 00:36:57.808 And what we really need to kind of
NOTE Confidence: 0.864160060882568

00:36:57.808 --> 00:37:00.838 move passed through these oneof.
NOTE Confidence: 0.864160060882568

00:37:00.840 --> 00:37:03.295 You know small convenience samples
NOTE Confidence: 0.864160060882568

00:37:03.295 --> 00:37:06.342 and lack of transparent data in
NOTE Confidence: 0.864160060882568

00:37:06.342 --> 00:37:08.912 regards the performance of these
NOTE Confidence: 0.864160060882568

00:37:08.912 --> 00:37:10.968 consumer sleep technologies is

NOTE Confidence: 0.869220197200775
00:37:11.050 --> 00:37:13.700 really large datasets with some
NOTE Confidence: 0.869220197200775
00:37:13.700 --> 00:37:16.866 disclosure of the methodology behind how
NOTE Confidence: 0.869220197200775
00:37:16.866 --> 00:37:19.446 this sleep classifiers are developed.
NOTE Confidence: 0.869220197200775
00:37:19.450 --> 00:37:23.080 An also information about the population.
NOTE Confidence: 0.869220197200775
00:37:23.080 --> 00:37:26.076 And we are getting closer to that.
NOTE Confidence: 0.869220197200775
00:37:26.080 --> 00:37:28.635 So the Somnia project is a project
NOTE Confidence: 0.869220197200775
00:37:28.635 --> 00:37:31.317 in the Netherlands where in their
NOTE Confidence: 0.869220197200775
00:37:31.317 --> 00:37:33.832 individuals who are receiving clinical
NOTE Confidence: 0.869220197200775
00:37:33.832 --> 00:37:36.116 polysomnogram there recording a variety
NOTE Confidence: 0.869220197200775
00:37:36.116 --> 00:37:38.916 of other sensors and these are sensors
NOTE Confidence: 0.869220197200775
00:37:38.920 --> 00:37:41.494 that could be incorporated into consumer
NOTE Confidence: 0.869220197200775
00:37:41.494 --> 00:37:44.050 sleep technologies or that already are,
NOTE Confidence: 0.869220197200775
00:37:44.050 --> 00:37:45.762 for example, respond PPG,
NOTE Confidence: 0.869220197200775
00:37:45.762 --> 00:37:48.330 an actigraphy under the bed sensor,
NOTE Confidence: 0.869220197200775
00:37:48.330 --> 00:37:50.365 microphones, and what this is
NOTE Confidence: 0.869220197200775

00:37:50.365 --> 00:37:53.384 going to establish is a data set
NOTE Confidence: 0.869220197200775

00:37:53.384 --> 00:37:55.180 that includes Co recorded.
NOTE Confidence: 0.869220197200775

00:37:55.180 --> 00:37:58.048 Polysomnogram with all of this different
NOTE Confidence: 0.869220197200775

00:37:58.048 --> 00:38:00.871 sensor signal so that the best
NOTE Confidence: 0.869220197200775

00:38:00.871 --> 00:38:03.367 predictors of sleep can be determined
NOTE Confidence: 0.869220197200775

00:38:03.367 --> 00:38:06.207 an also that these can be tested.
NOTE Confidence: 0.869220197200775

00:38:06.210 --> 00:38:09.225 These algorithms can be tested
NOTE Confidence: 0.869220197200775

00:38:09.225 --> 00:38:11.637 on different population subsets.
NOTE Confidence: 0.869220197200775

00:38:11.640 --> 00:38:14.840 So what does our future hold in regards
NOTE Confidence: 0.869220197200775

00:38:14.840 --> 00:38:17.209 to consumer sleep technologies?
NOTE Confidence: 0.869220197200775

00:38:17.210 --> 00:38:19.290 So although it's tempting to
NOTE Confidence: 0.869220197200775

00:38:19.290 --> 00:38:21.370 just Subs in for actigraphy,
NOTE Confidence: 0.869220197200775

00:38:21.370 --> 00:38:24.698 I believe these could be much more valuable.
NOTE Confidence: 0.869220197200775

00:38:24.700 --> 00:38:27.143 I think that they could change the
NOTE Confidence: 0.869220197200775

00:38:27.143 --> 00:38:29.285 logistics of Sleep Medicine and
NOTE Confidence: 0.869220197200775

00:38:29.285 --> 00:38:31.345 completely transform our practice.

NOTE Confidence: 0.869220197200775
00:38:31.350 --> 00:38:33.688 So instead of seeing a patient and
NOTE Confidence: 0.869220197200775
00:38:33.688 --> 00:38:35.968 taking this leap history that's
NOTE Confidence: 0.869220197200775
00:38:35.968 --> 00:38:37.180 primarily retroactive,
NOTE Confidence: 0.869220197200775
00:38:37.180 --> 00:38:39.508 and then maybe sending them home
NOTE Confidence: 0.869220197200775
00:38:39.508 --> 00:38:42.169 with an actigraph or sleep Diaries,
NOTE Confidence: 0.869220197200775
00:38:42.170 --> 00:38:44.865 we can have a long term recordings
NOTE Confidence: 0.869220197200775
00:38:44.865 --> 00:38:47.508 that were performed prior to their
NOTE Confidence: 0.869220197200775
00:38:47.508 --> 00:38:48.450 first appointment.
NOTE Confidence: 0.869220197200775
00:38:48.450 --> 00:38:50.472 Because they own the consumer sleep
NOTE Confidence: 0.869220197200775
00:38:50.472 --> 00:38:52.277 technology and have those available
NOTE Confidence: 0.869220197200775
00:38:52.277 --> 00:38:53.869 at our initial evaluation.
NOTE Confidence: 0.869220197200775
00:38:53.870 --> 00:38:56.096 So what I've heard this compared to
NOTE Confidence: 0.869220197200775
00:38:56.096 --> 00:38:58.962 that you would never hear a woman come
NOTE Confidence: 0.869220197200775
00:38:58.962 --> 00:39:00.807 to her first obstetric appointment
NOTE Confidence: 0.869220197200775
00:39:00.873 --> 00:39:03.610 without an over the counter pregnancy test.
NOTE Confidence: 0.869220197200775

00:39:03.610 --> 00:39:05.872 So this could be something equivalent
NOTE Confidence: 0.869220197200775

00:39:05.872 --> 00:39:08.437 to that where even if it isn't
NOTE Confidence: 0.869220197200775

00:39:08.437 --> 00:39:09.745 an FDA cleared device,
NOTE Confidence: 0.869220197200775

00:39:09.750 --> 00:39:12.422 we have some idea of the sleep wake
NOTE Confidence: 0.869220197200775

00:39:12.422 --> 00:39:14.798 patterns from over the counter source.
NOTE Confidence: 0.869220197200775

00:39:14.800 --> 00:39:15.157 Also,
NOTE Confidence: 0.869220197200775

00:39:15.157 --> 00:39:17.656 this can be used in between visits
NOTE Confidence: 0.869220197200775

00:39:17.656 --> 00:39:20.298 and given our move to Tele medicine.
NOTE Confidence: 0.869220197200775

00:39:20.300 --> 00:39:23.212 The fact that the patient's own these
NOTE Confidence: 0.869220197200775

00:39:23.212 --> 00:39:26.200 devices really makes us a completely no
NOTE Confidence: 0.869220197200775

00:39:26.200 --> 00:39:28.696 contact way to practice Sleep Medicine.
NOTE Confidence: 0.869220197200775

00:39:28.700 --> 00:39:30.288 Consumer sleep technologies would
NOTE Confidence: 0.869220197200775

00:39:30.288 --> 00:39:32.273 allow us to personalize interventions
NOTE Confidence: 0.869220197200775

00:39:32.273 --> 00:39:33.969 to patients actual sleep patterns
NOTE Confidence: 0.869220197200775

00:39:33.969 --> 00:39:36.383 as opposed to what we think they are
NOTE Confidence: 0.869220197200775

00:39:36.383 --> 00:39:38.105 or what they try and remember them

NOTE Confidence: 0.869220197200775
00:39:38.105 --> 00:39:41.139 to be at the clinic visit and those
NOTE Confidence: 0.869220197200775
00:39:41.139 --> 00:39:43.709 interventions could be made in real time.
NOTE Confidence: 0.869220197200775
00:39:43.710 --> 00:39:46.405 The API with the apps associated with
NOTE Confidence: 0.869220197200775
00:39:46.405 --> 00:39:49.458 CST might also make it easier for us
NOTE Confidence: 0.869220197200775
00:39:49.458 --> 00:39:52.538 to leave link sleep metrics to other things.
NOTE Confidence: 0.869220197200775
00:39:52.540 --> 00:39:52.871 So,
NOTE Confidence: 0.869220197200775
00:39:52.871 --> 00:39:53.533 for example,
NOTE Confidence: 0.869220197200775
00:39:53.533 --> 00:39:54.857 mobile apps really lend
NOTE Confidence: 0.869220197200775
00:39:54.857 --> 00:39:56.406 themselves to something called
NOTE Confidence: 0.869220197200775
00:39:56.406 --> 00:39:57.918 ecological momentary assessment,
NOTE Confidence: 0.869220197200775
00:39:57.920 --> 00:40:00.194 and that's when you evaluate self
NOTE Confidence: 0.869220197200775
00:40:00.194 --> 00:40:02.545 report symptoms in real time in
NOTE Confidence: 0.869220197200775
00:40:02.545 --> 00:40:04.445 response to a push notification,
NOTE Confidence: 0.869220197200775
00:40:04.450 --> 00:40:06.851 which might give us a better understanding
NOTE Confidence: 0.869220197200775
00:40:06.851 --> 00:40:09.819 of how sleep interacts with other symptoms.
NOTE Confidence: 0.869220197200775

00:40:09.820 --> 00:40:10.204 Additionally,
NOTE Confidence: 0.869220197200775

00:40:10.204 --> 00:40:13.276 we can get health and non health information.
NOTE Confidence: 0.869220197200775

00:40:13.280 --> 00:40:16.038 Things like Geo location, social media use.
NOTE Confidence: 0.869220197200775

00:40:16.040 --> 00:40:18.300 Alongside sleep through other apps,
NOTE Confidence: 0.869220197200775

00:40:18.300 --> 00:40:20.560 potentially use of smart devices
NOTE Confidence: 0.869220197200775

00:40:20.560 --> 00:40:21.916 like glucometers scales,
NOTE Confidence: 0.869220197200775

00:40:21.920 --> 00:40:22.782 blood pressure,
NOTE Confidence: 0.869220197200775

00:40:22.782 --> 00:40:24.937 cuffs with our consumer sleep
NOTE Confidence: 0.869220197200775

00:40:24.937 --> 00:40:27.712 technology to help see how sleep
NOTE Confidence: 0.869220197200775

00:40:27.712 --> 00:40:29.596 affects those objective parameters,
NOTE Confidence: 0.869220197200775

00:40:29.600 --> 00:40:32.190 and then obviously ideally these
NOTE Confidence: 0.869220197200775

00:40:32.190 --> 00:40:34.780 would interface with our electronic
NOTE Confidence: 0.869220197200775

00:40:34.856 --> 00:40:37.412 health records so the sleep provider
NOTE Confidence: 0.869220197200775

00:40:37.412 --> 00:40:39.116 could see this data
NOTE Confidence: 0.826324880123138

00:40:39.199 --> 00:40:41.575 in a seamless fashion and hopeful
NOTE Confidence: 0.826324880123138

00:40:41.575 --> 00:40:44.546 that one day sleep with what we've

NOTE Confidence: 0.826324880123138
00:40:44.546 --> 00:40:46.394 learned longitudinally could even.
NOTE Confidence: 0.826324880123138
00:40:46.400 --> 00:40:48.515 Act as a vital sign and we'd be able
NOTE Confidence: 0.826324880123138
00:40:48.515 --> 00:40:51.194 to see changes in the signature of
NOTE Confidence: 0.826324880123138
00:40:51.194 --> 00:40:52.782 consumer sleep technologies before
NOTE Confidence: 0.826324880123138
00:40:52.851 --> 00:40:54.596 an acute health event occurs,
NOTE Confidence: 0.826324880123138
00:40:54.600 --> 00:40:56.777 so we can see an impending deterioration
NOTE Confidence: 0.826324880123138
00:40:56.777 --> 00:40:58.786 in our patients and potentially intervene
NOTE Confidence: 0.826324880123138
00:40:58.786 --> 00:41:01.159 before they end up in the hospital.
NOTE Confidence: 0.826324880123138
00:41:01.160 --> 00:41:02.816 And that's the case.
NOTE Confidence: 0.826324880123138
00:41:02.816 --> 00:41:05.870 I hope with Pap data as well.
NOTE Confidence: 0.826324880123138
00:41:05.870 --> 00:41:08.930 So this is 1 example of a consumer sleep
NOTE Confidence: 0.826324880123138
00:41:08.930 --> 00:41:11.316 technology that has been FDA cleared
NOTE Confidence: 0.826324880123138
00:41:11.316 --> 00:41:13.710 up for personalized treatment and you
NOTE Confidence: 0.826324880123138
00:41:13.710 --> 00:41:15.828 guys have probably heard of this.
NOTE Confidence: 0.826324880123138
00:41:15.830 --> 00:41:18.548 So this is the night where app and this
NOTE Confidence: 0.826324880123138

00:41:18.548 --> 00:41:21.737 is an app for individuals with nightmares,
NOTE Confidence: 0.826324880123138

00:41:21.740 --> 00:41:23.372 primarily individuals with PTSD
NOTE Confidence: 0.826324880123138

00:41:23.372 --> 00:41:26.240 and what this entails is you charge
NOTE Confidence: 0.826324880123138

00:41:26.240 --> 00:41:28.322 your Apple Watch during the day
NOTE Confidence: 0.826324880123138

00:41:28.322 --> 00:41:30.589 and then you wear it at night.
NOTE Confidence: 0.826324880123138

00:41:30.590 --> 00:41:32.024 This device doesn't.
NOTE Confidence: 0.826324880123138

00:41:32.024 --> 00:41:34.414 Outright claim to track sleep.
NOTE Confidence: 0.826324880123138

00:41:34.420 --> 00:41:36.912 It says it kind of learns the
NOTE Confidence: 0.826324880123138

00:41:36.912 --> 00:41:38.952 the cardiac and motion patterns
NOTE Confidence: 0.826324880123138

00:41:38.952 --> 00:41:41.610 during sleep over the course of
NOTE Confidence: 0.826324880123138

00:41:41.610 --> 00:41:44.088 days and then based on that,
NOTE Confidence: 0.826324880123138

00:41:44.090 --> 00:41:46.125 it identifies departures from that
NOTE Confidence: 0.826324880123138

00:41:46.125 --> 00:41:49.063 that the app thinks that the algorithm
NOTE Confidence: 0.826324880123138

00:41:49.063 --> 00:41:51.133 thinks are nightmares and there's
NOTE Confidence: 0.826324880123138

00:41:51.133 --> 00:41:53.941 a stimuli of vibration or that goes
NOTE Confidence: 0.826324880123138

00:41:53.941 --> 00:41:56.582 through the watch to arouse the patient

NOTE Confidence: 0.826324880123138
00:41:56.582 --> 00:41:58.592 just slightly from the nightmare
NOTE Confidence: 0.826324880123138
00:41:58.592 --> 00:42:00.658 interfere with the nightmare without
NOTE Confidence: 0.826324880123138
00:42:00.658 --> 00:42:02.648 completely waking them for sleep.
NOTE Confidence: 0.826324880123138
00:42:02.650 --> 00:42:05.055 And there's trials going on
NOTE Confidence: 0.826324880123138
00:42:05.055 --> 00:42:07.460 right now with this device.
NOTE Confidence: 0.826324880123138
00:42:07.460 --> 00:42:11.052 Now we talked about the need for this
NOTE Confidence: 0.826324880123138
00:42:11.052 --> 00:42:13.569 truly longitudinal recording of sleep
NOTE Confidence: 0.826324880123138
00:42:13.569 --> 00:42:16.134 to really understand sleeping disease
NOTE Confidence: 0.826324880123138
00:42:16.134 --> 00:42:19.986 and when you look at the data that we
NOTE Confidence: 0.826324880123138
00:42:19.986 --> 00:42:22.036 currently have, it's pretty short,
NOTE Confidence: 0.826324880123138
00:42:22.036 --> 00:42:24.568 so active graphic recordings in studies
NOTE Confidence: 0.826324880123138
00:42:24.568 --> 00:42:27.197 that associate sleep timing duration,
NOTE Confidence: 0.826324880123138
00:42:27.200 --> 00:42:28.577 intraindividual variability with
NOTE Confidence: 0.826324880123138
00:42:28.577 --> 00:42:31.790 health outcomes have been 5 seven days.
NOTE Confidence: 0.826324880123138
00:42:31.790 --> 00:42:34.400 And if we're looking at contribution
NOTE Confidence: 0.826324880123138

00:42:34.400 --> 00:42:36.840 of sleep to chronic disease,
NOTE Confidence: 0.826324880123138

00:42:36.840 --> 00:42:39.630 we're going to learn much more.
NOTE Confidence: 0.826324880123138

00:42:39.630 --> 00:42:42.155 If a consumer sleep technology
NOTE Confidence: 0.826324880123138

00:42:42.155 --> 00:42:44.853 that's worn for weeks, months,
NOTE Confidence: 0.826324880123138

00:42:44.853 --> 00:42:48.218 seasons, years can be used.
NOTE Confidence: 0.826324880123138

00:42:48.220 --> 00:42:51.060 But the other thing is that these devices
NOTE Confidence: 0.826324880123138

00:42:51.060 --> 00:42:53.723 they are inexpensive and they're pretty
NOTE Confidence: 0.826324880123138

00:42:53.723 --> 00:42:56.537 widespread in regards to their use,
NOTE Confidence: 0.826324880123138

00:42:56.540 --> 00:42:59.908 and that gives us the ability to perform
NOTE Confidence: 0.826324880123138

00:42:59.908 --> 00:43:03.056 sleep research with objective data at scale.
NOTE Confidence: 0.826324880123138

00:43:03.060 --> 00:43:06.370 Colleagues at U of M used an app to globally
NOTE Confidence: 0.826324880123138

00:43:06.454 --> 00:43:09.169 quantify sleep in circadian rhythms.
NOTE Confidence: 0.826324880123138

00:43:09.170 --> 00:43:10.794 So across the world.
NOTE Confidence: 0.826324880123138

00:43:10.794 --> 00:43:11.200 Additionally,
NOTE Confidence: 0.826324880123138

00:43:11.200 --> 00:43:13.105 there's studies that have been
NOTE Confidence: 0.826324880123138

00:43:13.105 --> 00:43:15.976 done in interns who have a really

NOTE Confidence: 0.826324880123138
00:43:15.976 --> 00:43:17.308 unique sleep challenge,
NOTE Confidence: 0.826324880123138
00:43:17.310 --> 00:43:19.620 and because of the taxing nature
NOTE Confidence: 0.826324880123138
00:43:19.620 --> 00:43:21.780 of the medical training program,
NOTE Confidence: 0.826324880123138
00:43:21.780 --> 00:43:24.222 it would be difficult to assess
NOTE Confidence: 0.826324880123138
00:43:24.222 --> 00:43:25.443 their sleep otherwise.
NOTE Confidence: 0.826324880123138
00:43:25.450 --> 00:43:27.814 And there was really unique study
NOTE Confidence: 0.826324880123138
00:43:27.814 --> 00:43:30.302 by Eric to pollen colleagues where
NOTE Confidence: 0.826324880123138
00:43:30.302 --> 00:43:33.638 Fitbit data was looked at in a state.
NOTE Confidence: 0.826324880123138
00:43:33.640 --> 00:43:35.690 Aggregate level Anne used to
NOTE Confidence: 0.826324880123138
00:43:35.690 --> 00:43:37.740 determine the likelihood of influenza
NOTE Confidence: 0.826324880123138
00:43:37.809 --> 00:43:39.240 like illness outbreaks,
NOTE Confidence: 0.826324880123138
00:43:39.240 --> 00:43:42.120 so these are things that couldn't
NOTE Confidence: 0.826324880123138
00:43:42.120 --> 00:43:45.046 really be easily conducted with use
NOTE Confidence: 0.826324880123138
00:43:45.046 --> 00:43:47.806 of actigraphy and are very promising.
NOTE Confidence: 0.826324880123138
00:43:47.810 --> 00:43:50.228 And of course, what about Covid?
NOTE Confidence: 0.826324880123138

00:43:50.230 --> 00:43:54.260 So Covid has been now used in a few studies.
NOTE Confidence: 0.826324880123138

00:43:54.260 --> 00:43:56.678 These are the three big ones.
NOTE Confidence: 0.826324880123138

00:43:56.680 --> 00:43:57.374 Excuse me,
NOTE Confidence: 0.826324880123138

00:43:57.374 --> 00:43:59.803 CST's have been used in Covid studies
NOTE Confidence: 0.826324880123138

00:43:59.803 --> 00:44:02.824 are the three big ones to determine
NOTE Confidence: 0.826324880123138

00:44:02.824 --> 00:44:04.560 if consumer wearable technologies
NOTE Confidence: 0.826324880123138

00:44:04.629 --> 00:44:07.113 can help predict covid both with
NOTE Confidence: 0.826324880123138

00:44:07.113 --> 00:44:08.769 and without the incorporation
NOTE Confidence: 0.813572943210602

00:44:08.770 --> 00:44:11.507 of symptoms, and these have been promising
NOTE Confidence: 0.813572943210602

00:44:11.507 --> 00:44:13.971 these primarily used resting heart rate
NOTE Confidence: 0.813572943210602

00:44:13.971 --> 00:44:16.413 and heart rate variability and activity,
NOTE Confidence: 0.813572943210602

00:44:16.420 --> 00:44:18.880 and some of them you sleep.
NOTE Confidence: 0.813572943210602

00:44:18.880 --> 00:44:21.610 To predict covid, they've also been found
NOTE Confidence: 0.813572943210602

00:44:21.610 --> 00:44:24.252 to predict other viral illnesses and has
NOTE Confidence: 0.813572943210602

00:44:24.252 --> 00:44:27.256 shown that the data from the sensors is
NOTE Confidence: 0.813572943210602

00:44:27.256 --> 00:44:30.182 beneficial above and beyond the symptom data.

NOTE Confidence: 0.813572943210602

00:44:30.190 --> 00:44:32.806 And here is a nice picture from one

NOTE Confidence: 0.813572943210602

00:44:32.806 --> 00:44:35.296 of these investigations and you can

NOTE Confidence: 0.813572943210602

00:44:35.296 --> 00:44:38.380 see that symptom onsets day zero here,

NOTE Confidence: 0.813572943210602

00:44:38.380 --> 00:44:41.110 and your blue tracing is respiratory rate.

NOTE Confidence: 0.813572943210602

00:44:41.110 --> 00:44:43.450 Your red tracing is heart rate,

NOTE Confidence: 0.813572943210602

00:44:43.450 --> 00:44:45.790 and your green and pink are

NOTE Confidence: 0.813572943210602

00:44:45.790 --> 00:44:47.350 heart rate variability measures.

NOTE Confidence: 0.813572943210602

00:44:47.350 --> 00:44:50.136 This is all believe this one is.

NOTE Confidence: 0.813572943210602

00:44:50.140 --> 00:44:53.052 Yep, this ones from Fitbit and if you

NOTE Confidence: 0.813572943210602

00:44:53.052 --> 00:44:56.537 look at Day Zero which is symptoms start,

NOTE Confidence: 0.813572943210602

00:44:56.540 --> 00:44:59.132 you're already seeing a change from

NOTE Confidence: 0.813572943210602

00:44:59.132 --> 00:45:01.299 baseline and these consumer sensor

NOTE Confidence: 0.813572943210602

00:45:01.299 --> 00:45:03.519 parameters and so this could be

NOTE Confidence: 0.813572943210602

00:45:03.519 --> 00:45:05.468 very helpful in identifying people

NOTE Confidence: 0.813572943210602

00:45:05.468 --> 00:45:08.156 who are going to have a viral

NOTE Confidence: 0.813572943210602

00:45:08.156 --> 00:45:09.374 illness specifically coded.
NOTE Confidence: 0.813572943210602

00:45:09.374 --> 00:45:11.459 And if all else fails,
NOTE Confidence: 0.813572943210602

00:45:11.460 --> 00:45:13.060 you can put your wearable
NOTE Confidence: 0.813572943210602

00:45:13.060 --> 00:45:14.340 tracker on your pet.
NOTE Confidence: 0.813572943210602

00:45:14.340 --> 00:45:16.461 So I thank you for your attention
NOTE Confidence: 0.813572943210602

00:45:16.461 --> 00:45:18.786 today and I'm happy to take any
NOTE Confidence: 0.813572943210602

00:45:18.786 --> 00:45:21.060 questions and thank you for having me.
NOTE Confidence: 0.899885714054108

00:45:23.280 --> 00:45:25.996 Thank you so much for a fantastic
NOTE Confidence: 0.899885714054108

00:45:25.996 --> 00:45:27.710 overview of that topic.
NOTE Confidence: 0.899885714054108

00:45:27.710 --> 00:45:29.645 Doctor Goldstein, that was really
NOTE Confidence: 0.899885714054108

00:45:29.645 --> 00:45:32.069 just a really great in depth
NOTE Confidence: 0.899885714054108

00:45:32.069 --> 00:45:34.559 perspective on all of these devices,
NOTE Confidence: 0.899885714054108

00:45:34.560 --> 00:45:36.172 how they work algorithms,
NOTE Confidence: 0.899885714054108

00:45:36.172 --> 00:45:38.180 the data, everything. Thank you.
NOTE Confidence: 0.899885714054108

00:45:38.180 --> 00:45:40.980 So I'll open it up for questions.
NOTE Confidence: 0.899885714054108

00:45:40.980 --> 00:45:44.148 And while people are getting ready for that,

NOTE Confidence: 0.899885714054108
00:45:44.150 --> 00:45:46.130 I'll just start with one.
NOTE Confidence: 0.899885714054108
00:45:46.130 --> 00:45:48.384 I love your optimism vote kind of
NOTE Confidence: 0.899885714054108
00:45:48.384 --> 00:45:49.893 embracing the practical advantages
NOTE Confidence: 0.899885714054108
00:45:49.893 --> 00:45:51.817 of consumer sleep technology
NOTE Confidence: 0.899885714054108
00:45:51.817 --> 00:45:53.260 over traditional actigraphy,
NOTE Confidence: 0.899885714054108
00:45:53.260 --> 00:45:56.025 and obviously in the setting of research.
NOTE Confidence: 0.899885714054108
00:45:56.030 --> 00:45:58.045 I think you've shown great
NOTE Confidence: 0.899885714054108
00:45:58.045 --> 00:46:00.779 examples of how this can be used,
NOTE Confidence: 0.899885714054108
00:46:00.780 --> 00:46:02.288 especially for collecting large
NOTE Confidence: 0.899885714054108
00:46:02.288 --> 00:46:05.036 amounts of data that are just not
NOTE Confidence: 0.899885714054108
00:46:05.036 --> 00:46:06.716 possible with with actigraphy.
NOTE Confidence: 0.899885714054108
00:46:06.720 --> 00:46:08.223 What I'm struggling with.
NOTE Confidence: 0.899885714054108
00:46:08.223 --> 00:46:10.414 Is what the mechanism is that we
NOTE Confidence: 0.899885714054108
00:46:10.414 --> 00:46:12.461 as asleep community could use
NOTE Confidence: 0.899885714054108
00:46:12.461 --> 00:46:14.261 to actually encourage companies
NOTE Confidence: 0.899885714054108

00:46:14.261 --> 00:46:16.728 to be transparent about their
NOTE Confidence: 0.899885714054108

00:46:16.728 --> 00:46:18.816 algorithms to facilitate validation.
NOTE Confidence: 0.899885714054108

00:46:18.820 --> 00:46:21.421 And I am not sure how I could see
NOTE Confidence: 0.899885714054108

00:46:21.421 --> 00:46:24.818 that there ever will really be a great
NOTE Confidence: 0.899885714054108

00:46:24.818 --> 00:46:26.824 financial incentive for validation
NOTE Confidence: 0.899885714054108

00:46:26.824 --> 00:46:29.320 to hold companies accountable.
NOTE Confidence: 0.899885714054108

00:46:29.320 --> 00:46:31.420 I mean, by what means?
NOTE Confidence: 0.899885714054108

00:46:31.420 --> 00:46:34.073 Does Apple I mean have to to
NOTE Confidence: 0.899885714054108

00:46:34.073 --> 00:46:35.765 actually broadcast that these
NOTE Confidence: 0.899885714054108

00:46:35.765 --> 00:46:38.135 things are accurate to consumers?
NOTE Confidence: 0.899885714054108

00:46:38.140 --> 00:46:39.852 Pay attention to this,
NOTE Confidence: 0.899885714054108

00:46:39.852 --> 00:46:40.708 how can?
NOTE Confidence: 0.899885714054108

00:46:40.710 --> 00:46:43.131 How can we put pressure on them or what
NOTE Confidence: 0.899885714054108

00:46:43.131 --> 00:46:45.706 is their their ill and incentive to do
NOTE Confidence: 0.851561903953552

00:46:45.710 --> 00:46:47.348 this? Yeah, and I you know
NOTE Confidence: 0.851561903953552

00:46:47.348 --> 00:46:49.239 I I don't know the answer.

NOTE Confidence: 0.851561903953552
00:46:49.240 --> 00:46:50.998 There's obviously a lot of suggestibility,
NOTE Confidence: 0.851561903953552
00:46:51.000 --> 00:46:52.953 so once the patient starts wearing the
NOTE Confidence: 0.851561903953552
00:46:52.953 --> 00:46:55.620 device but we often see is that they take
NOTE Confidence: 0.851561903953552
00:46:55.620 --> 00:46:57.157 the information from that's reported
NOTE Confidence: 0.851561903953552
00:46:57.157 --> 00:46:59.222 obviously by the app more than they
NOTE Confidence: 0.851561903953552
00:46:59.222 --> 00:47:01.290 take their own perception of their sleep.
NOTE Confidence: 0.851561903953552
00:47:01.290 --> 00:47:02.760 So there becomes, you know,
NOTE Confidence: 0.851561903953552
00:47:02.760 --> 00:47:04.762 I would think that most patients would
NOTE Confidence: 0.851561903953552
00:47:04.762 --> 00:47:07.167 want these to be as accurate as possible,
NOTE Confidence: 0.851561903953552
00:47:07.170 --> 00:47:08.952 but there also interacting with the
NOTE Confidence: 0.851561903953552
00:47:08.952 --> 00:47:11.056 device in that way that they are
NOTE Confidence: 0.851561903953552
00:47:11.056 --> 00:47:12.778 taking into account what it says.
NOTE Confidence: 0.851561903953552
00:47:12.780 --> 00:47:15.604 So they might take that above their own.
NOTE Confidence: 0.851561903953552
00:47:15.610 --> 00:47:17.638 Own subjective impression of their sleep,
NOTE Confidence: 0.851561903953552
00:47:17.640 --> 00:47:19.680 and so it's hard to know.
NOTE Confidence: 0.851561903953552

00:47:19.680 --> 00:47:22.317 I don't know if it will be on the
NOTE Confidence: 0.851561903953552

00:47:22.317 --> 00:47:25.097 order of the customer because of that.
NOTE Confidence: 0.851561903953552

00:47:25.100 --> 00:47:27.480 That pushes the companies to more validation.
NOTE Confidence: 0.851561903953552

00:47:27.480 --> 00:47:29.846 I don't think that we can do.
NOTE Confidence: 0.851561903953552

00:47:29.850 --> 00:47:32.052 We can currently continue on with
NOTE Confidence: 0.851561903953552

00:47:32.052 --> 00:47:34.482 the validation framework as it is if
NOTE Confidence: 0.851561903953552

00:47:34.482 --> 00:47:36.282 we want to engage with corporations,
NOTE Confidence: 0.851561903953552

00:47:36.290 --> 00:47:37.304 it just doesn't.
NOTE Confidence: 0.851561903953552

00:47:37.304 --> 00:47:38.318 It doesn't work.
NOTE Confidence: 0.851561903953552

00:47:38.320 --> 00:47:40.546 It's too slow to wait till these
NOTE Confidence: 0.851561903953552

00:47:40.546 --> 00:47:43.022 are companies come out in a peer
NOTE Confidence: 0.851561903953552

00:47:43.022 --> 00:47:43.750 reviewed publication.
NOTE Confidence: 0.851561903953552

00:47:43.750 --> 00:47:45.778 I don't know if they'll have,
NOTE Confidence: 0.851561903953552

00:47:45.780 --> 00:47:48.216 you know, I know some of them.
NOTE Confidence: 0.851561903953552

00:47:48.220 --> 00:47:50.452 You know there might be occupational
NOTE Confidence: 0.851561903953552

00:47:50.452 --> 00:47:52.319 programs and insurance company programs

NOTE Confidence: 0.851561903953552
00:47:52.319 --> 00:47:54.221 and fitness for duty programs that
NOTE Confidence: 0.851561903953552
00:47:54.221 --> 00:47:56.728 might be more attractive than healthcare.
NOTE Confidence: 0.851561903953552
00:47:56.730 --> 00:47:57.402 You know,
NOTE Confidence: 0.851561903953552
00:47:57.402 --> 00:47:59.082 we already don't get reimbursed
NOTE Confidence: 0.851561903953552
00:47:59.082 --> 00:48:00.800 for FDA cleared Actigraphy,
NOTE Confidence: 0.851561903953552
00:48:00.800 --> 00:48:03.089 so I don't think that you know
NOTE Confidence: 0.851561903953552
00:48:03.089 --> 00:48:05.395 from the hospital from the Medical
NOTE Confidence: 0.851561903953552
00:48:05.395 --> 00:48:07.059 Center standpoint we're really
NOTE Confidence: 0.851561903953552
00:48:07.059 --> 00:48:09.678 going to move the needle on that.
NOTE Confidence: 0.851561903953552
00:48:09.680 --> 00:48:11.948 I would hope that they are
NOTE Confidence: 0.851561903953552
00:48:11.948 --> 00:48:14.489 interested in what we have to say,
NOTE Confidence: 0.851561903953552
00:48:14.490 --> 00:48:16.710 and they seem like they are.
NOTE Confidence: 0.851561903953552
00:48:16.710 --> 00:48:18.118 I mean, I've had.
NOTE Confidence: 0.851561903953552
00:48:18.118 --> 00:48:19.526 Positive interactions with industry,
NOTE Confidence: 0.851561903953552
00:48:19.530 --> 00:48:22.114 you know, and we don't need to have.
NOTE Confidence: 0.851561903953552

00:48:22.120 --> 00:48:23.735 You know when you're using
NOTE Confidence: 0.851561903953552

00:48:23.735 --> 00:48:25.027 machine learning in general,
NOTE Confidence: 0.851561903953552

00:48:25.030 --> 00:48:26.974 it's you're not going to know
NOTE Confidence: 0.851561903953552

00:48:26.974 --> 00:48:28.594 everything about the algorithm, right?
NOTE Confidence: 0.851561903953552

00:48:28.594 --> 00:48:30.538 But we do need some trends,
NOTE Confidence: 0.851561903953552

00:48:30.540 --> 00:48:32.160 so that can you know,
NOTE Confidence: 0.851561903953552

00:48:32.160 --> 00:48:33.081 maintain trade secret,
NOTE Confidence: 0.851561903953552

00:48:33.081 --> 00:48:34.923 but we do need some information
NOTE Confidence: 0.851561903953552

00:48:34.923 --> 00:48:36.050 about the population.
NOTE Confidence: 0.851561903953552

00:48:36.050 --> 00:48:38.157 And just like we were going to
NOTE Confidence: 0.851561903953552

00:48:38.157 --> 00:48:40.260 recommend with AI based sleep stage,
NOTE Confidence: 0.851561903953552

00:48:40.260 --> 00:48:42.012 and we need to understand what
NOTE Confidence: 0.851561903953552

00:48:42.012 --> 00:48:43.615 population it was trained on
NOTE Confidence: 0.851561903953552

00:48:43.615 --> 00:48:45.119 hasn't been independently tested.
NOTE Confidence: 0.851561903953552

00:48:45.120 --> 00:48:46.092 Things like that,
NOTE Confidence: 0.851561903953552

00:48:46.092 --> 00:48:48.760 or things that we would like to know.

NOTE Confidence: 0.851561903953552
00:48:48.760 --> 00:48:49.984 From the companies.
NOTE Confidence: 0.851561903953552
00:48:49.984 --> 00:48:52.840 Before we use these and you know,
NOTE Confidence: 0.851561903953552
00:48:52.840 --> 00:48:54.778 rely on these, but you know,
NOTE Confidence: 0.851561903953552
00:48:54.780 --> 00:48:56.724 I don't really know what's going
NOTE Confidence: 0.851561903953552
00:48:56.724 --> 00:48:58.800 to push the needle. That's that.
NOTE Confidence: 0.851561903953552
00:48:58.800 --> 00:49:01.530 I don't have any answer to it's
NOTE Confidence: 0.851561903953552
00:49:01.530 --> 00:49:03.279 a great question.
NOTE Confidence: 0.851561903953552
00:49:03.280 --> 00:49:04.330 Thanks.
NOTE Confidence: 0.845190644264221
00:49:04.960 --> 00:49:07.018 Anyone else who wants to ask a
NOTE Confidence: 0.845190644264221
00:49:07.018 --> 00:49:08.570 question to Doctor Goldstein?
NOTE Confidence: 0.856640815734863
00:49:10.290 --> 00:49:16.450 Hi, it's Brian. I have a question.
NOTE Confidence: 0.856640815734863
00:49:16.450 --> 00:49:18.646 So yeah, I agree with Lauren
NOTE Confidence: 0.856640815734863
00:49:18.646 --> 00:49:21.089 that's so great talk an I myself,
NOTE Confidence: 0.856640815734863
00:49:21.090 --> 00:49:23.680 I'm sort of wondering about using various
NOTE Confidence: 0.856640815734863
00:49:23.680 --> 00:49:25.728 different technologies in my own research,
NOTE Confidence: 0.856640815734863

00:49:25.730 --> 00:49:28.970 so one one comment and then one question just

NOTE Confidence: 0.856640815734863

00:49:28.970 --> 00:49:31.794 based on what you guys were just saying.

NOTE Confidence: 0.856640815734863

00:49:31.800 --> 00:49:35.080 I wonder if. I mean if they if the this

NOTE Confidence: 0.856640815734863

00:49:35.174 --> 00:49:38.210 you know ASM sleep research society,

NOTE Confidence: 0.856640815734863

00:49:38.210 --> 00:49:40.576 could we have any leverage with these

NOTE Confidence: 0.856640815734863

00:49:40.576 --> 00:49:43.153 companies to say you know the more

NOTE Confidence: 0.856640815734863

00:49:43.153 --> 00:49:45.403 transparent you are about your technology,

NOTE Confidence: 0.856640815734863

00:49:45.410 --> 00:49:46.882 it how it works,

NOTE Confidence: 0.856640815734863

00:49:46.882 --> 00:49:48.722 the more likely researchers already

NOTE Confidence: 0.856640815734863

00:49:48.722 --> 00:49:50.809 use it in their own research.

NOTE Confidence: 0.856640815734863

00:49:50.810 --> 00:49:53.330 I mean what I've thought about is,

NOTE Confidence: 0.856640815734863

00:49:53.330 --> 00:49:55.682 I've looked at these different technologies

NOTE Confidence: 0.856640815734863

00:49:55.682 --> 00:49:59.446 is am I going to have access to the raw data?

NOTE Confidence: 0.856640815734863

00:49:59.450 --> 00:50:01.250 I think that's really important

NOTE Confidence: 0.856640815734863

00:50:01.250 --> 00:50:03.050 from a reach research perspective,

NOTE Confidence: 0.856640815734863

00:50:03.050 --> 00:50:05.570 and so perhaps some companies you know.

NOTE Confidence: 0.856640815734863
00:50:05.570 --> 00:50:07.988 They want uptake of these devices.
NOTE Confidence: 0.856640815734863
00:50:07.990 --> 00:50:11.206 Might be receptive to that kind of argument.
NOTE Confidence: 0.856640815734863
00:50:11.210 --> 00:50:12.419 Just a thought.
NOTE Confidence: 0.856640815734863
00:50:12.419 --> 00:50:14.434 My question is Doctor Goldstein,
NOTE Confidence: 0.856640815734863
00:50:14.440 --> 00:50:17.205 have you whether you've looked at some
NOTE Confidence: 0.856640815734863
00:50:17.205 --> 00:50:19.276 of these consumer technologies that
NOTE Confidence: 0.856640815734863
00:50:19.276 --> 00:50:22.500 actually look at EEG as opposed to you,
NOTE Confidence: 0.856640815734863
00:50:22.500 --> 00:50:23.218 know actigraphy,
NOTE Confidence: 0.856640815734863
00:50:23.218 --> 00:50:25.731 and if you have any thoughts or
NOTE Confidence: 0.856640815734863
00:50:25.731 --> 00:50:27.740 comments about those technologies.
NOTE Confidence: 0.856640815734863
00:50:27.740 --> 00:50:30.977 So I haven't in detail, I'll say it.
NOTE Confidence: 0.856640815734863
00:50:30.977 --> 00:50:33.840 Probably many people miss in this room
NOTE Confidence: 0.856640815734863
00:50:33.928 --> 00:50:36.658 zoom room whatever we call it now.
NOTE Confidence: 0.856640815734863
00:50:36.660 --> 00:50:37.800 Have tried them.
NOTE Confidence: 0.856640815734863
00:50:37.800 --> 00:50:38.560 I mean,
NOTE Confidence: 0.856640815734863

00:50:38.560 --> 00:50:40.460 I haven't been impressed physically
NOTE Confidence: 0.856640815734863

00:50:40.460 --> 00:50:43.099 trying those myself and we don't have.
NOTE Confidence: 0.856640815734863

00:50:43.100 --> 00:50:44.246 There's very limited,
NOTE Confidence: 0.856640815734863

00:50:44.246 --> 00:50:46.538 limited data on those as well
NOTE Confidence: 0.856640815734863

00:50:46.538 --> 00:50:48.410 an I haven't seen much.
NOTE Confidence: 0.856640815734863

00:50:48.410 --> 00:50:50.330 I haven't personally as far as
NOTE Confidence: 0.856640815734863

00:50:50.330 --> 00:50:53.013 like the dry e.g head mansized and
NOTE Confidence: 0.856640815734863

00:50:53.013 --> 00:50:55.228 that's where you're talking about.
NOTE Confidence: 0.856640815734863

00:50:55.230 --> 00:50:57.840 I haven't seen them interact with
NOTE Confidence: 0.856640815734863

00:50:57.840 --> 00:51:01.228 academia as much as the heart rate and.
NOTE Confidence: 0.856640815734863

00:51:01.230 --> 00:51:03.034 Motion based wearable devices.
NOTE Confidence: 0.856640815734863

00:51:03.034 --> 00:51:06.549 You would think that they would be better,
NOTE Confidence: 0.856640815734863

00:51:06.550 --> 00:51:07.822 but I'm not sure.
NOTE Confidence: 0.856640815734863

00:51:07.822 --> 00:51:09.412 There's definitely a disconnect and
NOTE Confidence: 0.856640815734863

00:51:09.412 --> 00:51:11.167 they want to make it so patient
NOTE Confidence: 0.856640815734863

00:51:11.167 --> 00:51:12.310 can just put it on,

NOTE Confidence: 0.856640815734863
00:51:12.310 --> 00:51:14.039 but that it also records the EG
NOTE Confidence: 0.856640815734863
00:51:14.039 --> 00:51:16.314 and I just don't know if the dry
NOTE Confidence: 0.856640815734863
00:51:16.314 --> 00:51:17.784 e.g technology is there yet.
NOTE Confidence: 0.856640815734863
00:51:17.790 --> 00:51:19.278 You should try some of these
NOTE Confidence: 0.856640815734863
00:51:19.278 --> 00:51:21.069 out and I think you'll agree.
NOTE Confidence: 0.856640815734863
00:51:21.070 --> 00:51:22.440 I looked like I was.
NOTE Confidence: 0.856640815734863
00:51:22.440 --> 00:51:24.816 I was in some kind of like I was
NOTE Confidence: 0.856640815734863
00:51:24.816 --> 00:51:26.826 awake and I was like in Delta.
NOTE Confidence: 0.856640815734863
00:51:26.830 --> 00:51:28.468 I mean they're just they don't.
NOTE Confidence: 0.856640815734863
00:51:28.470 --> 00:51:30.353 I mean 'cause you when you think
NOTE Confidence: 0.856640815734863
00:51:30.353 --> 00:51:32.038 about the work that guys end
NOTE Confidence: 0.856640815734863
00:51:32.038 --> 00:51:33.398 up putting on e.g leads,
NOTE Confidence: 0.856640815734863
00:51:33.400 --> 00:51:34.524 it just doesn't translate.
NOTE Confidence: 0.856640815734863
00:51:34.524 --> 00:51:36.210 I mean you can have like.
NOTE Confidence: 0.856640815734863
00:51:36.210 --> 00:51:37.194 Single lady e.g.
NOTE Confidence: 0.856640815734863

00:51:37.194 --> 00:51:39.490 But these are embedded in the headband,
NOTE Confidence: 0.856640815734863

00:51:39.490 --> 00:51:40.758 so I don't know.
NOTE Confidence: 0.856640815734863

00:51:40.758 --> 00:51:42.343 I just don't think we're
NOTE Confidence: 0.856640815734863

00:51:42.343 --> 00:51:44.078 quite there yet with that.
NOTE Confidence: 0.861600995063782

00:51:49.230 --> 00:51:51.912 I'm just going to scan the chat for any
NOTE Confidence: 0.861600995063782

00:51:51.920 --> 00:51:53.718 question I had actually question then
NOTE Confidence: 0.861600995063782

00:51:53.718 --> 00:51:56.102 this is that you know where how you
NOTE Confidence: 0.861600995063782

00:51:56.110 --> 00:51:58.196 doing Kathy good to see you again.
NOTE Confidence: 0.861600995063782

00:51:58.200 --> 00:51:59.118 At Norwalk hospital.
NOTE Confidence: 0.861600995063782

00:51:59.120 --> 00:52:01.584 So yeah, we talk and it's a very,
NOTE Confidence: 0.861600995063782

00:52:01.584 --> 00:52:03.738 you know, sort of hot topic issue.
NOTE Confidence: 0.861600995063782

00:52:03.740 --> 00:52:05.896 You know when I think about this
NOTE Confidence: 0.852784693241119

00:52:05.900 --> 00:52:08.276 I I think about how in terms of
NOTE Confidence: 0.852784693241119

00:52:08.276 --> 00:52:09.907 population health is probably where
NOTE Confidence: 0.852784693241119

00:52:09.907 --> 00:52:12.057 it may have its biggest effect and
NOTE Confidence: 0.852784693241119

00:52:12.057 --> 00:52:13.910 I think of sleep deprivation, which

NOTE Confidence: 0.852784693241119

00:52:13.910 --> 00:52:15.510 is really an epidemic that

NOTE Confidence: 0.852784693241119

00:52:15.510 --> 00:52:17.300 we don't talk much about in

NOTE Confidence: 0.852784693241119

00:52:17.300 --> 00:52:19.756 Sleep Medicine as much as we probably should.

NOTE Confidence: 0.852784693241119

00:52:19.760 --> 00:52:21.916 And so when people track their sleep,

NOTE Confidence: 0.852784693241119

00:52:21.916 --> 00:52:24.068 you know one thing I find similar

NOTE Confidence: 0.852784693241119

00:52:24.068 --> 00:52:26.230 to like the step trackers you know

NOTE Confidence: 0.852784693241119

00:52:26.230 --> 00:52:28.074 they'll look at and they'll say,

NOTE Confidence: 0.852784693241119

00:52:28.074 --> 00:52:29.665 oh, I've done, you know?

NOTE Confidence: 0.852784693241119

00:52:29.665 --> 00:52:30.960 5000 steps OK, Great

NOTE Confidence: 0.84787517786026

00:52:30.960 --> 00:52:32.565 and you don't do anything

NOTE Confidence: 0.84787517786026

00:52:32.565 --> 00:52:33.530 with the information,

NOTE Confidence: 0.84787517786026

00:52:33.530 --> 00:52:36.096 so I guess the question is can we

NOTE Confidence: 0.84787517786026

00:52:36.096 --> 00:52:38.029 can we use these sleep trackers?

NOTE Confidence: 0.84787517786026

00:52:38.030 --> 00:52:39.310 ANO Validation is important,

NOTE Confidence: 0.84787517786026

00:52:39.310 --> 00:52:41.234 but maybe sort of the more

NOTE Confidence: 0.84787517786026

00:52:41.234 --> 00:52:42.840 important issue is can the
NOTE Confidence: 0.84787517786026

00:52:42.840 --> 00:52:44.448 individual person use it to
NOTE Confidence: 0.84787517786026

00:52:44.448 --> 00:52:46.050 sort of improve their health,
NOTE Confidence: 0.84787517786026

00:52:46.050 --> 00:52:47.338 get more sleep and
NOTE Confidence: 0.84787517786026

00:52:47.340 --> 00:52:49.260 you know? And so is there.
NOTE Confidence: 0.84787517786026

00:52:49.260 --> 00:52:51.507 I think that maybe a sense of
NOTE Confidence: 0.84787517786026

00:52:51.507 --> 00:52:53.751 kind of focus in on a population
NOTE Confidence: 0.84787517786026

00:52:53.751 --> 00:52:55.998 in because a lot of people have
NOTE Confidence: 0.84787517786026

00:52:55.998 --> 00:52:57.930 these these trackers now so you
NOTE Confidence: 0.84787517786026

00:52:57.930 --> 00:52:59.938 aware of anyone who is using.
NOTE Confidence: 0.84787517786026

00:52:59.940 --> 00:53:01.276 Consumer technology in an algorithm
NOTE Confidence: 0.84787517786026

00:53:01.276 --> 00:53:03.140 to try to help people either get
NOTE Confidence: 0.862934768199921

00:53:03.140 --> 00:53:04.742 more sleep or you know similar
NOTE Confidence: 0.862934768199921

00:53:04.742 --> 00:53:06.081 to maybe diagnosis or like
NOTE Confidence: 0.862934768199921

00:53:06.081 --> 00:53:07.418 a screening for sleep apnea.
NOTE Confidence: 0.862934768199921

00:53:07.420 --> 00:53:08.747 I can't do what they

NOTE Confidence: 0.862934768199921
00:53:08.747 --> 00:53:10.084 have for the Apple Watch,
NOTE Confidence: 0.862934768199921
00:53:10.084 --> 00:53:11.421 which is this A-fib detection,
NOTE Confidence: 0.862934768199921
00:53:11.421 --> 00:53:12.760 which is quite interesting. Where
NOTE Confidence: 0.862934768199921
00:53:12.760 --> 00:53:14.888 that would sort of clue them in that
NOTE Confidence: 0.862934768199921
00:53:14.890 --> 00:53:16.486 they may have a sleep problem.
NOTE Confidence: 0.862934768199921
00:53:16.490 --> 00:53:18.100 So I guess the question is,
NOTE Confidence: 0.862934768199921
00:53:18.100 --> 00:53:19.694 are you aware of any studies
NOTE Confidence: 0.862934768199921
00:53:19.694 --> 00:53:21.298 that are looking at using the
NOTE Confidence: 0.862934768199921
00:53:21.300 --> 00:53:22.368 zoom technologies to increase
NOTE Confidence: 0.862934768199921
00:53:22.368 --> 00:53:23.970 total sleep time in a population?
NOTE Confidence: 0.862934768199921
00:53:23.970 --> 00:53:25.004 So this is it.
NOTE Confidence: 0.862934768199921
00:53:25.004 --> 00:53:27.440 This is a great question and a great point.
NOTE Confidence: 0.862934768199921
00:53:27.440 --> 00:53:29.260 And as of this time you know
NOTE Confidence: 0.862934768199921
00:53:29.260 --> 00:53:30.679 both for fitness and sleep.
NOTE Confidence: 0.862934768199921
00:53:30.680 --> 00:53:32.738 There there's not good evidence to
NOTE Confidence: 0.862934768199921

00:53:32.738 --> 00:53:34.640 suggest that tracking improves behavior.
NOTE Confidence: 0.862934768199921

00:53:34.640 --> 00:53:37.520 There is some work that's going on though,
NOTE Confidence: 0.862934768199921

00:53:37.520 --> 00:53:39.265 so Kelly Baron and colleagues
NOTE Confidence: 0.862934768199921

00:53:39.265 --> 00:53:41.480 at University of Utah I think.
NOTE Confidence: 0.862934768199921

00:53:41.480 --> 00:53:44.360 Or maybe she did this back in Chicago,
NOTE Confidence: 0.862934768199921

00:53:44.360 --> 00:53:46.880 but they used a consumer sleep technology.
NOTE Confidence: 0.862934768199921

00:53:46.880 --> 00:53:49.057 They developed an app and they did
NOTE Confidence: 0.862934768199921

00:53:49.057 --> 00:53:51.318 sleep extension in people with short
NOTE Confidence: 0.862934768199921

00:53:51.318 --> 00:53:52.998 sleep duration and hypertension,
NOTE Confidence: 0.862934768199921

00:53:53.000 --> 00:53:54.866 and they did improve sleep times
NOTE Confidence: 0.862934768199921

00:53:54.866 --> 00:53:57.036 and they did improve blood pressure
NOTE Confidence: 0.862934768199921

00:53:57.036 --> 00:53:58.760 control in those individuals.
NOTE Confidence: 0.862934768199921

00:53:58.760 --> 00:54:01.350 So an I think that's the key.
NOTE Confidence: 0.862934768199921

00:54:01.350 --> 00:54:03.492 In how we use these is there
NOTE Confidence: 0.862934768199921

00:54:03.492 --> 00:54:05.702 never gonna be exactly like e.g
NOTE Confidence: 0.862934768199921

00:54:05.702 --> 00:54:08.126 defined sleep like they will just.

NOTE Confidence: 0.862934768199921
00:54:08.130 --> 00:54:09.562 It's your measuring something
NOTE Confidence: 0.862934768199921
00:54:09.562 --> 00:54:10.278 totally different.
NOTE Confidence: 0.862934768199921
00:54:10.280 --> 00:54:12.416 Magni Eunice told me once he was like
NOTE Confidence: 0.862934768199921
00:54:12.416 --> 00:54:14.680 I don't understand he's like these
NOTE Confidence: 0.862934768199921
00:54:14.680 --> 00:54:16.760 sleep trackers there monitoring things
NOTE Confidence: 0.862934768199921
00:54:16.760 --> 00:54:19.495 that we don't stay asleep with that
NOTE Confidence: 0.862934768199921
00:54:19.495 --> 00:54:20.986 they're totally different, right?
NOTE Confidence: 0.862934768199921
00:54:20.986 --> 00:54:22.766 So but maybe it's not,
NOTE Confidence: 0.862934768199921
00:54:22.770 --> 00:54:23.482 you know,
NOTE Confidence: 0.862934768199921
00:54:23.482 --> 00:54:25.974 getting to this perfection level of accuracy.
NOTE Confidence: 0.862934768199921
00:54:25.980 --> 00:54:28.374 Maybe it's using it as a completely
NOTE Confidence: 0.862934768199921
00:54:28.374 --> 00:54:30.594 different construct of sleep and seeing
NOTE Confidence: 0.862934768199921
00:54:30.594 --> 00:54:32.474 how interventions applied to that.
NOTE Confidence: 0.862934768199921
00:54:32.480 --> 00:54:34.358 Can change your still both your
NOTE Confidence: 0.862934768199921
00:54:34.358 --> 00:54:36.105 sleep outcome in other health
NOTE Confidence: 0.862934768199921

00:54:36.105 --> 00:54:37.410 outcomes totally agree.
NOTE Confidence: 0.693542003631592

00:54:39.700 --> 00:54:41.398 Thank you, *****
NOTE Confidence: 0.801599562168121

00:54:45.680 --> 00:54:47.360 Hi Kathy, this is Andres
NOTE Confidence: 0.801599562168121

00:54:47.360 --> 00:54:49.040 and Chuck really nice talk.
NOTE Confidence: 0.801599562168121

00:54:49.040 --> 00:54:51.393 Hey, thank you hear hear your thoughts
NOTE Confidence: 0.801599562168121

00:54:51.393 --> 00:54:54.076 and agree with you and Ian about you
NOTE Confidence: 0.801599562168121

00:54:54.076 --> 00:54:56.504 know these are probably not going to
NOTE Confidence: 0.801599562168121

00:54:56.504 --> 00:54:59.108 be perfect matches to what we measure
NOTE Confidence: 0.801599562168121

00:54:59.108 --> 00:55:01.924 in the PSG and I wonder if you know
NOTE Confidence: 0.801599562168121

00:55:01.924 --> 00:55:04.160 we can use the metrics from these
NOTE Confidence: 0.801599562168121

00:55:04.160 --> 00:55:05.760 devices as biomarkers and correlate
NOTE Confidence: 0.801599562168121

00:55:05.760 --> 00:55:07.768 them or establish a relationship with
NOTE Confidence: 0.801599562168121

00:55:07.768 --> 00:55:09.200 meaningful outcomes and overtime.
NOTE Confidence: 0.801599562168121

00:55:09.200 --> 00:55:11.215 They might be actually more relevant
NOTE Confidence: 0.801599562168121

00:55:11.215 --> 00:55:13.225 than e.g signals that we get.
NOTE Confidence: 0.801599562168121

00:55:13.230 --> 00:55:15.777 I mean sleep is defined by e.g but we're

NOTE Confidence: 0.801599562168121

00:55:15.777 --> 00:55:17.949 only looking at superficial layer.

NOTE Confidence: 0.801599562168121

00:55:17.950 --> 00:55:20.155 Of the cells and you know that some of

NOTE Confidence: 0.801599562168121

00:55:20.155 --> 00:55:22.355 that sleep occurs supportively, right?

NOTE Confidence: 0.801599562168121

00:55:22.355 --> 00:55:23.165 And so.

NOTE Confidence: 0.801599562168121

00:55:23.165 --> 00:55:26.000 It's hard to say what we what

NOTE Confidence: 0.801599562168121

00:55:26.093 --> 00:55:27.749 is the truth here,

NOTE Confidence: 0.801599562168121

00:55:27.750 --> 00:55:31.520 but I was going to ask you question about the

NOTE Confidence: 0.801599562168121

00:55:31.611 --> 00:55:35.220 what do we do with all of this information.

NOTE Confidence: 0.801599562168121

00:55:35.220 --> 00:55:36.399 So for example,

NOTE Confidence: 0.801599562168121

00:55:36.399 --> 00:55:38.757 if we're tracking patients over days,

NOTE Confidence: 0.801599562168121

00:55:38.760 --> 00:55:39.468 weeks, months,

NOTE Confidence: 0.801599562168121

00:55:39.468 --> 00:55:41.238 how do you analyze that

NOTE Confidence: 0.801599562168121

00:55:41.238 --> 00:55:43.480 data in a meaningful way?

NOTE Confidence: 0.801599562168121

00:55:43.480 --> 00:55:46.135 And how do you relate it to an outcome?

NOTE Confidence: 0.801599562168121

00:55:46.135 --> 00:55:48.790 I think it's been a challenge 'cause so far.

NOTE Confidence: 0.801599562168121

00:55:48.790 --> 00:55:50.570 We've really mostly been used
NOTE Confidence: 0.801599562168121

00:55:50.570 --> 00:55:52.350 to metrics that are very.
NOTE Confidence: 0.801599562168121

00:55:52.350 --> 00:55:55.080 Sort of Abacus like where we count
NOTE Confidence: 0.801599562168121

00:55:55.080 --> 00:55:57.940 things overtime or we you know measure
NOTE Confidence: 0.801599562168121

00:55:57.940 --> 00:56:00.364 some intensity area under the curve
NOTE Confidence: 0.801599562168121

00:56:00.444 --> 00:56:03.020 and so the data is being collected.
NOTE Confidence: 0.801599562168121

00:56:03.020 --> 00:56:05.312 Now at these devices is vastly
NOTE Confidence: 0.801599562168121

00:56:05.312 --> 00:56:08.223 different and so even with just sleep
NOTE Confidence: 0.801599562168121

00:56:08.223 --> 00:56:10.827 duration or sleep period written ecity
NOTE Confidence: 0.801599562168121

00:56:10.827 --> 00:56:13.455 like have you seen any unique ways
NOTE Confidence: 0.801599562168121

00:56:13.455 --> 00:56:15.664 that that data has been analyzed?
NOTE Confidence: 0.801599562168121

00:56:15.664 --> 00:56:18.046 And so not from consumer wearables
NOTE Confidence: 0.801599562168121

00:56:18.046 --> 00:56:20.937 and not for extended amounts of time.
NOTE Confidence: 0.801599562168121

00:56:20.940 --> 00:56:23.190 And that's where we'll obviously need
NOTE Confidence: 0.801599562168121

00:56:23.190 --> 00:56:25.367 people with your level of expertise
NOTE Confidence: 0.801599562168121

00:56:25.367 --> 00:56:27.502 in AI to help distill the data,

NOTE Confidence: 0.801599562168121
00:56:27.510 --> 00:56:29.586 because there's going to be a
NOTE Confidence: 0.801599562168121
00:56:29.586 --> 00:56:30.970 lot of Co dependencies,
NOTE Confidence: 0.801599562168121
00:56:30.970 --> 00:56:34.084 there's going to be just a vast number of,
NOTE Confidence: 0.801599562168121
00:56:34.090 --> 00:56:35.820 and this is not even.
NOTE Confidence: 0.801599562168121
00:56:35.820 --> 00:56:37.096 The machine learning algorithms
NOTE Confidence: 0.801599562168121
00:56:37.096 --> 00:56:38.691 to determine sleep from wake
NOTE Confidence: 0.801599562168121
00:56:38.691 --> 00:56:40.308 for everyone who's listening.
NOTE Confidence: 0.801599562168121
00:56:40.310 --> 00:56:42.515 This is the once the post process
NOTE Confidence: 0.801599562168121
00:56:42.515 --> 00:56:44.683 data is just so much bigger
NOTE Confidence: 0.801599562168121
00:56:44.683 --> 00:56:46.608 and faster than anything else.
NOTE Confidence: 0.801599562168121
00:56:46.610 --> 00:56:48.554 So we will need more flexible
NOTE Confidence: 0.801599562168121
00:56:48.554 --> 00:56:50.250 models to deal with that.
NOTE Confidence: 0.801599562168121
00:56:50.250 --> 00:56:52.014 I think the closest that we
NOTE Confidence: 0.801599562168121
00:56:52.014 --> 00:56:54.220 get is the work that Meredith.
NOTE Confidence: 0.801599562168121
00:56:54.220 --> 00:56:55.380 I think there's no.
NOTE Confidence: 0.801599562168121

00:56:55.380 --> 00:56:57.589 I don't think pen is here that
NOTE Confidence: 0.801599562168121

00:56:57.589 --> 00:56:59.189 Meredith Wallace has done,
NOTE Confidence: 0.801599562168121

00:56:59.190 --> 00:57:01.176 but that was using actigraphy for
NOTE Confidence: 0.801599562168121

00:57:01.176 --> 00:57:03.254 about 5 days, but they were able.
NOTE Confidence: 0.801599562168121

00:57:03.254 --> 00:57:05.335 At least you know it's a start
NOTE Confidence: 0.801599562168121

00:57:05.335 --> 00:57:07.285 for looking at these different
NOTE Confidence: 0.801599562168121

00:57:07.285 --> 00:57:08.455 parameters of sleep,
NOTE Confidence: 0.801599562168121

00:57:08.460 --> 00:57:10.770 at least at the same time simultaneously,
NOTE Confidence: 0.801599562168121

00:57:10.770 --> 00:57:11.799 duration rhythmicity timing,
NOTE Confidence: 0.801599562168121

00:57:11.799 --> 00:57:14.200 but this is going to be even
NOTE Confidence: 0.801599562168121

00:57:14.265 --> 00:57:15.409 way more than that,
NOTE Confidence: 0.801599562168121

00:57:15.410 --> 00:57:17.348 so it'll be interesting to see
NOTE Confidence: 0.801599562168121

00:57:17.348 --> 00:57:19.469 how that data is dealt with.
NOTE Confidence: 0.801599562168121

00:57:19.470 --> 00:57:20.310 When we get to that point.
NOTE Confidence: 0.822471618652344

00:57:23.430 --> 00:57:25.700 Great, thank you so much again,
NOTE Confidence: 0.822471618652344

00:57:25.700 --> 00:57:26.460 Doctor Goldstein.

NOTE Confidence: 0.822471618652344

00:57:26.460 --> 00:57:28.740 I think will will close there.

NOTE Confidence: 0.822471618652344

00:57:28.740 --> 00:57:31.337 I just want to let everybody know

NOTE Confidence: 0.822471618652344

00:57:31.337 --> 00:57:33.863 that our talk next week we were

NOTE Confidence: 0.822471618652344

00:57:33.863 --> 00:57:37.198 going to have as we have on the 2nd

NOTE Confidence: 0.822471618652344

00:57:37.198 --> 00:57:39.724 Wednesday of each month adjoint Yale,

NOTE Confidence: 0.822471618652344

00:57:39.730 --> 00:57:41.615 Harvard Sleep Conference and we're

NOTE Confidence: 0.822471618652344

00:57:41.615 --> 00:57:43.900 having a kind of unique talk.

NOTE Confidence: 0.822471618652344

00:57:43.900 --> 00:57:47.020 James Nestor is an author of the book

NOTE Confidence: 0.822471618652344

00:57:47.020 --> 00:57:49.957 Breathe the new science of a Lost Art,

NOTE Confidence: 0.822471618652344

00:57:49.960 --> 00:57:52.536 and so he's going to be giving

NOTE Confidence: 0.822471618652344

00:57:52.536 --> 00:57:54.530 next week stock so please.

NOTE Confidence: 0.822471618652344

00:57:54.530 --> 00:57:56.690 Join us for that and again,

NOTE Confidence: 0.822471618652344

00:57:56.690 --> 00:57:58.982 thank you so much Doctor Goldstein

NOTE Confidence: 0.822471618652344

00:57:58.982 --> 00:58:01.368 and stay well everybody will see you

NOTE Confidence: 0.860342860221863

00:58:01.370 --> 00:58:03.170 next week. Sounds good. Thanks,