White paper

Sleep metrics baseline-to-go-live analysis

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1. Executive summary

Across 811 residents in 37 care homes, we compared each resident's sleep in the month before Teton went live with the three months after. By the third live month, residents were asleep almost an hour longer each day (about 0.9 hours, 95% CI 0.6–1.2) and sleep efficiency was around five percentage points higher (95% CI 3.2–6.8, roughly an eight percent relative gain). Both gains are present from the first month and hold through month three rather than drifting over time. Wake-ups fall in proportion to how disturbed sleep was at baseline: large in the few high-baseline sites, modest across more typical residents, and absent where wake-ups were already low. These effects are associated with Teton but without a control group we cannot prove causation, but the pattern is consistent across seasons, countries, and home types.

We also conducted 3-week analysis across our care homes and hospitals customers to understand how residents and patients sleep.

2. Three week analysis

The distribution charts in the companion blog post come from a separate, descriptive analysis rather than the before/after study below. Instead of following the same residents over time, it takes a recent three-week cross-section of every live community to show how residents sleep day to day.

- **Residents represented:** 2,661 – every resident tracked in a live community during the window.
- **Communities and countries:** 79 communities across four countries: Denmark, the United Kingdom, the United States, and Switzerland.
- **Dates:** the 21 nights of 1–21 June 2026.
- **Resident-night:** the unit of analysis: one resident on one calendar night in a live community. The snapshot covers 46,731 resident-nights.
- **Incomplete data:** a resident-night counts toward a metric only if that metric has a computed value that night. Nights with no reading (sensor offline or partial coverage) are dropped per metric, so each chart's denominator reflects valid nights only – about 44,400 nights carry a 24-hour sleep figure.

2.1. Headline figures

Total daily sleep clusters at 7–9 hours, with about 60% of resident-nights at or above 7 hours and a wide spread from 4 to 11 hours. Residents sleep in bed on 97% of nights and mainly in a chair on 3%. A typical night runs from going to bed around 9 PM and asleep by 9–10 PM to waking near 7 AM and getting up around 8 AM.

Care homes and hospitals differ sharply:

Table 1: Median per resident-night, care home versus hospital (three-week snapshot).

Metric	Care home	Hospital
Total sleep per day	8h 7min	6h 48min
Time in bed per day	11h 55min	16h 2min
Sleep efficiency	70%	44%
Night wake-ups	5	6

3. Before and after installing Teton

The following is a brief statistical analysis of the change experienced in care homes before and after installing Teton.

3.1. Study design

This analysis covers a subset of care homes with Teton installed. We analyzed 811 residents – those with sufficient data across the whole period, out of 935 tracked – across 37 homes, comparing each resident against themselves before and after go-live and keeping only those present the whole way through: four months in total, one month of baseline (tracking only, staff cannot see the data) followed by three months live (staff have access and receive training). Differences in age, frailty, and overall health could all influence sleep, but comparing each resident against themselves over a short four-month window largely holds these characteristics constant, so we do not model them explicitly. Hospitals are excluded because we cannot follow the same patients across the period.

Comparing the periods is not as simple as a paired t-test. Residents in the same home share staff and routines, so they are correlated rather than independent, and treating each as an independent observation would overstate the evidence. Collapsing each home to a single average avoids that but throws away the resident-level detail and most of the data. A mixed-effects model with a random intercept per home sits between the two: it credits only the independent information actually present, reflected in the effective sample size. The *p*-values are Holm-corrected across the six period comparisons.

3.2. Per-metric results

We track three metrics:

- **Total daily sleep** – hours scored as asleep over each 24-hour day, including daytime naps.
- **Sleep efficiency** – the share of time in bed that is spent asleep.
- **Night wake-ups** – the number of separate awakenings during the night, defined as 7 PM to 7 AM.

Table 1 reports, for all three metrics, the change between the baseline month and each live month and between live months. Each panel is one metric; rows are the six pairwise contrasts.

Table 2: Within-resident change from baseline to each live month, by metric.

Comparison	Δ (95% CI)	*p*	ICC	Eff. *n*
A. Total daily sleep -- hours per 24 h				
baseline → m1	+0.54 (0.21, 0.86)	0.007**	0.17	176
baseline → m2	+0.66 (0.33, 1.00)	0.002**	0.14	209
baseline → m3	+0.88 (0.61, 1.16)	< 0.001***	0.06	373
m1 → m2	+0.16 (−0.03, 0.34)	0.088	0.08	322
m1 → m3	+0.36 (0.09, 0.64)	0.033*	0.09	280
m2 → m3	+0.24 (0.02, 0.46)	0.064	0.10	264
B. Sleep efficiency -- percentage points				
baseline → m1	+3.28 (1.08, 5.47)	0.018*	0.24	134
baseline → m2	+3.65 (1.39, 5.90)	0.012*	0.21	153
baseline → m3	+5.01 (3.24, 6.78)	< 0.001***	0.11	242
m1 → m2	+0.39 (−1.07, 1.85)	0.591	0.18	171
m1 → m3	+1.63 (−0.26, 3.53)	0.220	0.20	160
m2 → m3	+1.35 (−0.13, 2.82)	0.220	0.18	173
C. Night wake-ups -- count per night				
baseline → m1	−1.08 (−1.73, −0.43)	0.007**	0.54	66
baseline → m2	−1.39 (−2.20, −0.58)	0.007**	0.59	60
baseline → m3	−1.47 (−2.30, −0.65)	0.005**	0.60	60
m1 → m2	−0.28 (−0.79, 0.23)	0.701	0.63	57
m1 → m3	−0.33 (−0.89, 0.22)	0.701	0.61	59
m2 → m3	−0.07 (−0.20, 0.07)	0.701	0.10	268

Δ = model-estimated mean within-resident change (95% CI in parentheses)
p = Holm-adjusted p-value across the six contrasts.
ICC, home-level intraclass correlation coefficient
Eff. *n*, effective sample size.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

The ICC (intraclass correlation coefficient) differs per metric and highlights an interesting point. Sleep duration and efficiency barely cluster (0.06 and 0.11), meaning residents respond individually, so we keep most of the sample (≈373 and ≈242 of 811 residents' worth of independent evidence) and the result is solid. Wake-ups cluster hard (≈0.60), suggesting residents in a home move together, so it is a home-level effect carrying only ≈60 homes' worth of evidence, still significant but on a smaller effective sample. Why wake-ups behave at the home level is unpacked in the next section.

3.2.1. Sub-analysis: the wake-up reduction by home

The wake-up reduction is concentrated in a subset of care homes, so we ran two checks to see whether it reflects a genuine change rather than an artefact of the statistics.

The reduction scales with the starting level

Homes that started with more wake-ups fell more; homes that were already low changed little. Six of the 37 homes started above 8 wake-ups a night and account for about 77% of the total reduction, so the average home moves little, simply because most homes did not have a wake-up problem to begin with. Excluding residents above each baseline level confirms this: the reduction shrinks as the high-baseline residents are removed, and disappears once only the already-low remain.

Table 3: Wake-up change (baseline → month 3) as residents with higher baseline wake-ups are progressively excluded.

Residents included	Mean baseline	Δ (per night)	*p*
All residents	5.14	−1.47	< 0.001***
Baseline ≤ 8	4.09	−0.34	0.004**
Baseline ≤ 6	3.84	−0.14	0.135
Baseline ≤ 5	3.46	+0.08	0.362

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (unadjusted).

The high baselines are whole homes, not stray residents

The baseline distribution is heavily skewed. The median resident wakes about four times a night and roughly 80% wake six times or fewer, but about one resident in eight wakes more than eight times a night – and that eighth holds nearly 30% of all baseline wake-ups. These high-baseline residents are not scattered across the homes; they are concentrated in six of them, where most or all residents read 8–13 wake-ups a night while the rest of the homes sit around four.

Table 4: The six highest-baseline homes (anonymised). Most or all of their residents wake far more than the ≈4/night typical elsewhere.

Home	Mean wake-ups/night	Residents > 8/night
A (short-stay unit)	13.1	100%
B	12.7	91%
C	10.6	81%
D	10.3	56%
E	9.1	80%
F	8.3	57%

This is why wake-ups cluster so strongly at the home level (ICC ≈ 0.6): the elevated counts are a property of a handful of homes, not of particular residents. It also raises a data-quality question. Whole homes recording roughly one waking every 45 minutes for nearly every resident is at least as consistent with a per-home sensor or threshold difference as with genuinely that-disturbed populations. One of the six is a short-stay rehabilitation unit,

where high turnover and acuity are expected; the others are standard nursing homes. The split-half check shows the counts are internally consistent rather than random noise, but a systematic per-home detection difference would look the same.

It is not regression to the mean

A home with an unusually high baseline could drift back toward normal on its own. To check this, we classified each resident using a random half of their baseline nights and measured the change on the other half, so the nights used to set the starting level and the nights used to measure the change are independent.

Table 5: Mean change in wake-ups per night by baseline level, measured on held-out (independent) nights.

Baseline wake-ups	*n*	Change (independent nights)
≤ 4 (already fine)	337	+0.15
4–6	280	−0.45
6–8	63	−1.10
8–11	63	−4.93
> 11	49	−9.88

The relationship is almost unchanged from the naive version (slope −0.79 vs −0.87), and the baseline counts are stable (correlation 0.94 between odd and even nights). For the highest group, the baseline measured on the independent nights (11.4) matches the one used to classify them (11.8), so those high counts are consistent rather than one-off. About 5% of the reduction can be attributed to regression to the mean; the rest reflects a genuine change.

Wake-ups are skewed counts, so a handful of very high nights can pull the mean. Repeating the analysis on the square root of wake-ups which down-weights those extremes leaves the conclusions unchanged: every baseline-to-month contrast stays significant (Holm $p \approx 0.01$) and every month-to-month contrast stays non-significant, exactly as on the raw scale. The home-level clustering barely moves (ICC ≈ 0.55 versus ≈ 0.60 on the raw scale), so it reflects a genuine home effect rather than an artefact of the skew. Back-transformed, the typical baseline-to-month-3 reduction is about 0.8 wake-ups per night – smaller than the raw mean of roughly 1.5, because the mean is inflated by the high-baseline tail. The median, the square root of the mean, and the square root of the median all agree on this ≈0.8/night figure, so it is not an artefact of any one choice of summary

3.3. Robustness

Every baseline-to-month gap is significant; no month-to-month gap is, apart from a weak hint that sleep duration keeps creeping up (m1 → m3 just survives), but this is a step-change at go-live, not a monthly climb.

Collapsing each resident's nights by median instead of mean barely moves anything. Every significance call is unchanged, sleep and efficiency come out slightly larger, and wake-ups hold at −1.4 per night ($p = 0.01$), so the drop is not an artefact of a few outlier nights.

4. Conclusion

We've shown how residents at care homes and patients at hospitals sleep, and how they differ from each other. Then analyzed the impact of using Teton 1 to 3 months after installing the system

After go-live, residents slept roughly an hour longer and gained several percentage points of sleep efficiency. Wake-ups fell in proportion to how disturbed sleep was at baseline, large in the few high-baseline homes, modest across more typical residents, and absent where wake-ups were already low. The changes appear within the first month and hold.

Of course, this result has to be considered in the light of the following limitations:

- **It shows association, not proof of cause:** there is no comparison group of homes without Teton, so we cannot prove causation, but the before/after spans multiple seasons, countries, and home types.
- **The wake-up benefit is targeted, not universal:** it is large in the handful of homes that began with very disturbed sleep, modest but still detectable across more typical residents, and absent where wake-ups were already low. The high-baseline reduction is genuine rather than regression to the mean.
- **Survivor bias:** only residents present for all four months are included, so the picture can skew toward more stable residents.