| (A) | (B) |
| --- | --- |
| (C) | (D) |
| (E) | |

**Figure S1 -** Publication bias funnel-plot for actigraphy outcomes between patients with narcolepsy type 1 and healthy controls. **A -** Sleep efficiency. **B -** Sleep onset latency. **C -** Wake after sleep onset. **D -** Sleep motor activity. **E** - Awakenings.

**Table S1** - Eligibility criteria according to PICOTS framework.

| **PICOTS** | **Inclusion criteria** | **Exclusion criteria** |
| --- | --- | --- |
| Participants / Population | Studies encompassing adult patients with the diagnosis of CDH according to the ICSD-3 | Studies including pediatric or pregnant patients or not performed in humans |
| Interventions | Studies that evaluated sleep characteristics using actigraphy | Studies evaluating therapeutic interventions |
| Comparators / Control | Studies comprising healthy controls and/or comparing different types of CDH | Studies with no comparators |
| Outcomes | Studies that reported actigraphy data outcomes, namely TIB, TST, SE, SOL, WASO, SMA, Awk, DMA, LNAP, IS, IV, RA and/or DS | Studies with no available actigraphy data |
| Time frame | Studies published after January 2015 | Studies published previously to 2015 |
| Study design | Randomized controlled trials, cohort and case-control studies | All other study designs |

Awk: number of awakenings, CDH: central disorders of hypersomnolence, DMA: daytime motor activity, DS: discriminant score, ICSD-3: International Classification of Sleep Disorders - 3rd Edition, IS: interdaily stability, IV: Intradaily variability, LNAP: mean duration of longest sleep episodes during day, PICOTS: Participants/Population, Interventions, Comparators/Controls, Outcomes, Timing, and Study design, RA: relative amplitude, SE: sleep efficiency, SMA: sleep motor activity, SOL: sleep onset latency, TIB: time in bed, TST: total sleep time, WASO: wake after sleep onset.

**Table S2** - Description of queries used in the search.

| **Database** | **Query** |
| --- | --- |
| PubMed | ("Disorders of Excessive Somnolence"[Mesh] OR "Narcolepsy"[Mesh] OR "Idiopathic Hypersomnia"[Mesh] OR "Kleine-Levin Syndrome"[Mesh] OR "Sleep Deprivation"[Mesh] OR "Central Disorders of Hypersomnolence" OR "Narcolepsy type 1" OR "Narcolepsy type 2" OR "Idiopathic Hypersomnia" OR "Kleine-Levin Syndrome" OR "Hypersomnia due to a Medical Disorder" OR "Hypersomnia due to a Medication or Substance" OR "Hypersomnia associated with a Psychiatric Disorder" OR "Insufficient Sleep Syndrome") AND ("Actigraphy"[Mesh] OR Actigraph\*) |
| EMBASE | ('narcolepsy'/exp OR narcolepsy OR 'narcolepsy type 1'/exp OR 'narcolepsy type 1' OR 'narcolepsy type 2'/exp OR 'narcolepsy type 2' OR 'idiopathic hypersomnia'/exp OR 'idiopathic hypersomnia' OR (idiopathic AND ('hypersomnia'/exp OR hypersomnia)) OR 'kleine levin syndrome'/exp OR 'kleine levin syndrome' OR 'central disorders of hypersomnolence' OR (('central'/exp OR central) AND ('disorders'/exp OR disorders) AND of AND ('hypersomnolence'/exp OR hypersomnolence)) OR 'insufficient sleep syndrome'/exp OR 'insufficient sleep syndrome') AND ('actimetry'/exp OR actimetry OR 'actigraph'/exp OR actigraph\*) |
| Web of Science | (“narcolepsy” OR “narcolepsy type 1” OR “narcolepsy type 2” OR “idiopathic hypersomnia” OR (idiopathic AND hypersomnia) OR “kleine levin” OR “central disorders of hypersomnolence” OR (central AND hypersomnolence) OR “insufficient sleep syndrome” OR (insufficient AND sleep AND syndrome)) AND (actimetry OR actigraph\*) |
| Scopus | (“narcolepsy” OR “narcolepsy type 1” OR “narcolepsy type 2” OR “idiopathic hypersomnia” OR (idiopathic AND hypersomnia) OR “kleine levin” OR “central disorders of hypersomnolence” OR (central AND hypersomnolence) OR “insufficient sleep syndrome” OR (insufficient AND sleep AND syndrome)) AND (actimetry OR actigraph\*) |
| Cochrane | (“narcolepsy” OR “narcolepsy type 1” OR “narcolepsy type 2” OR “idiopathic hypersomnia” OR (idiopathic AND hypersomnia) OR “kleine levin” OR “central disorders of hypersomnolence” OR (central AND hypersomnolence) OR “insufficient sleep syndrome” OR (insufficient AND sleep AND syndrome)) AND (actimetry OR actigraph\*) |
| SciELO | (“narcolepsy” OR “narcolepsy type 1” OR “narcolepsy type 2” OR “idiopathic hypersomnia” OR (idiopathic AND hypersomnia) OR “kleine levin” OR “central disorders of hypersomnolence” OR (central AND hypersomnolence) OR “insufficient sleep syndrome” OR (insufficient AND sleep AND syndrome) OR narcolepsia OR ((hipersónia OR hipersonolência) AND idiopática) OR (central AND (hipersónia OR hipersonolência))) AND (actimetry OR actigraph\* OR actigrafia) |

**Table S3** - Pathophysiologic subtypes of hypersomnia associated with medical or psychiatric disorders and due to medication according to International Classification of Sleep Disorders, 3rd Edition.

| Pathophysiologic subtypes of hypersomnia |
| --- |
| **Hypersomnia associated with medical disorders**  Hypersomnia secondary to Parkinson disease  Posttraumatic hypersomnia  Genetic disorders with primary central nervous system somnolence  Hypersomnia secondary to brain tumors, infections, or other central nervous system lesions Hypersomnia secondary to endocrine disorder  Hypersomnia secondary to metabolic encephalopathy  Residual hypersomnia in patients with adequately treated obstructive sleep apnea |
| **Hypersomnia associated with a psychiatric disorder**  Hypersomnia associated with mood disorder  Hypersomnia associated with a conversion disorder or somatic symptom disorder |
| **Hypersomnia due to medication or substance**  Hypersomnia due to sedating medications  Hypersomnia due to substance abuse  Hypersomnia due to stimulant withdrawal |

**Table S4** - Newcastle - Ottawa quality assessment scale for case-control studies.

| **Author** | **Adequate definition of case** | **Representativeness of cases** | **Selection of controls** | **Definition of controls** | **Comparability of cases and controls** | **Ascertainment of exposure** | **Same method of ascertainment for cases and controls** | **Non-response rate** | **Total quality scores** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Filardi *et al.*14 | \* | \* | \* | \* | \* | \* | \* | \* | 8 |
| Cook *et al.*16 |  | \* | \* |  | \* | \* | \* | \* | 6 |
| Tonetti *et al.*17 | \* | \* | \* | \* | \* | \* | \* | \* | 8 |
| Leger *et al.18* |  | \* | \* |  | \* | \* | \* | \* | 6 |
| Chen *et al.*19 |  | \* |  |  | \* | \* | \* | \* | 5 |
| Lin *et al.*20 | \* | \* | \* | \* | \* | \* | \* |  | 7 |
| Torstensen *et al.*21 | \* | \* | \* | \* | \* | \* | \* | \* | 8 |

**Table S5** - Newcastle - Ottawa quality assessment scale for cohort study.

| **Study** | **Representativeness of the exposed cohort** | **Selection of the non-exposed cohort** | **Ascertainment of exposure** | **Demonstration that outcome of interest was not present at start of study** | **Comparability of cohorts** | **Assessment of outcome** | **Follow-up length** | **Adequacy of follow up of cohorts** | **Total quality scores** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Imbach *et al.*15 | \* | \* | \* |  | \*\* | \* | \* | \* | 8 |

**Table S6**: Actigraphy outcomes of the studies included in the review.

| **Outcome** | **Mean ± SD** | **Comparisons** |
| --- | --- | --- |
| **TIB (min)**    Filardi *et al*.  Leger *et al*.  *.*Torstensen *et al.* | NT1 471.04 ± 65.13; IH 465.07 ± 85.59; HC 478.82 ± 59.69  NT1 474.57 ± 58.18; PI 508.18 ± 47.72; HC 455.62 ± 51.38  NT1 588.00 ± 60.00; Normal CSF-Hcrt-1 hypersomnolence 570.00 ± 96.00; HC 528.00 ± 60.00 | ns  N/R  NT1 vs Normal CSF-Hcrt-1 hypersomnolence: p=.48;  Normal CSF-Hcrt-1 hypersomnolence vs HC: p=.10;  HC vs NT1: p=.02 |
| **TST (min)**    Filardi *et al*.  Imbach *et al.*  Cook *et al.*  Leger *et al*.  Chen *et al*.  Lin *et al.*  Torstensen *et al.* | NT1 362.57 ± 83.49; IH 417.41 ± 74.73; HC 457.97 ± 53.04  TBI 498.00 ± 66.00; HC 426.00 ± 48.00  MDD 441.00 ± 37.80; HC 411.00 ± 31.80  NT1 404.69 ± 50.75; PI 436.46 ± 37.36; HC 423.54 ± 46.06  MD 429.00 ± 38.00; IH 456.00 ± 65.00; HC 393.00 ± 64.00  No KLS attack 467.00 ± 82.50; KLS attack 583.10 ± 110.30; HC 463.70 ± 71.30  NT1 426.00 ± 84.00; Normal CSF-Hcrt-1 hypersomnolence 438.00 ± 66.00;  HC 444.00 ± 60.00 | NT1 vs HC: p=.0001; NT1 vs IH: p=.01; IH vs HC ns  p<.00001  p=.015  N/R  p=.02  N/R  NT1 vs Normal CSF-Hcrt-1 hypersomnolence: p=.54;  Normal CSF-Hcrt-1 hypersomnolence vs HC: p=.87;  HC vs NT1: p=.47 |
| **SE (%)**    Filardi *et al*.  Tonetti *et al*.  Leger *et al*.  Lin *et al*.  Torstensen *et al*. | NT1 76.97 ± 13.97; IH 89.65 ± 5.34; HC 95.70 ± 1.99  NT1 78.78 ± 10.77; HC 95.13 ± 1.96  NT1 86.00 ± 8.78; PI 87.03 ± 3.60; HC 93.01 ± 2.96  No KLS attack 82.20 ± 5.30; KLS attack 79.50 ± 4.20; HC 84.40 ± 9.50  NT1 73.00 ± 15.00; Normal CSF-Hcrt-1 hypersomnolence 79.00 ± 5.00;  HC 84.00 ± 4.00 | NT1 vs HC: p=.0001; NT1 vs IH: p=.0001; IH vs HC ns  NT1 vs HC: p<.001  N/R  N/R  NT1 vs Normal CSF-Hcrt-1 hypersomnolence: p=.08;  Normal CSF-Hcrt-1 hypersomnolence vs HC: p=.001;  HC vs NT1: p=.02 |

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**Table S6 (continued)**

| **Outcome** | **Mean ± SD** | **Comparisons** |
| --- | --- | --- |
| **SOL (min)**    Filardi *et al*.  Tonetti *et al.*  Leger *et al*.  Lin *et al.*  Torstensen *et al.* | NT1 13.29 ± 13.34; IH 11.53 ± 9.73; HC 8.32 ± 4.68  NT1 11.65 ± 5.95; HC 7.94 ± 2.72  NT1 12.38 ± 13.74; PI 11.23 ± 7.38; HC 4.38 ± 4.52  No KLS attack 25.80 ± 21.40; KLS attack 17.50 ± 9.20; HC 23.40 ± 24.70  NT1 36.70 ± 25.00; Normal CSF-Hcrt-1 hypersomnolence 34.80 ± 16.80;  HC 18.10 ± 12.30 | ns  NT1 vs HC: p<.005  N/R  N/R  NT1 vs Normal CSF-Hcrt-1 hypersomnolence: p=.80;  Normal CSF-Hcrt-1 hypersomnolence vs HC: p=.001;  HC vs NT1: p=.02 |
| **WASO (min)**    Filardi *et al*.  Leger *et al*.  Lin *et al*.  Torstensen *et al*. | NT1 92.50 ± 55.17; IH 36.46 ± 26.68; HC 12.49 ± 8.80  NT1 51.00 ± 39.29; PI 51.54 ± 15.77; HC 23.00 ± 9.08  No KLS attack 52.30 ± 20.20; KLS attack 104.20 ± 31.50; HC 68.90 ± 71.00  NT1 69.00 ± 30.00; Normal CSF-Hcrt-1 hypersomnolence 50.00 ± 18.00;  HC 43.00 ± 13.00 | NT1 vs HC: p=.0001; NT1 vs IH: p=.0001; IH vs HC ns  N/R  N/R  NT1 vs Normal CSF-Hcrt-1 hypersomnolence: p=.04;  Normal CSF-Hcrt-1 hypersomnolence vs HC: p=.15;  HC vs NT1: p=.01 |
| **SMA (counts)**    Filardi *et al*.  Tonetti *et al*.  Leger *et al*.  Lin *et al*. | NT1 29.80 ± 14.25; IH 16.12 ± 6.21; HC 9.98 ± 3.27  NT1 28.14 ± 10.88; HC 10.16 ± 3.03  NT1 21.32 ± 13.60; PI 21.77 ± 8.28; HC 10.83 ± 4.21  No KLS attack 38.00 ± 15.80; KLS attack 21.60 ± 12.40; HC 44.30 ± 9.90 | NT1 vs HC: p=.0001; NT1 vs IH: p=.0001; IH vs HC ns  NT1 vs HC: p<.001  N/R  N/R |
| **Awk (number)**    Filardi *et al*.    Leger *et al*.    Lin *et al.*  Torstensen *et al.* | NT1 17.13 ± 6.90; IH 11.95 ± 6.63; HC 3.47 ± 2.13    NT1 22.65 ± 11.76; PI 29.54 ± 6.83; HC 15.97 ± 5.52    No KLS attack 44.70 ± 9.40; KLS attack 86.70 ± 35.10; HC 44.40 ± 21.70  NT1 49.00 ± 12.00; Normal CSF-Hcrt-1 hypersomnolence 41.00 ± 11.00;  HC 35.00 ± 7.80 | NT1 vs HC: p=.0001; NT1 vs IH: p=.005; IH vs HC: p=.0001  NT1 vs PI: p=.11; NT1 vs HC: p=.12; PI vs HC: p=<.001  N/R  NT1 vs Normal CSF-Hcrt-1 hypersomnolence: p=.06;  Normal CSF-Hcrt-1 hypersomnolence vs HC: p=.04;  HC vs NT1: p=.001 |

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**Table S6 (continued)**

| **Outcome** | **Mean ± SD** | **Comparisons** |
| --- | --- | --- |
| **DMA (counts)**    Filardi *et al*.  Lin *et al*.  Torstensen *et al*. | NT1 192.41 ± 30.26; IH 199.14 ± 45.11; HC 222.88 ± 15.94  No KLS attack 111.50 ± 57.60; KLS attack 53.00 ± 32.90; HC 98.50 ± 25.40  NT1 72.00 ± 25.00; Normal CSF-Hcrt-1 hypersomnolence 89.00 ± 19.00;  HC 93.00 ± 23.00 | NT1 vs HC: p=.0001; NT1 vs IH: ns; IH vs HC: p=.05  N/R  NT1 vs Normal CSF-Hcrt-1 hypersomnolence: p=.03;  Normal CSF-Hcrt-1 hypersomnolence vs HC: p=.65;  HC vs NT1: p=.03 |
| **LNAP (min)**    Filardi *et al*.    Leger *et al*. | NT1 35.46 ± 15.50; IH 19.83 ± 17.38; HC 6.40 ± 11.46    NT1 34.85 ± 10.97; PI 21.46 ± 7.55; HC 15.69 ± 7.25 | NT1 vs HC: p=.0001; NT1 vs IH: p=.0001; IH vs HC: p=.005  NT1 vs PI: p=<.005; NT1 vs HC: p=<.001; PI vs HC: p=.23 |
| **IS**    Leger *et al*.  Lin *et al*.    Torstensen *et al*. | NT1 0.65 ± 0.15; PI 0.73 ± 0.14; HC 0.71 ± 0.11  No KLS attack 0.49 ± 0.07; KLS attack 0.41 ± 0.15; HC 0.51 ± 0.09    NT1 0.30 ± 0.10; Normal CSF-Hcrt-1 hypersomnolence 0.40 ± 0.10;  HC 0.50 ± 0.10 | N/R  KLS attack vs no KLS attack: p=.02; KLS attack vs HC: p=.02  NT1 vs Normal CSF-Hcrt-1 hypersomnolence: p=.11;  Normal CSF-Hcrt-1 hypersomnolence vs HC: p=.04;  HC vs NT1: p=.003 |
| **IV**    Leger *et al*.  Torstensen *et al.* | NT1 0.84 ± 0.28; PI 0.83 ± 0.27; HC 0.72 ± 0.14  NT1 1.10 ± 0.30; Normal CSF-Hcrt-1 hypersomnolence 0.80 ± 0.10;  HC 0.80 ± 0.20 | N/R  NT1 vs Normal CSF-Hcrt-1 hypersomnolence: p=.01;  Normal CSF-Hcrt-1 hypersomnolence vs HC: p=.07;  HC vs NT1: p=.003 |

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**Table S6 (continued)**

| **Outcome** | **Mean ± SD** | **Comparisons** |
| --- | --- | --- |
| **RA**    Leger *et al*.  Lin *et al.*  Torstensen *et al.* | NT1 0.85 ± 0.11; PI 0.90 ± 0.06; HC 0.94 ± 0.02  No KLS attack 0.88 ± 0.07; KLS attack 0.74 ± 0.14; HC 0.85 ± 0.10  NT1 0.80 ± 0.10; Normal CSF-Hcrt-1 hypersomnolence 0.80 ± 0.10;  HC 0.90 ± 0.10 | N/R  N/R  NT1 vs Normal CSF-Hcrt-1 hypersomnolence: p=.13;  Normal CSF-Hcrt-1 hypersomnolence vs HC: p=.40;  HC vs NT1: p=.01 |
| **DS**    Filardi *et al*.    Leger *et al*. | NT1 1.57 ± 1.17; IH -0.22 ± 1.17; HC -1.80 ± -0.46    NT1 1.66 ± 1.68; PI 1.80 ± 0.82; HC -0.26 ± 0.68 | NT1 vs HC: p=.0001; NT1 vs IH: p=.0001  IH vs HC: p=.0001  NT1 vs PI: p=.95; NT1 vs HC: p=<.001; PI vs HC: p=<.001 |

Awk: number of awake episodes, CSF-Hcrt-1: cerebrospinal fluid hypocretin-1, DMA: daytime motor activity, DS: discriminant score, HC: healthy control, IH: idiopathic hypersomnia, IS: interdaily stability, IV: Intradaily variability, KLS: Kleine-Levin syndrome, LNAP: mean duration of longest sleep episodes during day, MD: myotonic dystrophy, MDD: major depressive disorder, Min: minutes, N/R: not reported, ns: non-significant, NT1: narcolepsy type 1, PI: primary insomnia, RA: relative amplitude, SD: standard deviation, SE: sleep efficiency, SMA: sleep motor activity, SOL: sleep onset latency, TBI: traumatic brain injury, TIB: time in bed, TST: total sleep time, WASO: wake after sleep onset.