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# Exploring the uncertain relationship between lunar phases and human sleep duration and quality: A narrative literature review

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## Introduction

- There is evidence for lunar influence in other organisms:
  - Firenecked Nightjar lays its eggs during the full moon in September and uses the extra light for greater foraging time<sup>1</sup>.
- A handful of reviews from the early 2000s concluded there was not sufficient evidence for a lunar influence on sleep quality in humans<sup>2,3</sup>.
- That conclusion stood until a retrospective study in 2013 by Cajochen et al. discovered that sleep quality decreased in their subjects during the days surrounding the full moon<sup>4</sup>.
- Several studies<sup>5-8</sup> were published in response to Cajochen et al, but despite having larger sample sizes and null findings, they varied greatly in data collection and research methods.
- However, other studies, also with larger samples managed to find statistically significant interactions between lunar phases and human sleep<sup>11-13</sup>.
- Despite the varied evidence, the moon still has a strong presence in popular culture today and continues to be blamed for poor sleep or behavioral issues<sup>2</sup>.

## Objectives

- Provide an updated perspective on the relevant literature in this field
- Propose methods for standardizing future research

## Method

- Academic Search Complete, Web of Science, PsychARTICLES, PsychINFO, and Psychology Database were the five databases used for this literature review.
- Keywords sleep, moon, (lunar cycles), and (circadian rhythms)
- Articles were excluded if they did not fit the following inclusion criterion:
  - (1) Articles must include actual experimental procedures, commentaries, literature reviews, and other non-experimental works were noted for reference and discussion but not included in the literature review.

## Method (Cont.)

- (2) Studies needed to include human participants in some manner. Those studies which were only about other organisms were not included.
- (3) Studies needed to include some measure of sleep quality, either subjective or objective, relative to lunar phase.
- (4) Studies needed to be primarily interested in relationships between the moon and health individuals. Those articles which studied those with medical or psychological disorders exclusively were not included.
- Figure 1 shows the delineation of articles throughout the literature search.

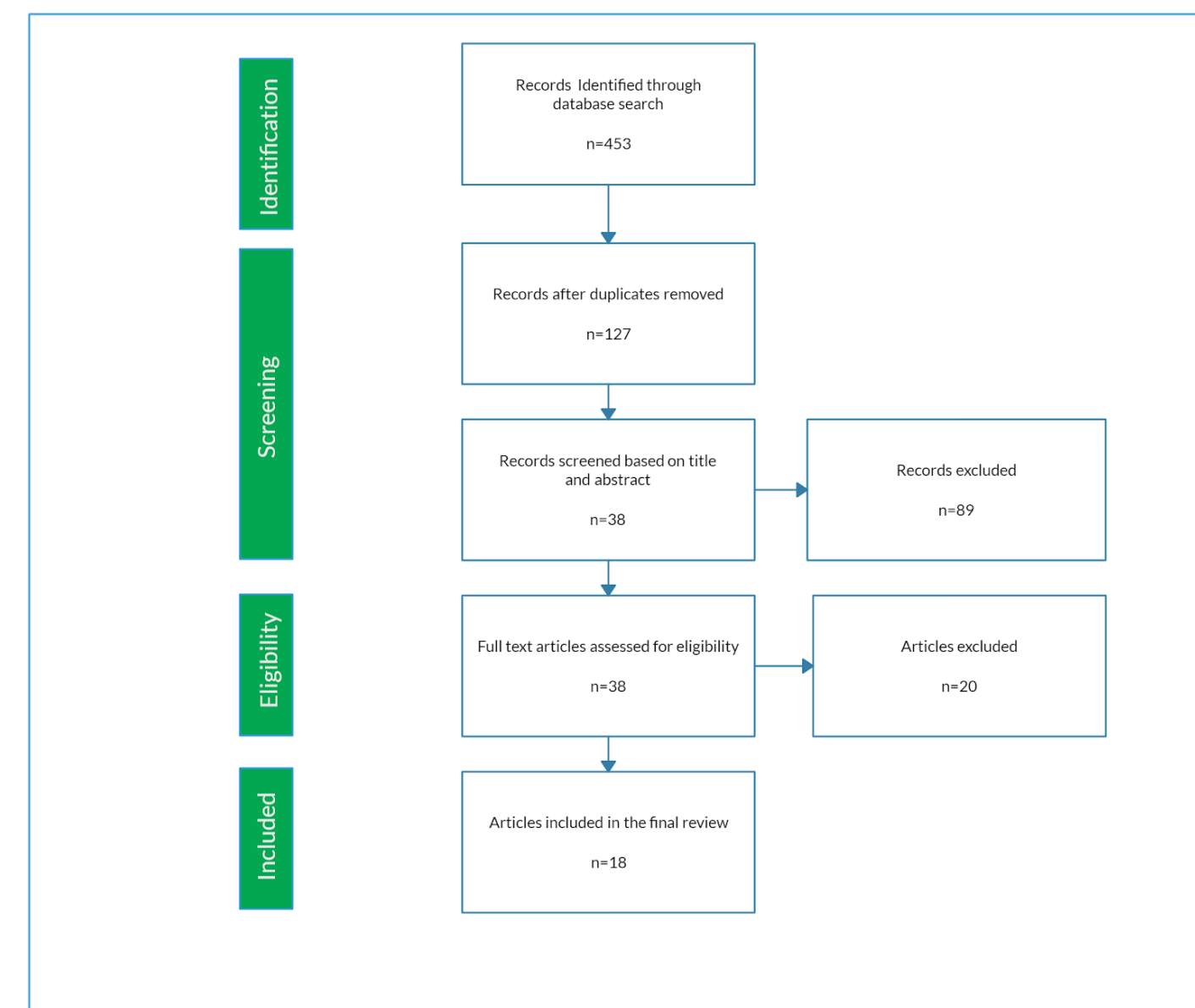


Figure 1: Flow chart of literature selection process

## Results

- 18 papers were found in total
  - 12 experiments for review
  - 6 reviews, commentaries, etc for discussion and background
- Studies measured populations from 21 different countries
- Of the 12 studies:
  - 6 used EEG equipment as objective measures for sleep<sup>4,8,11</sup>
  - 5 used actigraph data<sup>9,10,12-14</sup>
  - 1 used sleep diaries exclusively<sup>15</sup>
  - 5 Used a sleep laboratory<sup>4,5,7,8,11</sup>
  - 3 of these found significant interactions<sup>4,8,11</sup>

## Results (Cont.)

- 7 studies rejected their null and found statistically significant interactions between lunar phase and sleep<sup>4,8-11,14,15</sup>. Of these:
  - 6 found shorter sleep duration around full moon<sup>4,8-11,15</sup>
    - Durations ranged from 5 min-51.5 min
    - Sleep Latencies Ranged from 5-40.5 min
  - 1 found greater sleep duration around full moon<sup>14</sup>
    - Participants in hunter-gatherer societies had higher sleep duration during full moon and decreased nighttime activity<sup>14</sup>

First Author, Year	Countries of Research	Sample Size	Sleep Measures	Laboratory Design	Sleep Duration Differences
Cajochen, 2013	Switzerland	N=33	EEG Data Sleep duration Cortisol levels Subjective Sleep Quality	Yes	20min shorter around full moon 5min longer latency
Chaput, 2016	Australia, Brazil, Canada, China, Colombia, Finland, India, Kenya, Portugal, South Africa, United Kingdom, United States	N=5812 Age 9-11 54.3%F 45.7%M	Sleep duration	None. Participants slept in own homes	4.9min shorter around full moon
Cordi, 2014	Germany	Data Set 1: N=366 Data Set 2: N=29 Data Set 3: N=870	EEG Data Sleep duration	For data sets 1 & 2, 3 was done at home	None
Haba-Rubio, 2015	Lausanne, Switzerland	N=2125	EEG Data Sleep duration Subjective Sleep Quality Salivary Cortisol Levels	None, Polysomnography done in-home	None
Monica, 2015	Surrey, United Kingdom	N=205	EEG Data Sleep duration Subjective Sleep Quality	Yes.	None
Refinetti, 2016	Ghana, South Africa, Jamaica, Seychelles, United States	Ghana: N= 207 S. Africa: N= 236 Jamaica: N=249 Seychelles: N=230 US: N=245	Sleep duration	No, actigraph data was measured at home.	None
Roosli, 2006	Basel, Switzerland	N=31	Sleep duration Times awake Subjective Sleep Quality	No, all data were subjective and taken at home.	19min shorter around full moon
Samson, 2018	Northern Tanzania, Malawi, Madagascar	N= 31 adults from Hadza tribe N= 21 Malagasy Adults	Sleep duration	No, participants slept in their own homes.	Longer duration for Hadza, around full moon
Sjödin, 2016	Denmark	N=795	Sleep duration	No, participants slept in their own homes.	4.1 minutes shorter at full moon
Smith MP, 2016	Germany	N=1411	Sleep duration Subjective Sleep quality	No, participants slept in their own homes.	None
Smith, 2014	United States	N=47	EEG Data Sleep duration	Yes	Men had 51 minutes shorter duration, 35min-40.5 min longer latency
Turányi, 2014	Hungary	N=319	EEG Data Sleep Duration Times awake Sleep latency Subjective Sleep Quality	Yes	Shorter REM and Deep sleep %, increased wake %

Table 1: Comparison of study characteristics between 12 experiments

## Conclusions

- Despite the revival of research regarding the connection between lunar phases and human sleep, studies have yet to find conclusive, reproducible results.
  - This is largely due to the immense variation in tools and measurements used throughout the studies.
    - Many of those which rejected the null measured different variables and did not take place in a laboratory which was resilient to confounds
  - Even those 7 studies which did reject their null and found statistically significant interactions had great variance between amount of sleep disturbance
- We currently know that around 1/3 of US adults gets less than the recommended hours of sleep each night; this figure jumps to 2/3 in adolescents<sup>16</sup>.
- With the evidence currently available, it is impossible to determine whether the moon's influence on sleep is just an old legend or if it actual results in clinically significant sleep disturbances.
- Future studies will need to compare comprehensive objective sleep measures between subjects sleeping in the lab and at home, as well as measuring for any significant performance deficits in daily life which result from these disruptions.

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