Information: Actigraph Device

Physical activity monitor for quantifiable activity data

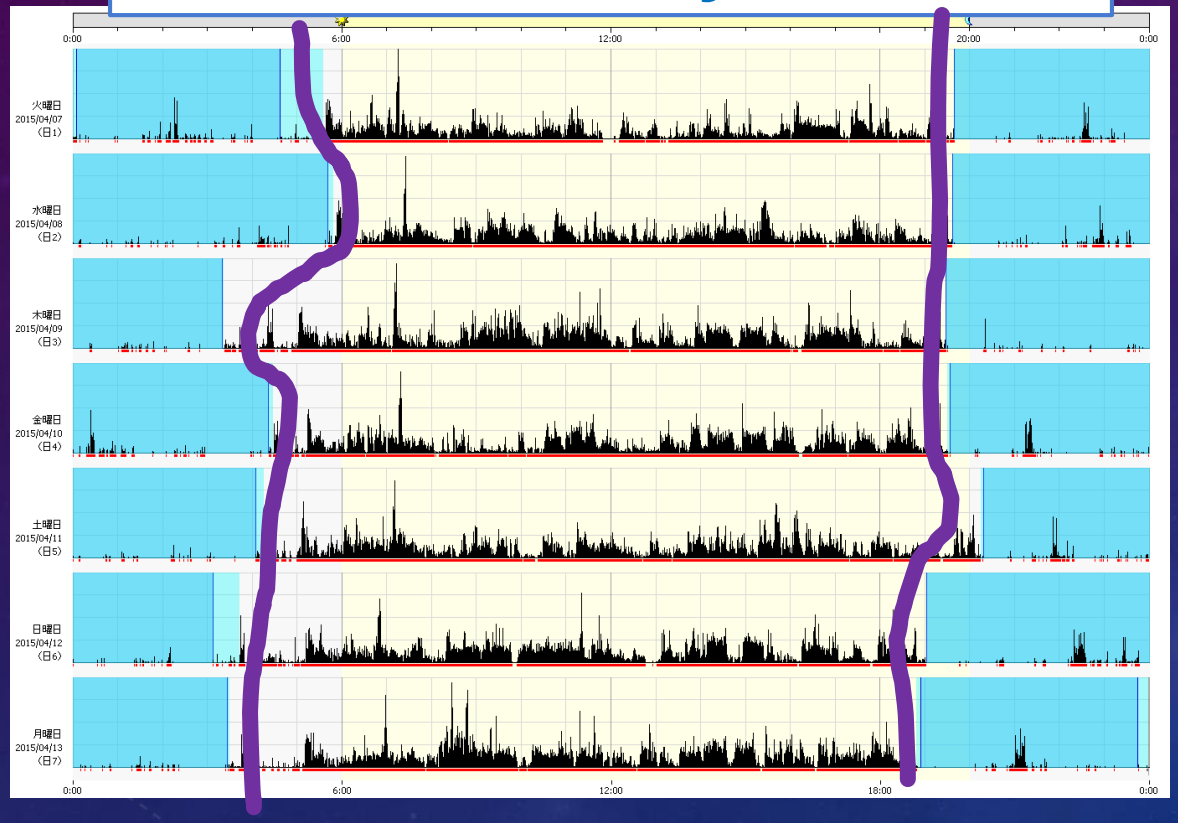
Actigraph device is equipped with a highly sensitive accelerometer. ***"Sleep/awake status"*** throughout the night and ***"circadian motor activity patterns"*** (Van Someren, 1997) can be determined, using the activity data.

Reference)
Van Someren, E. J., Kessler, A., Mirmiran, M. and Swaab, D. F. (1997). Indirect bright light improves circadian rest-activity rhythm disturbances in demented patients. Biol Psychiatry, 41, 955-963.

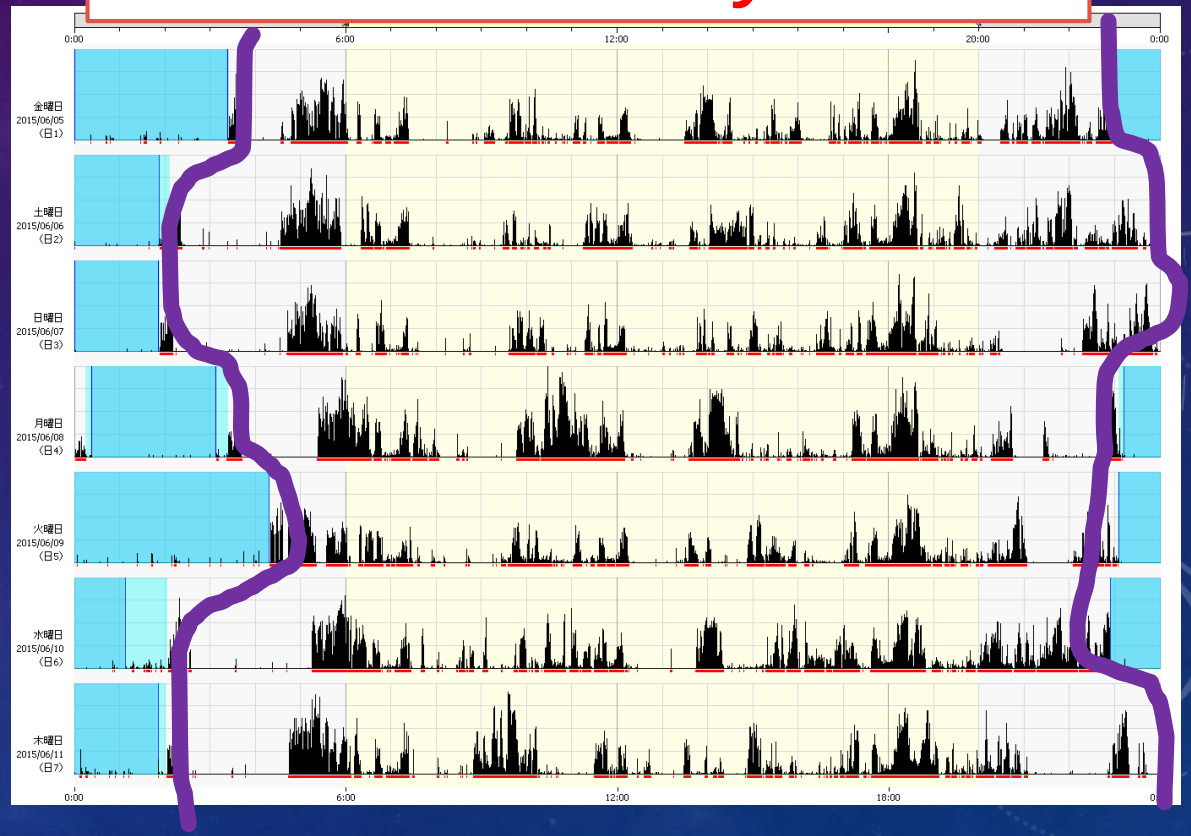
In this research, the activity data was recorded at 1-minute intervals. the subject was instructed to wear it on non-dominant wrist for 7 days.

What is “Stability” of Activity Rhythm ?

Stable rhythm



Unstable rhythm



The graph of unstable rhythm shows irregular active status during a week (see Right Figure).

Formula of “Stability” (Interdaily Stability)

$$\mathrm{IS} = \frac{\mathrm{n}\sum_{h=1}^{p}(\bar{x}_h - \bar{x})^2}{p\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

n; the total number of data (24h * 7 days = 168 data)

p; the number of data entries per day (in this study, 24)

$\bar{x}_h$; the hourly mean

$\bar{x}$; the mean of all the data

x_i; the individual data point.

Stable

1.00

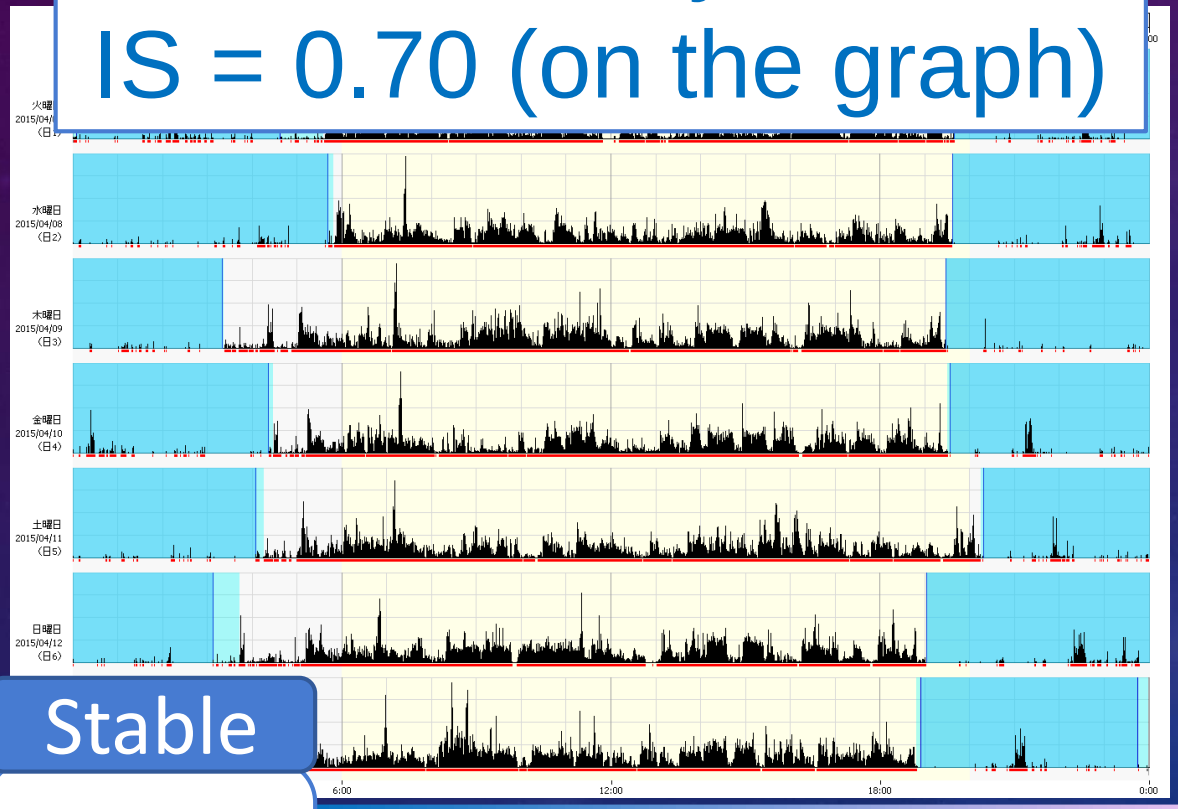
Range of IS Value; 0.00 - 1.00

Unstable

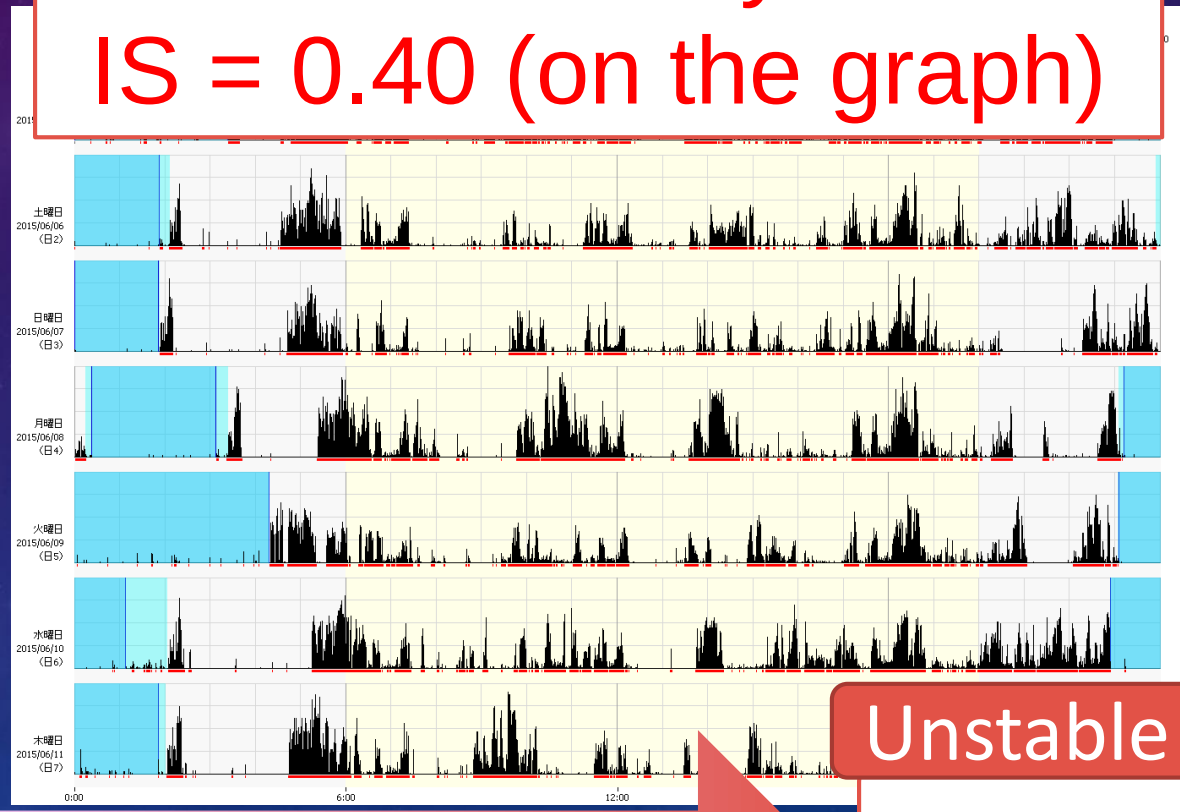
0.00

What is “Stability” of Activity Rhythm ?

Stable rhythm
IS = 0.70 (on the graph)



Unstable rhythm
IS = 0.40 (on the graph)



Stable

1.00

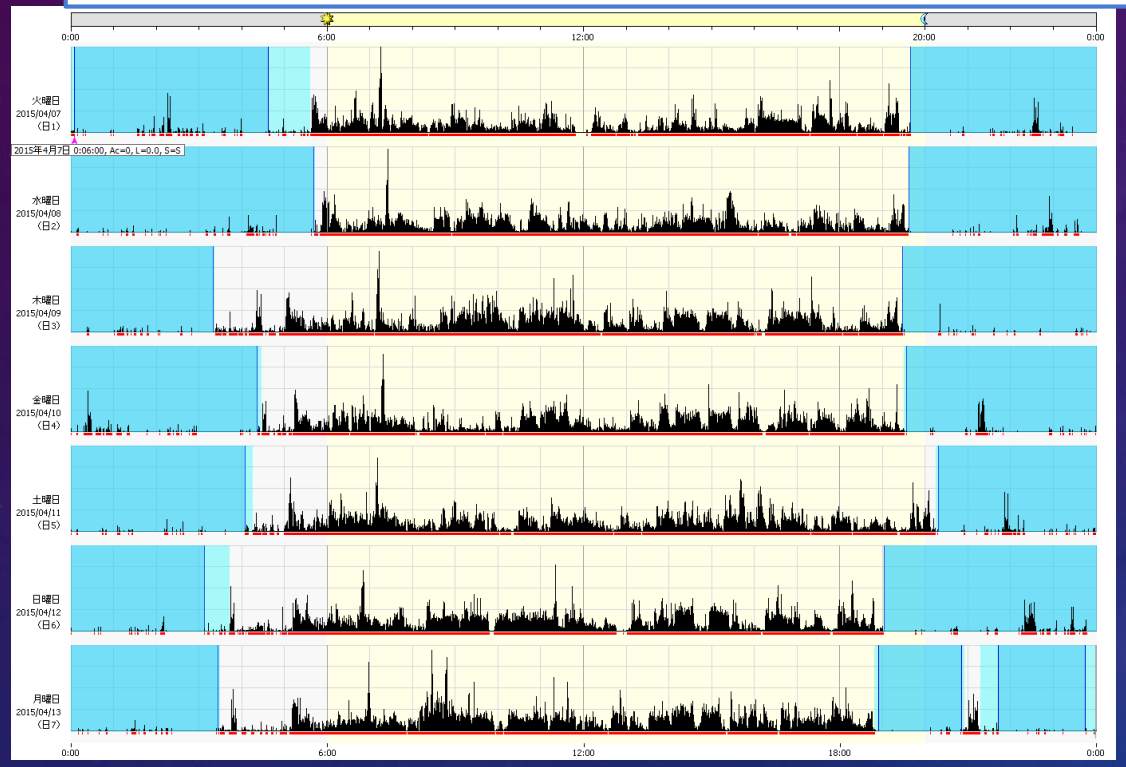
Standard Value in the elderly; 0.55

Unstable

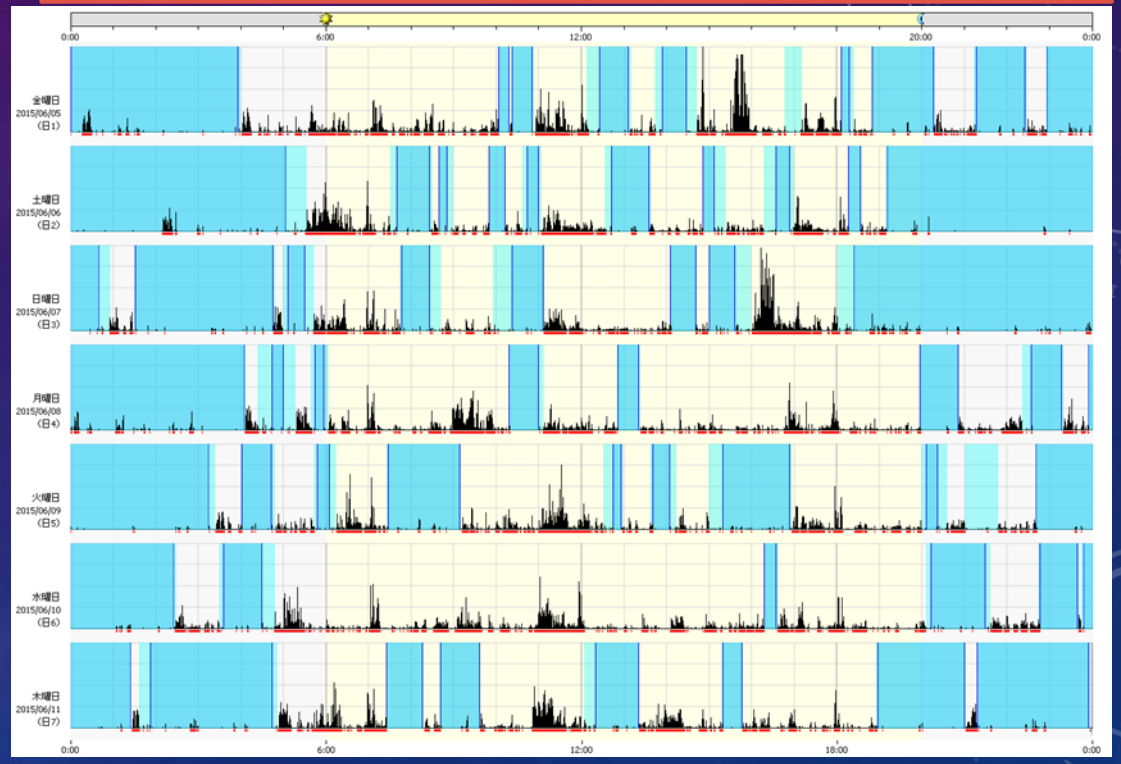
0.00

What is “Fragmentation” of Activity Rhythm ?

Good rhythm



Fragmented rhythm



The graph of fragmented rhythm shows more rest status throughout the daytime (see Right Figure).

Formula of “Fragmentation” (Intra-daily Variability)

$$\mathrm{IV} = \frac{\mathrm{n}\sum_{i=2}^{n}(x_i - x_{i-1})^2}{(n-1)\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

n; the total number of data (24h * 7 days = 168 data)

p; the number of data entries per day (in this study, 24)

$\bar{x}_h$; the hourly mean

$\bar{x}$; the mean of all the data

x_i; the individual data point.

Good Rhythm

Fragmented Rhythm

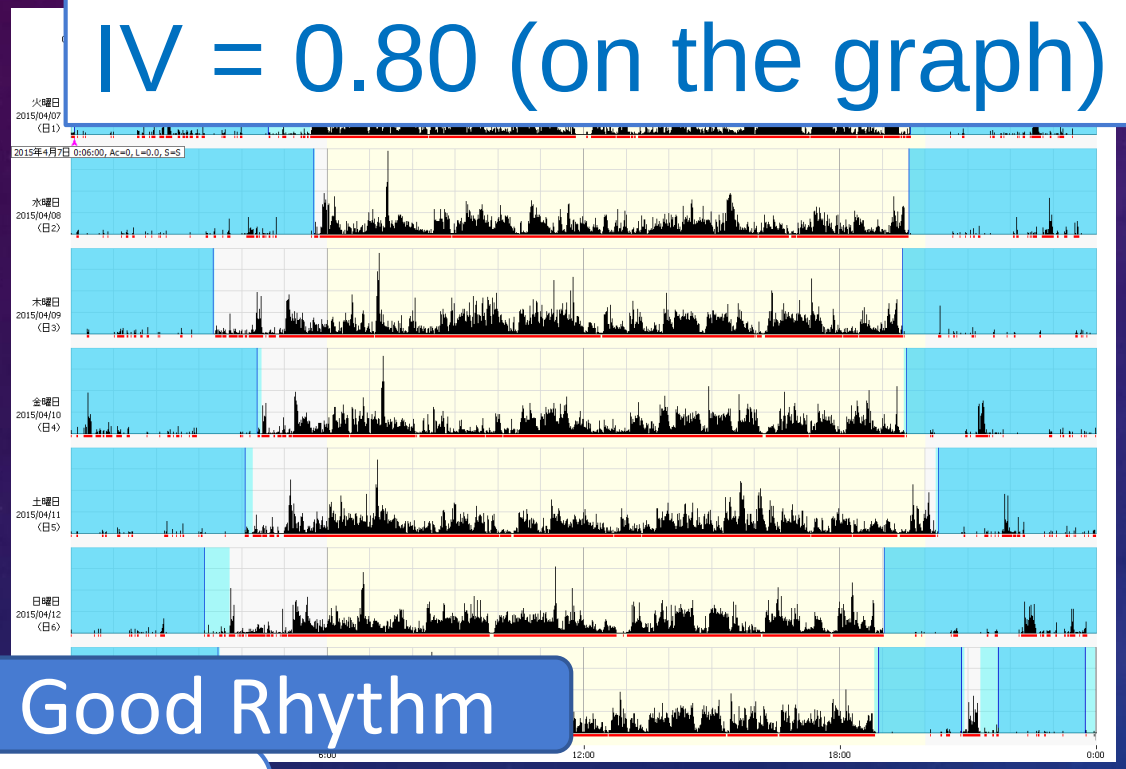
0.00

Range of IV Value; 0.00 - 2.00

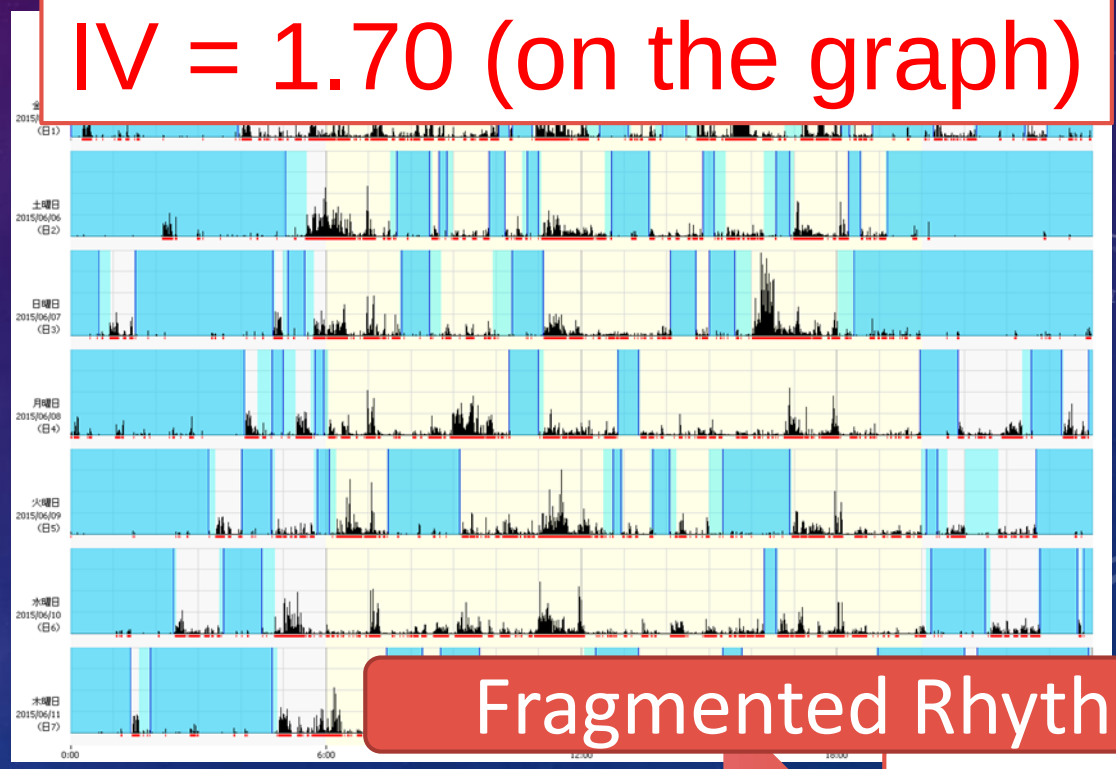
2.00

What is “Fragmentation” of Activity Rhythm ?

Good rhythm
IV = 0.80 (on the graph)



Fragmented rhythm
IV = 1.70 (on the graph)



Good Rhythm

Fragmented Rhythm

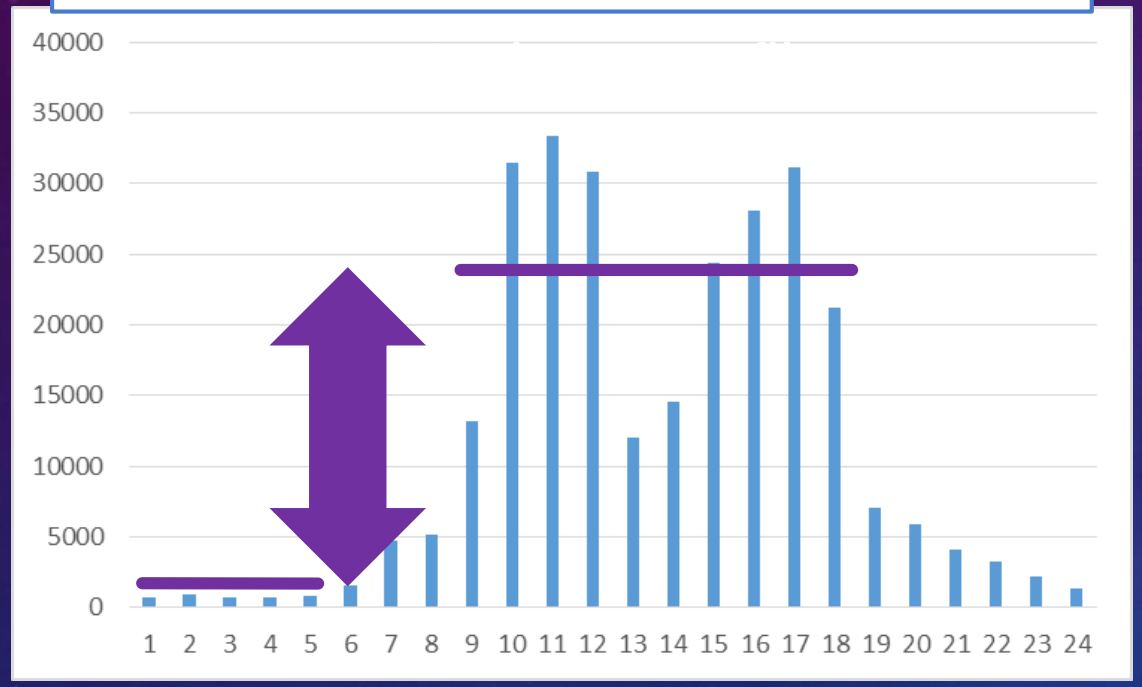
0.00

Standard Value in the elderly; less than 1.10

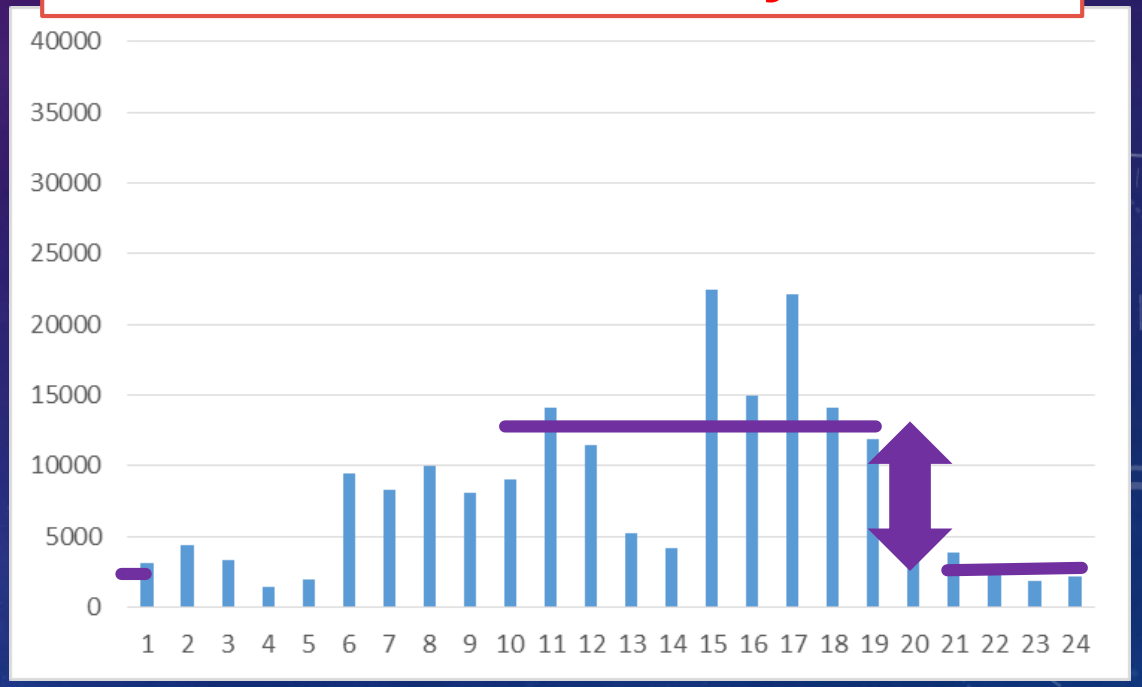
2.00

What is “Relative Amplitude” of rest-active cycle ?

High Amplitude of rest-active cycle



Low Amplitude of rest-active cycle



The graph of low amplitude shows an insufficient balance of rest-active status.
(see Right Figure).

Formula of “Relative Amplitude”

$$\mathrm{RA} = \frac{M10 - L5}{M10 + L5}$$

$M10$; Mean of Activity Counts on the most active 10-hour period.
$L5$; Mean of Activity Counts on the least active 5-hour period.

High Amplitude (Good Balance)

Low Amplitude (Bad Balance)

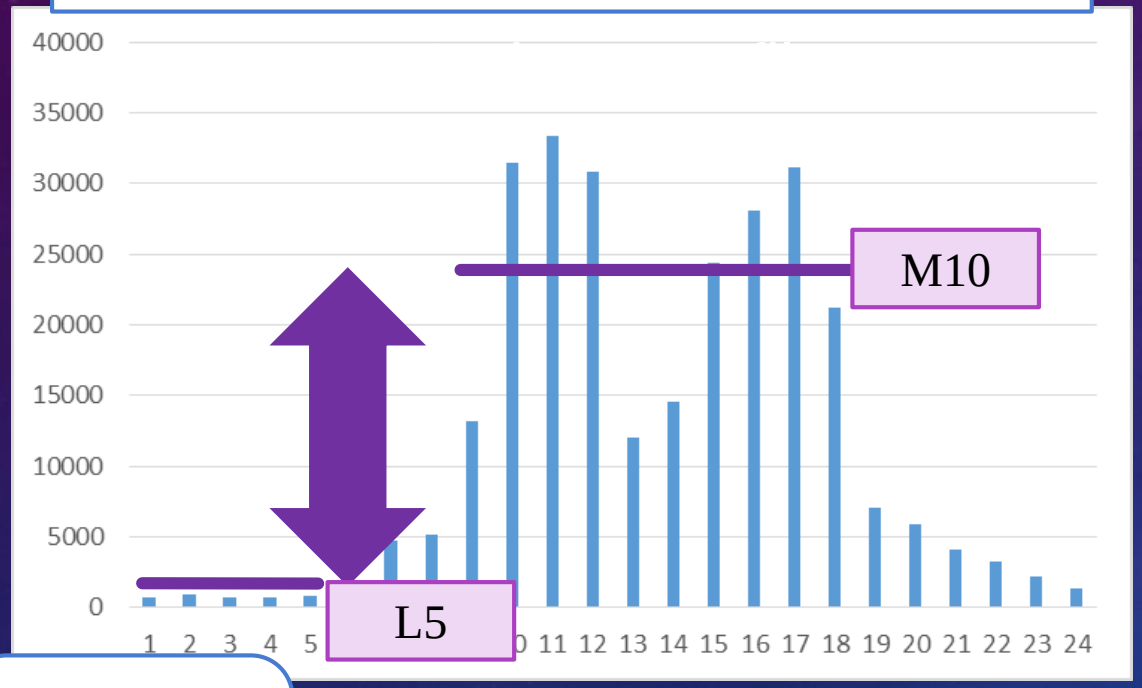
1.00

Range of RA value; 0.00 – 1.00

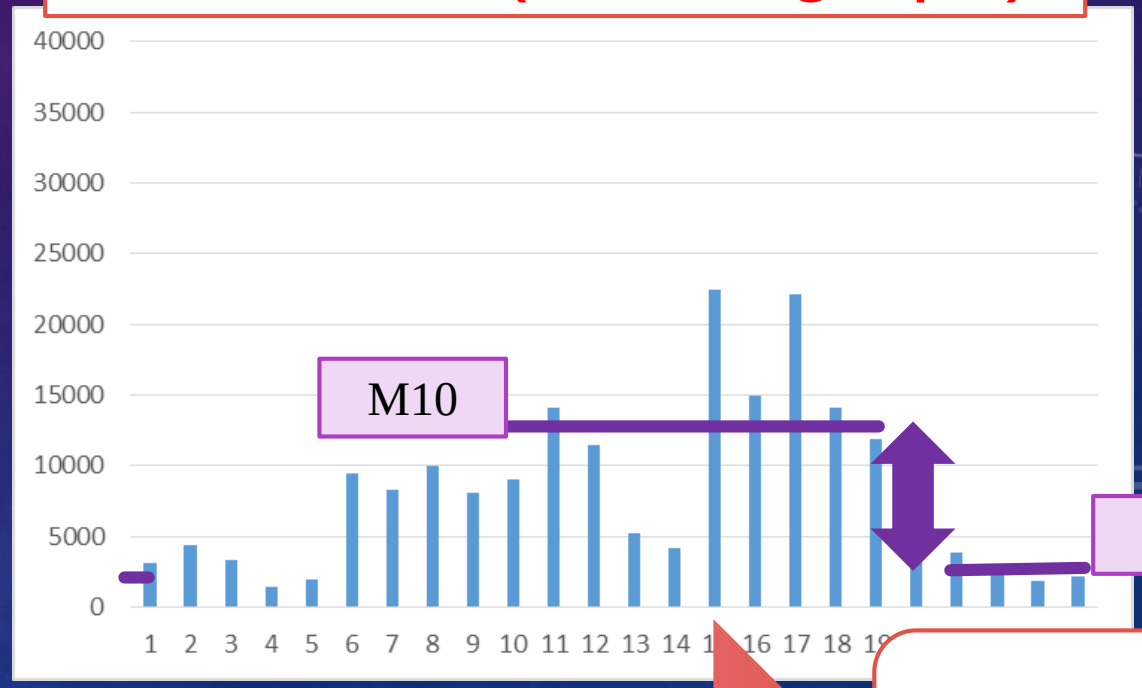
0.00

What is “Relative Amplitude” of rest-active cycle ?

High Amplitude
RA = 0.90 (on the graph)



Low Amplitude
RA = 0.50 (on the graph)



1.00

High Amplitude

Standard value in the elderly; 0.82

0.00

Low Amplitude