

Análisis del sueño y la fatiga en dos entornos operacionales de las FFAA

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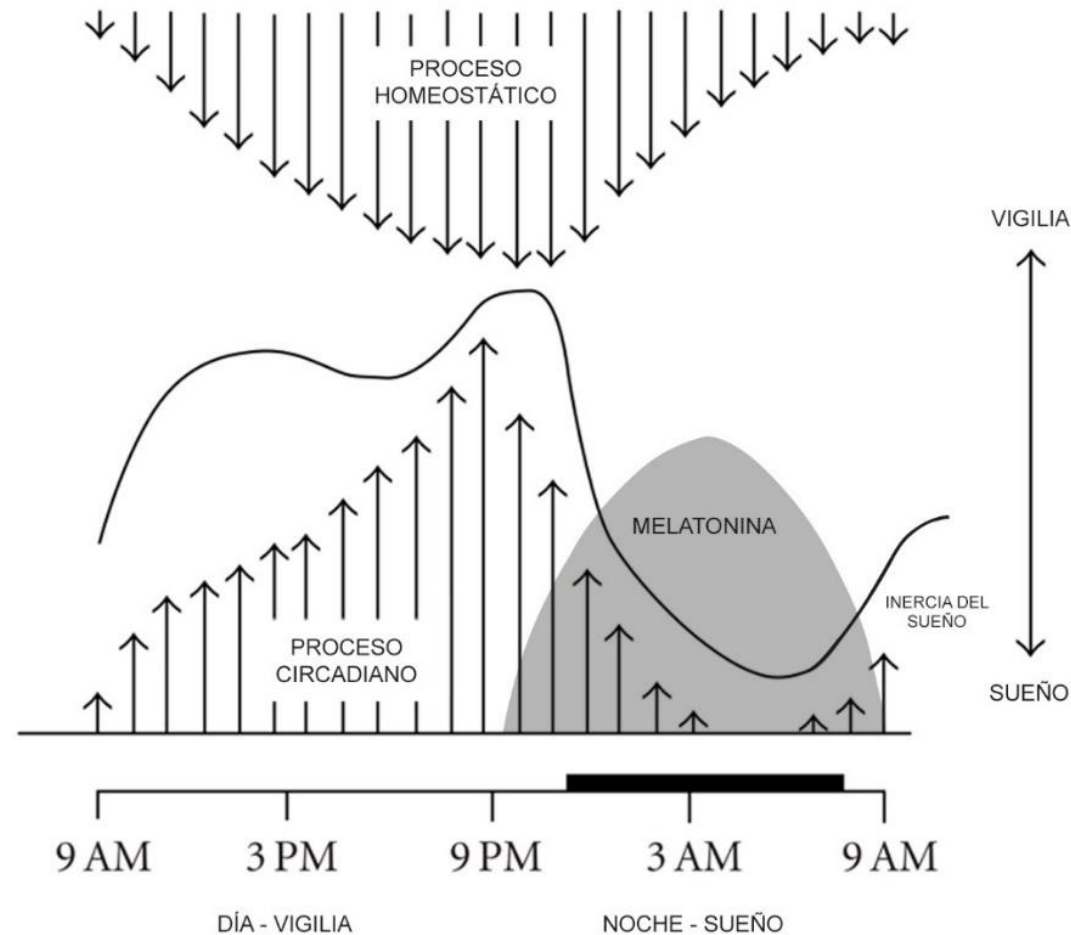


INTRODUCCIÓN

Sistemas de manejo de riesgo de fatiga

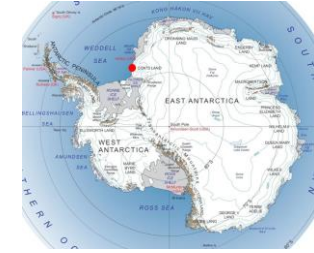
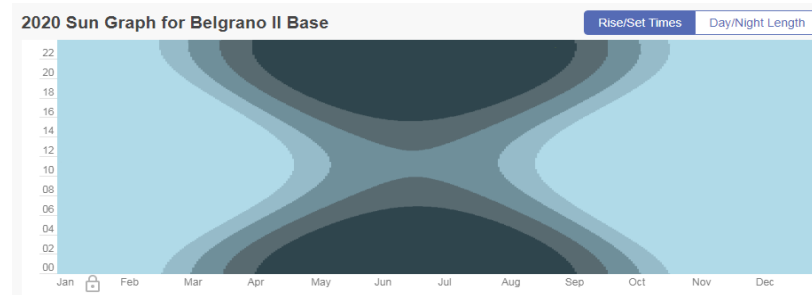
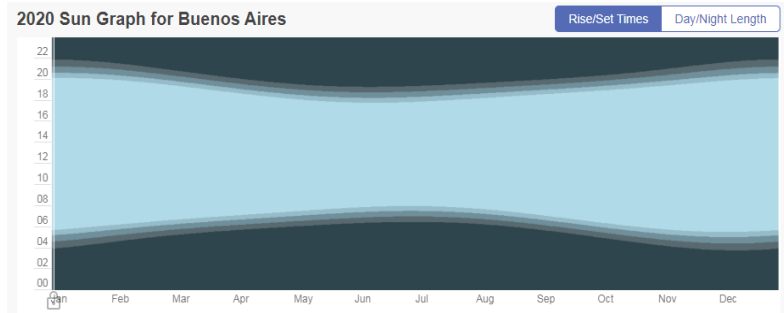


Modelado biomatemático de la fatiga



CASOS DE ESTUDIO

Caso 1: Base Belgrano II



Desincronización biológica y confinamiento extremo

OPEN

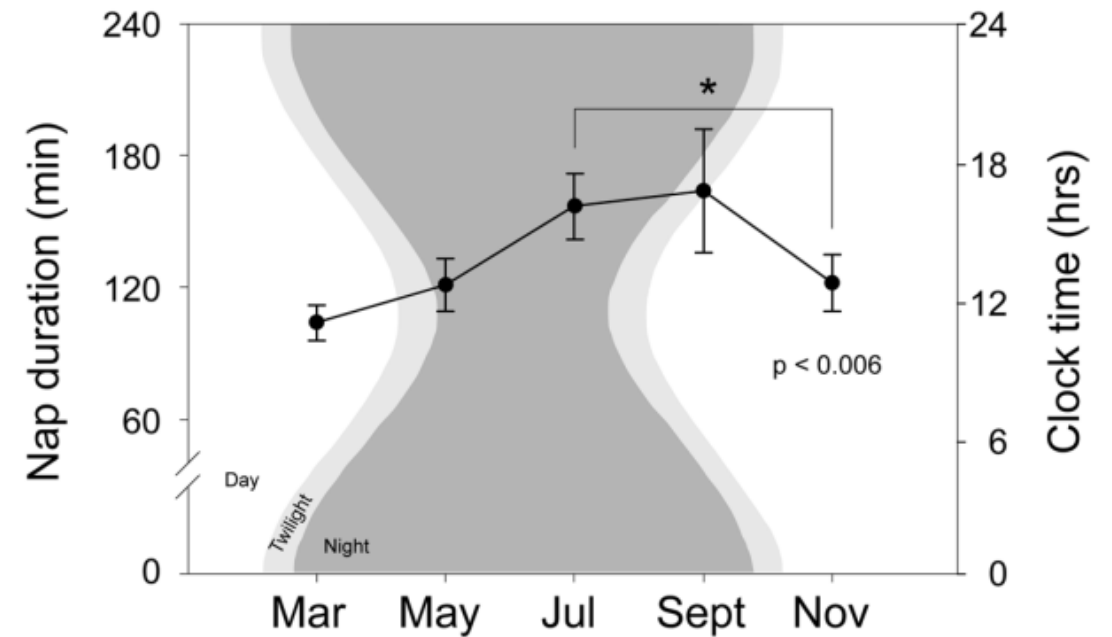
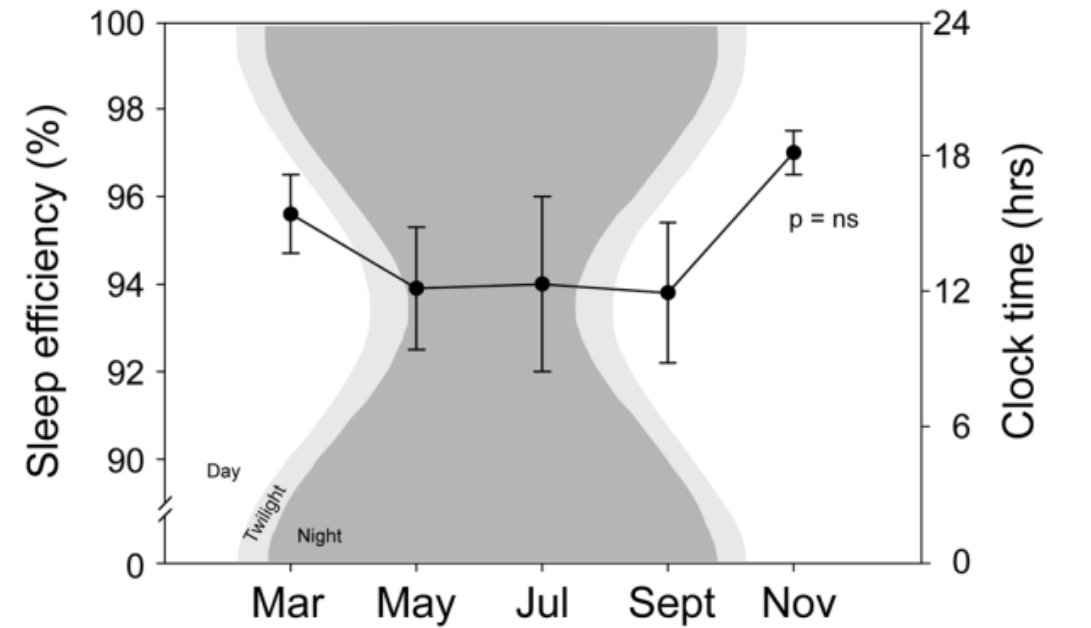
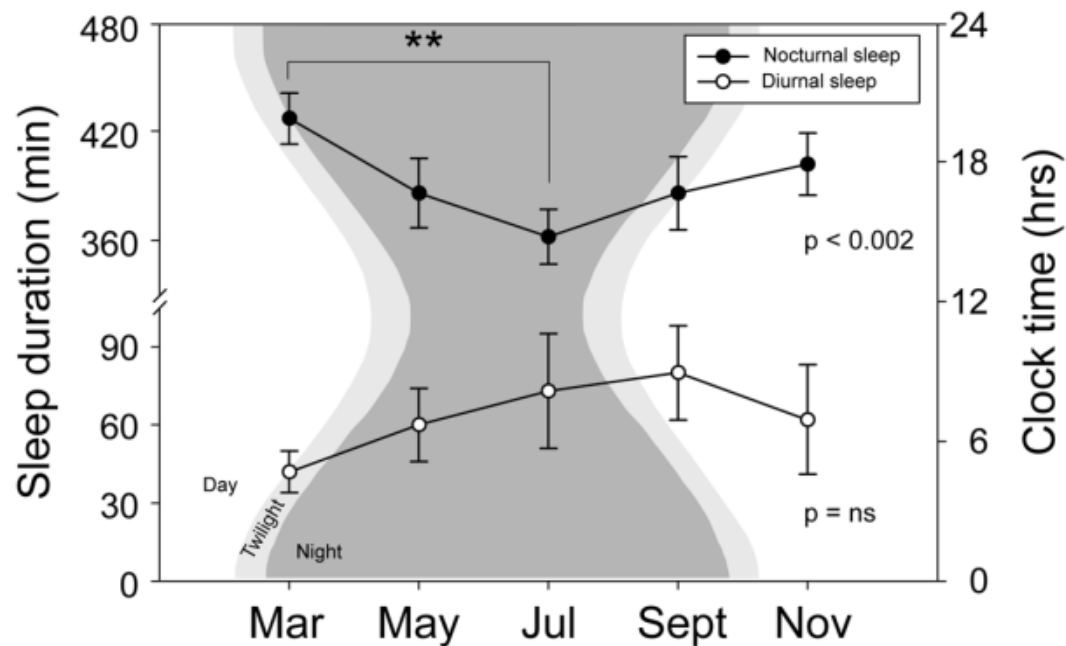
Sleep, napping and alertness during an overwintering mission at Belgrano II Argentine Antarctic station

Received: 18 December 2018

Accepted: 24 June 2019

Published online: 26 July 2019

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Caso 2: Tropas de Operaciones Especiales



Diseño


Día	Lunes	Martes	Miércoles	Jueves	Viernes
Actividad - descanso					
Actigrafía	continua				
Alerta	3 x día	3 x día	3 x día	3 x día	3 x día
Rendimiento armado de fusil	2 x día	2 x día	2 x día	2 x día	2 x día
Rendimiento en tiro	10 x día	10 x día	10 x día	10 x día	10 x día

Table 1 Biomathematical equations governing the Unified Model of Performance (UMP)*UMP governing equations*

Performance impairment:

$$f(t, \theta) = S(t) + \kappa C(t) \quad (1)$$

where θ comprises the eight model parameters of the UMP, with $\theta = [U, \tau_w, \tau_s, \tau_{LA}, \kappa, \phi, S_0, L_0]^T$ as defined below. $S(t)$ and $C(t)$ denote the homeostatic and circadian processes at time t , respectively, and κ represents the circadian amplitude.

Circadian process (C):

$$C(t) = \sum_{j=1}^5 a_j \sin[j \frac{2\pi}{\tau} (t + \phi)] \quad (2)$$

where a_j , $j = 1, \dots, 5$, represent the amplitude of the five harmonics ($a_1 = 0.97$, $a_2 = 0.22$, $a_3 = 0.07$, $a_4 = 0.03$, and $a_5 = 0.001$), τ denotes the fundamental period of the circadian clock (~ 24 h) and ϕ denotes the circadian phase.

Homeostatic process (S):

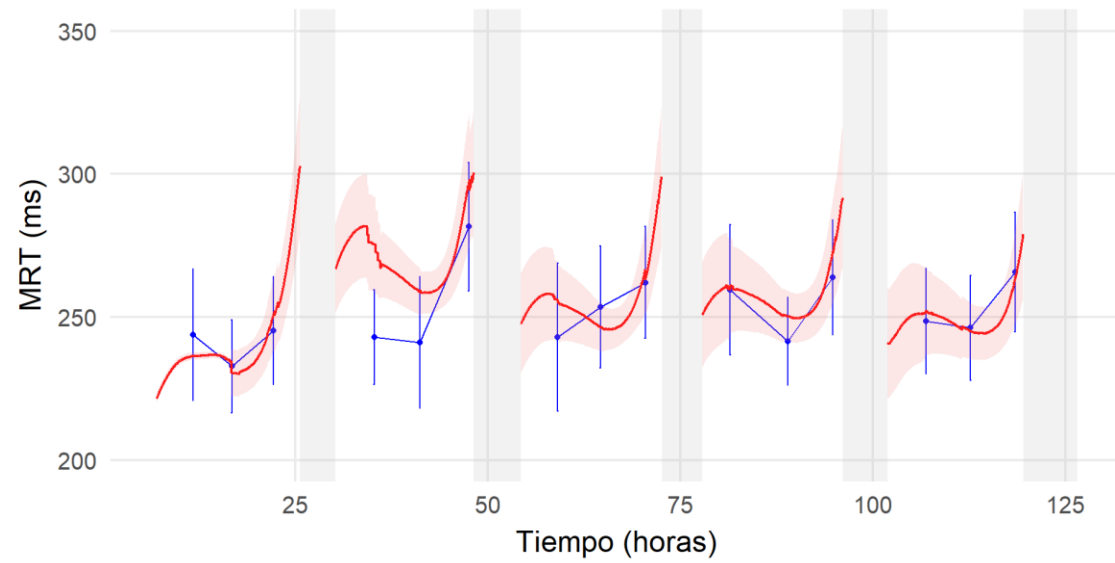
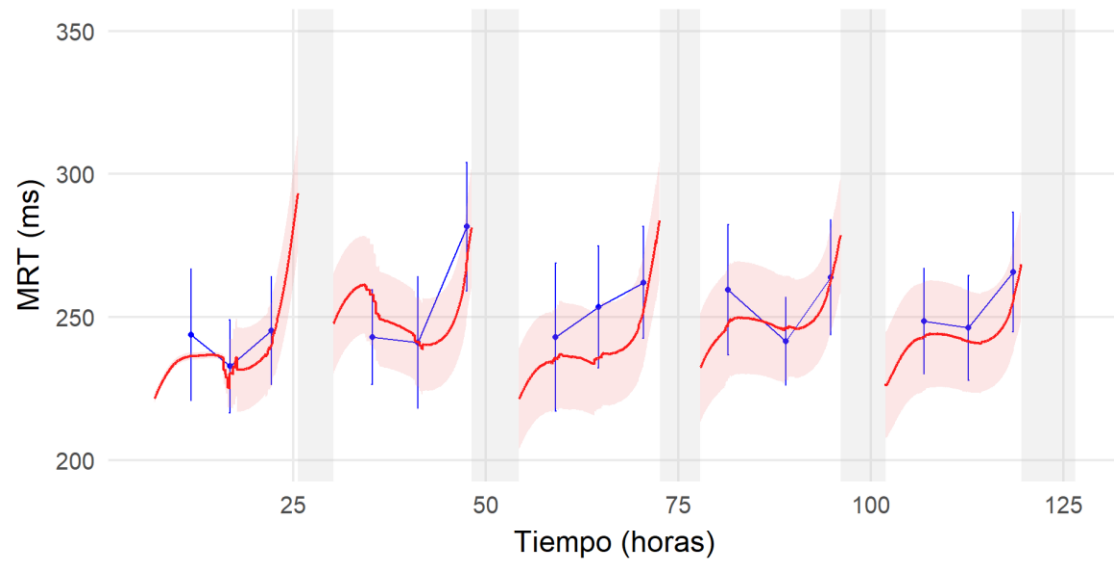
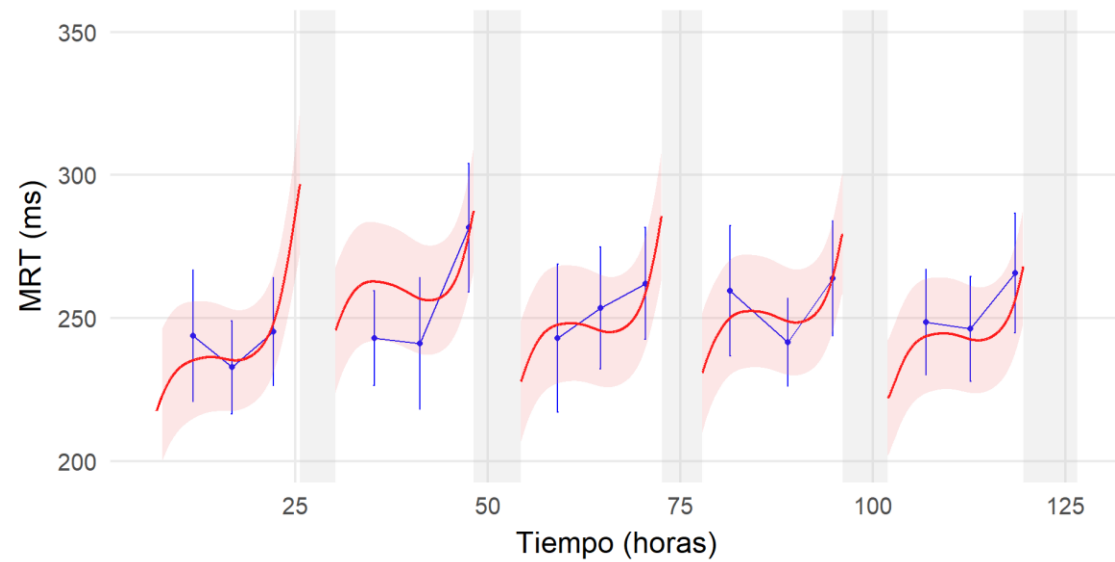
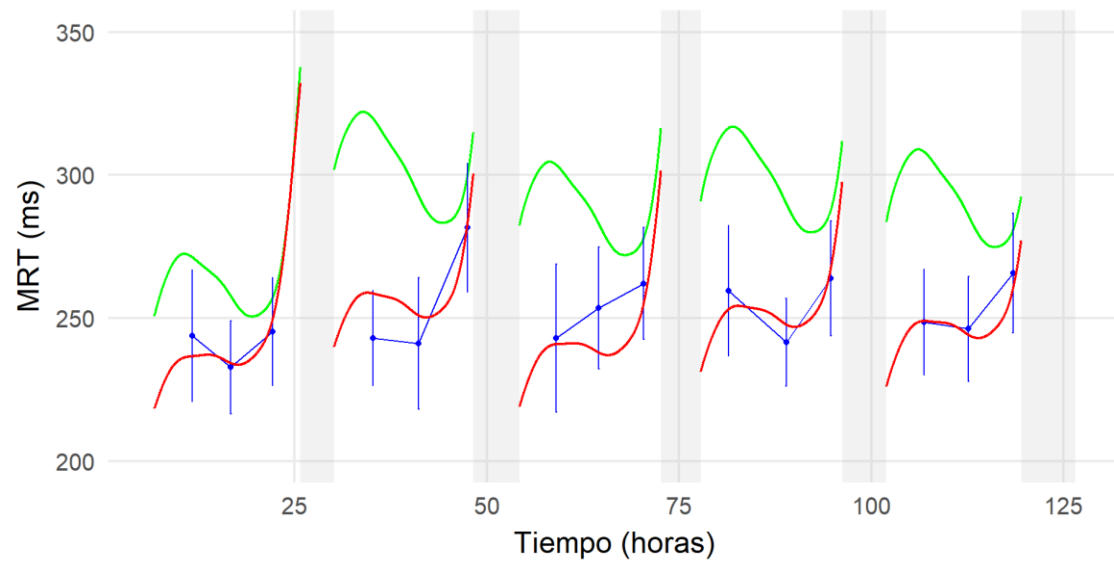
$$\dot{S}(t) = \begin{cases} 1/\tau_w [U - S(t)] & \text{during wakefulness} \\ -1/\tau_s [S(t) - L(t)] & \text{during sleep} \end{cases} \quad (3)$$

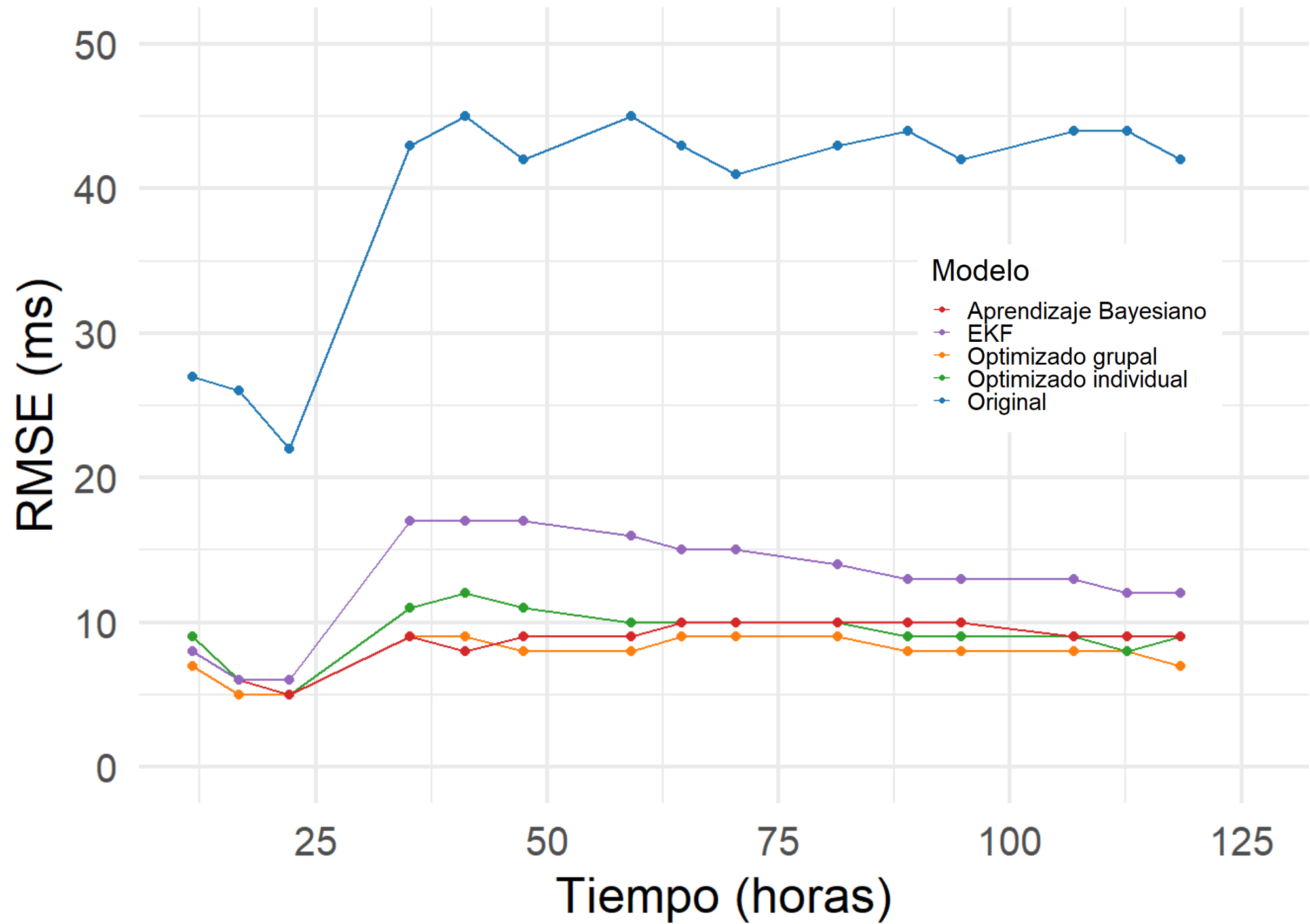
where U and L denote the upper and lower asymptotes, respectively, and τ_w and τ_s denote the wake and sleep time constants of the increasing and decreasing sleep pressure, respectively. $S(0) = S_0$ and $L(0) = L_0$ correspond to the initial state values for S and L .

Lower asymptote (L) of process S :

$$L(t) = \begin{cases} \max\{U - (U - L_0)\exp(-t/\tau_{LA}), -0.11U\} & \text{during wakefulness} \\ \max\{-2U + (2U + L_0)\exp(-t/\tau_{LA}), -0.11U\} & \text{during sleep} \end{cases} \quad (4)$$

where τ_{LA} denotes the time constant of the exponential decay of the effect of sleep history on performance.





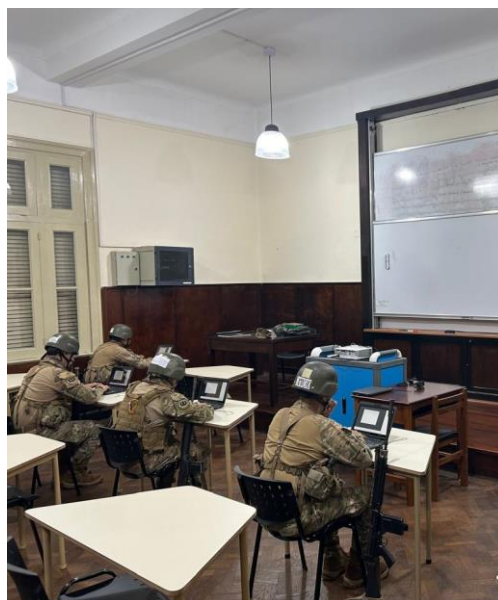
Nuevos Casos: **INFANTERIA**



Simulador de Tiro
Escuela de Infantería



Pista de Liderazgo
Batallón de Infantería
Colegio Militar de la Nación

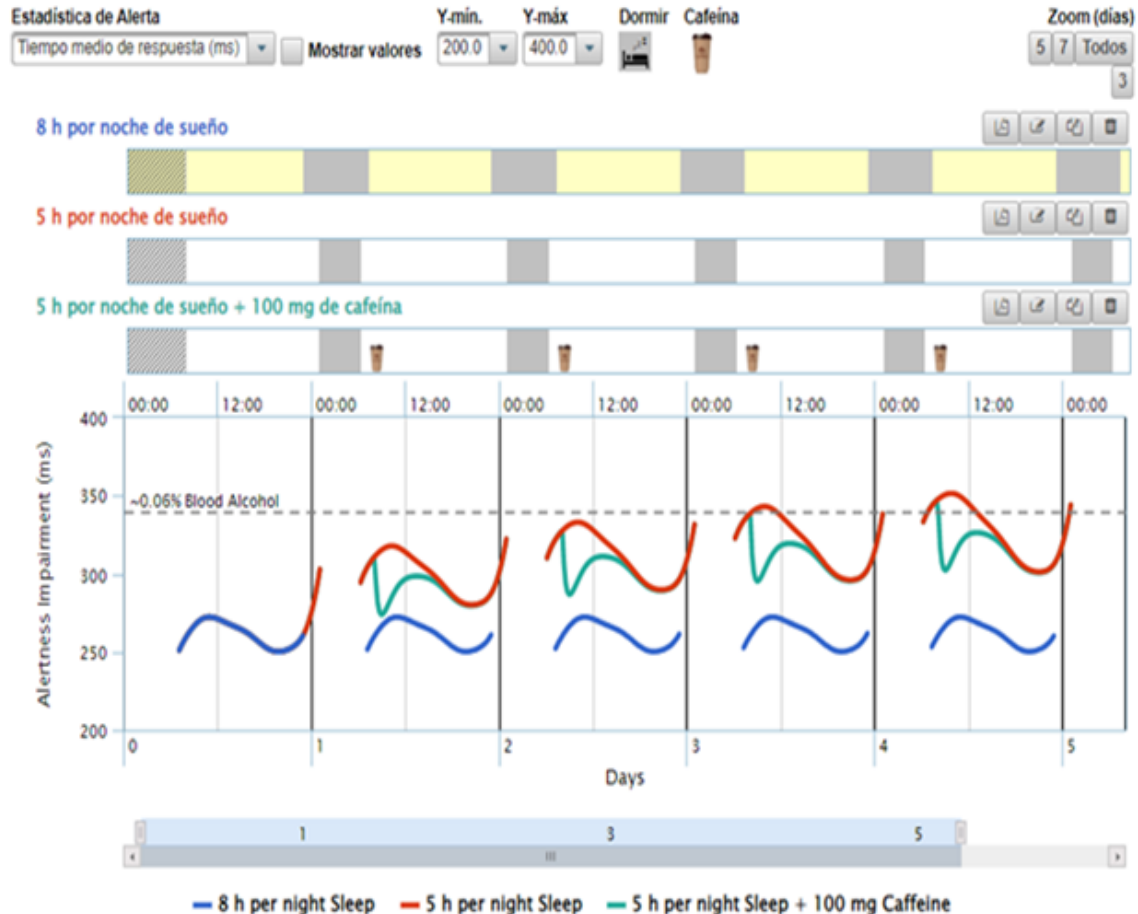


DISCUSIÓN

Planificación de operaciones

Alerta 2B Web

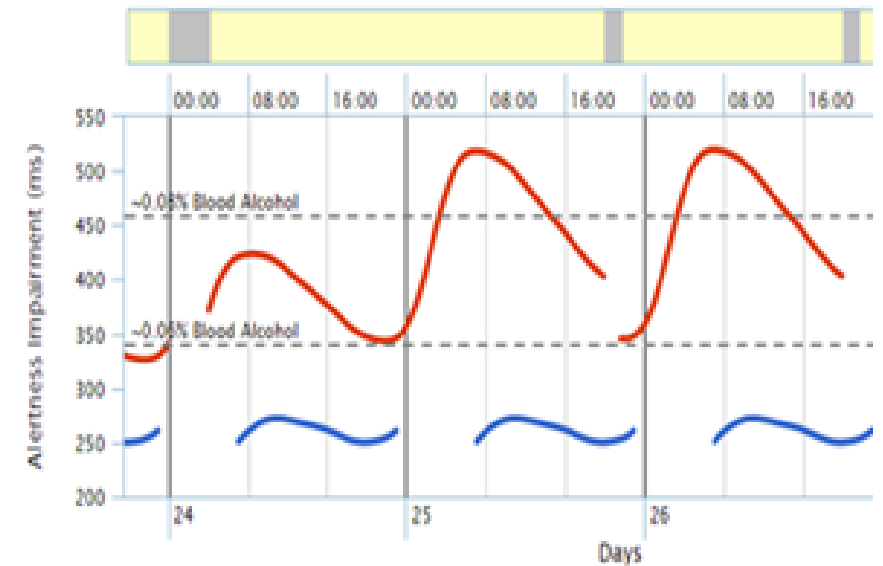
Predicción de los efectos del sueño/vigilia y la cafeína en el estado de alerta



Persona que duerme 8 Hs al día



Curso de Cazadores 2021



Etchehun, F. Escuela Militar de Montaña
"Tte. Gral. Juan Domingo Perón" 2022.

Predicción del riesgo de fatiga

Military Operations and Warfighting BAND C	PRIOR SLEEP WAKE MODEL (PSWM)	FATIGUE LIKELIHOOD SCORE: 0	FATIGUE LIKELIHOOD SCORE: 1 - 5	FATIGUE LIKELIHOOD SCORE: 6 - 12	FATIGUE LIKELIHOOD SCORE: 13+
	DARS PSWM 24HR AWAKE / SLEEP 'RULE OF THUMB'	16HRS AWAKE 8HRS SLEEP	>17HRS AWAKE < 7HRS SLEEP	>18HRS AWAKE < 6HRS SLEEP	>19HRS AWAKE < 5HRS SLEEP
	INDICATIVE LEVEL OF AUTHORITY REQUIRED	NA	SUB-UNIT / FLT COMD aeo / SENG0	SHIP / UNIT / SQN FORCE COMD	THEATRE COMD
	FATIGUE RISK LEVEL	LOW	MEDIUM	HIGH	EXTREME



Evans, CP. Military Maintainer & Groundcrew Working Hours and Fatigue Risk Management. Royal Aeronautical Society, 2010.

Gracias!



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