


**WORKLOAD VARIATIONS AND ITS REFLECTION IN
PARAMETERS OF COGNITIVE PERFORMANCE AND
CARDIOVASCULAR SYSTEM FUNCTIONING IN
ELECTRICITY DISTRIBUTION NETWORK
CONTROLLERS**

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Subjects of the study

**Electricity
distribution
network
controllers**
(working 12-h shifts)



**The characteristics of electricity
distribution network controllers' work**

Against the background of the “operative quietness” – continuous readiness to act as the basis of human-operator work, the expressed uneven workloads and unpredictability of their sharp increase under extreme situations are the characteristics of electricity distribution network controllers' work

The objective

to reveal the variations in the workload of electricity distribution network controllers and its reflection in parameters of cognitive performance and cardiovascular system functioning at the different working shifts

Methods

19 electricity distribution network controllers aged 25-63 (43±2.5 y. o.) during 5 months under 2-day shifts rotation:
 $D_{12} R_{12} D_{12} R_{48} N_{12} R_{12} N_{12} R_{72}$
 where D – day shift (8:00-20:00), N- night shift (20:00-8:00), R- rest, and the figure means the number of hours

CARDIOVASCULAR SYSTEM FUNCTIONING
(altogether 913 subject-shifts, 1826 human-observations)

- Blood pressure systolic (BPS) and diastolic (BPD)
- Heart rate (HR)

calculated haemodynamic parameters:

- pulse pressure $PP=BPS-BPD$,
- middle-dynamic pressure $MDP=0.42PP+BPD$,
- systolic volume $SV=100+0.5PP-0.6BPD-0.6Age$,
- circulatory minute volume $CMV=HV*HR$,
- periphery vascular resistance $PVR=(MDP*1333*60)/CMV$,
- index of blood circulation insufficiency (BPS/HR) ,
- Kerdo's vegetative index $KVI=(1-BPD/HR)*100\%$.

Methods

SUBJECTIVE EVALUATIONS
(altogether 913 subject-shifts, 913 human-observations)

**EXPRESS-SURVEY
OF ELECTRICITY DISTRIBUTION NETWORK CONTROLLERS
AT THE END OF A WORK SHIFT**

Please EVALUATE WORK SHIFT THAT IS ENDING compared to the other work shifts (circle one number for the each question):

	One of the most easy shifts	Moderately difficult shift compared to others	One of the most difficult shifts
1. TIREDNES (how tired do you feel?)	1	2	3 4 5
2. TENSION (how long you have had to stay busy to solve the current task?)	1	2	3 4 5
3. STRESS (how often do you have to work at full capacity to carry out current tasks?)	1	2	3 4 5
4. GENERAL VOLUME OF WORKLOAD (general number and complexity of tasks)	1	2	3 4 5

Also report:

Number of completed events of moderate complexity _____
 Number of completed events of very high complexity _____
 Number of completed events of extraordinary complexity _____

Methods

COGNITIVE PERFORMANCE
(during 1 month, altogether 218 subject-shifts, 436 human-observations)

- Attention switching form example

24	15	7	1	12	23	18	22	6	10	14	5
2	11	19	8	21	16	3	13	20	4	17	9

- Short-term memory form example

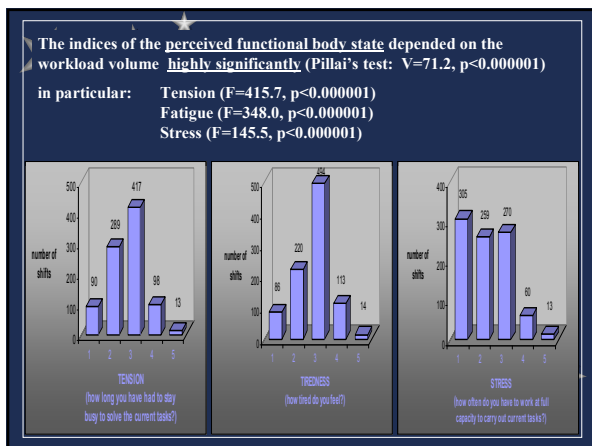
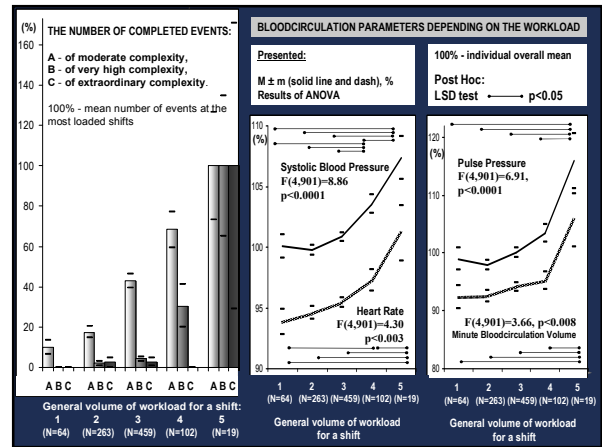
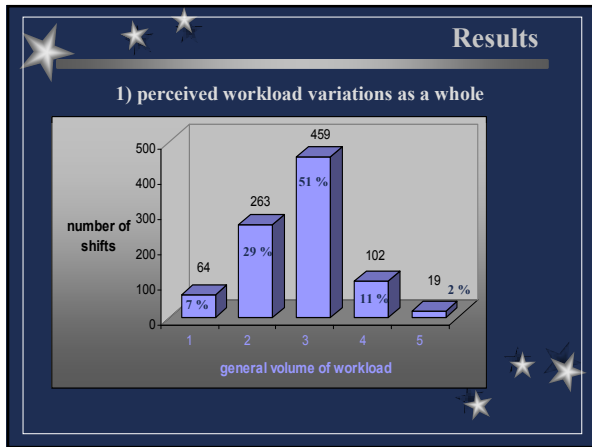
25	31	74	89	15
76	53	68	93	48

- Data were analysed at $p < 0.05$

Methods

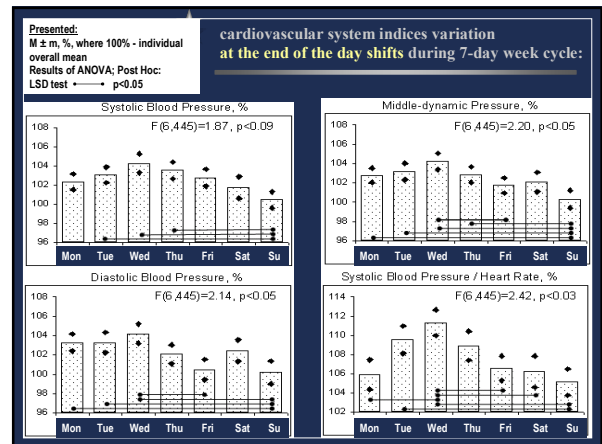
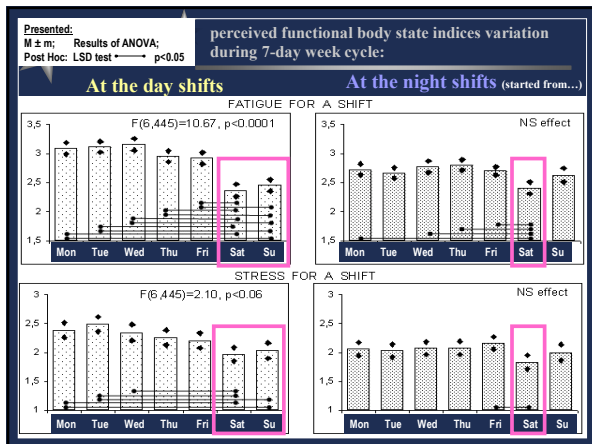
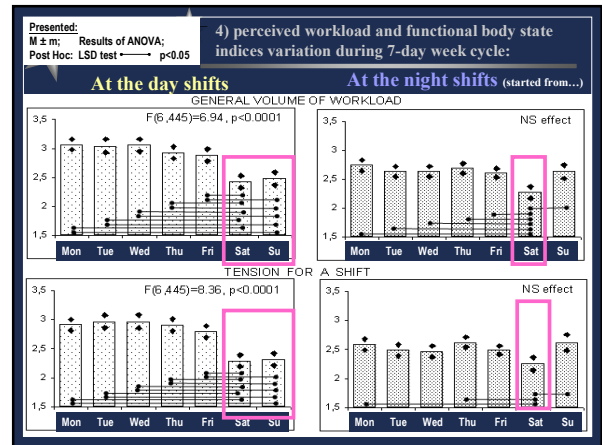
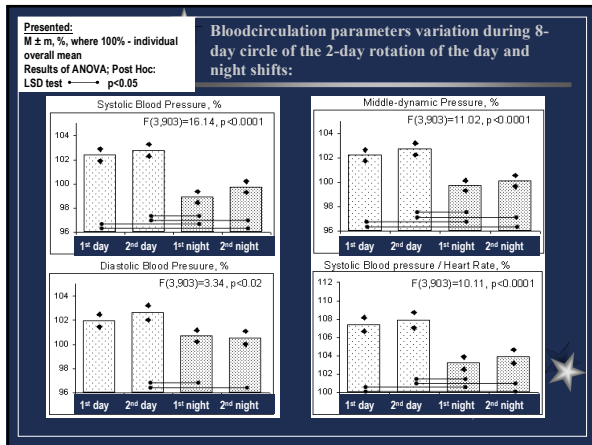
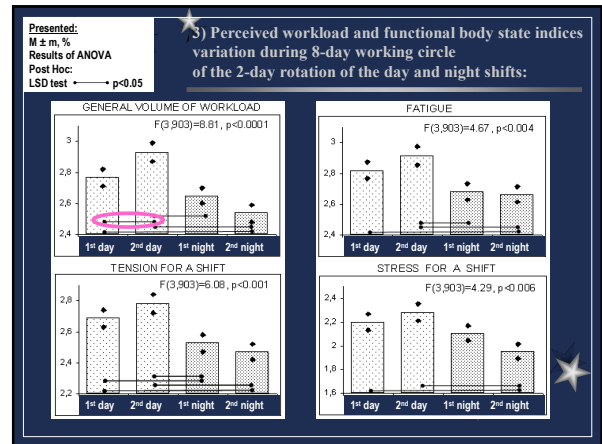
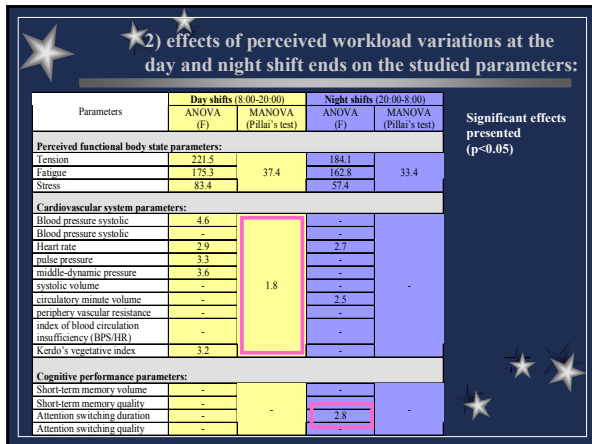
The workload variations were considered at 4 levels:

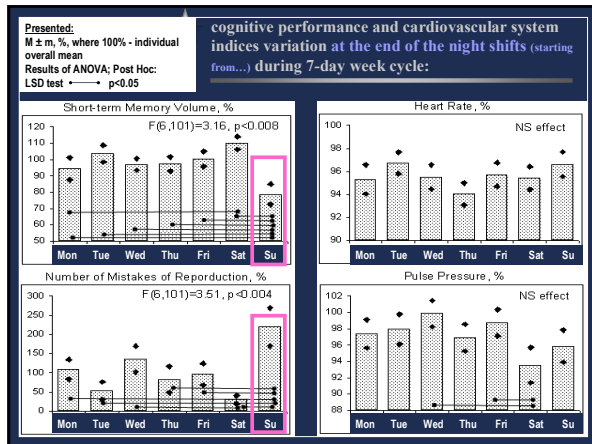
- 1) workload variations as a whole;
- 2) workload variations at the day and night shifts;
- 3) workload variations during 8-day working circle of the 2-day rotation of the day and night shifts;
- 4) workload variations during 7-day week of variations in energy consumption supposing decrease in a workload during weekend and also at the night shifts.



Cognitive performance at the end of the shifts **weakly** depended on the workload (Pillai's test: $V=1.42, p < 0.13$ – at the low tendency level).

Less pronounced dependence of the cognitive performance on the workload compared to blood circulation indices corresponds to the professional demand of the reliable human-operator work.





- ## Conclusions
- The increase in workload is accompanied by increase in tension, fatigue, stress; at the day shifts – also by bloodcirculatory intensity and shows little effect on cognitive performance that meets the professional demand of the reliable human-operator work.
 - Complications of cognitive performance are more pronounced after the loaded night shifts.
 - Intensification in bloodcirculation after the day shifts is realised mainly by its vascular part, after the night shifts it is very weak and realised mainly by the cardiac part evidencing the insufficient maintenance of the controllers' professional activity from CVS.
 - Evaluations of tension, fatigue and stress are less subjective compared to evaluation of workload and therefore are preferable for monitoring of controllers' body state.

Thank you