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STRESS TEST OF HOSPITALS IN BULGARIA – PROPOSED METHODOLOGY

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Abstract: Stress tests of financial institutions are becoming more common in the midst of a global recession and unpredictable future economic growth. We believe that apart from banks, stress tests can be conducted on hospitals as well and will have their merit. The proposed methodology for risk assessment in hospitals is only one of many possible solutions and has already been tested on the field. We demonstrate the results from such testing. Consequently, we propose the introduction of routine stress testing in the hospital care sector.

Key words: *stress test, risk assessment, hospitals, Bulgaria*

Introduction

Stress tests are used to determine the stability of an organization. They simulate the behavior of a system beyond its normal operational capacity or, to put in other words, whether the institution will be strong enough to survive through an economical storm.

Stress testing models typically allow for testing of different, rather than individual stressors. Another type of stress testing involves the hypothetical behavior of the organization in the wake of a historical scenario repetition. Generally, the methodology of stress testing, characterizes it as a type of sensitivity analysis or, less commonly, scenario analysis (2).

This type of analysis is becoming increasingly widespread and is used by numerous governmental bodies already as a regulatory requirement on financial institutions to ensure they have adequate capital levels to cover losses during extreme events. The current unpredictable economic environment seems to call for such solutions.

A group of American financial institutions, holding an estimated two-thirds of the assets in the national banking system, have been put to test in 2009. Variables used in the baseline and more adverse scenario have been shrinking of economy, rise of unemployment and drop in home prices. The idea behind the process was to give consumers greater confidence in the banking system (3).

The Committee of European banking supervisors together with the European Commission and the European Central Bank have also performed stress tests on 91 banks in the European Union, representing 65% of all EU banking assets. Stress tests focused on credit and market risks, including exposure to European sovereign debt. Two macroeconomic scenarios – benchmark (more favorable) and adverse have been used. The underlying desire was to instill more confidence in consumers but, more importantly, to address organizational weaknesses exposed during the test and furthermore, single out vulnerable institutions which need to be monitored and possibly recapitalized by national bodies (4).

In Bulgaria, stress tests are routinely performed by banks according to regulations from the Bulgarian National Bank. In the Bulgarian context, stress tests are used not only to predict future adverse events, but as an analytical tool to better understand the risk profile of the bank, i.e. as an element in a risk assessment. The complexity of stress tests implemented depends on the size and profile of the banks (5).

The idea of performing stress test on hospitals seems novel, but to our opinion, makes sense. Hospitals tend to operate within an increasingly competitive environment and, particularly in Eastern Europe, may be subject to sudden and grave financial restraints. In

Bulgaria, the recession has lead to widespread budget cutbacks for state and municipal hospitals. Risk assessment methodology for hospitals has already been proposed in Bulgaria (1) and the groups of indicators used to assess organizational and financial stability may be used in the process of a stress testing, as well.

Methods

Our model for risk assessment documents and quantifies the probability and severity of different types of adverse events (natural, technological and human) possibly affecting the functioning of the hospital.

Six groups of indicators are used – for activities, efficacy, quality, economical effectiveness, financial and organizational stability. The indicators have been chosen on the basis of expert statements by 100 hospital managers in Bulgaria. The model is suitable for any types of hospitals, but has so far been tested for multi-profile hospitals. Hospitals are sub-divided in 5 clusters according to size (number of beds).

The model is based on Excel and uses some simple calculations. It is being sent to hospital directors with guidelines for filling in the necessary data. An average value should be received for each indicator.

In creating this test, data for 2005-2009, has been used. On the basis of this data, we made predictions for a 5-year period. The mathematical procedure used was extrapolation through descriptive indicators of dynamics: absolute increase, rate of development and rate of increase. In order to smooth out fluctuations when assessing the trend, the linear weighted moving average method was used.

Collected data was used to calculate the average value for each indicator. The individual values for each hospital are weighted towards these average values. The divergence from these average values expresses the degrees of risk for the individual hospital. It should be noted that for indicators where the greater value is worse (e.g. average length of stay in hospital); there is an inversion in the assessment.

The scale of total average risk ranges from 0 to 100, divided in five categories:

➢ Very low risk level – over 90 in total for the hospital
➢ Low level of risk – 75-90
➢ Average level of risk – 50-75
➢ High level of risk – 25-50
➢ Very high level of risk – below 25

This methodology has passed the pilot testing phase in several hospitals and represents one of the possible approaches to obtain a quick stress assessment. The methodology has been approved by hospital directors and can be applied for yearly or trimester periods.

Results

In this section we demonstrate the results of a multi-profile 340-bed municipal hospital (A) and a state-owned multi-profile university hospital with 540 beds (B), illustrating the usage of selected indicators for each group.

Indicators for activities	Coefficient Hospital A	Coefficient Hospital B	Maximum coefficient
Number of patients treated	9,80	6,53	10,89
Number of outpatients	9,03	9,03	9,03
Number of urgently hospitalized	8,44	2,11	8,44
Number of discharged patients (incl. dead)	7,17	4,78	9,56
Number of bed-days	6,05	6,05	8,07
Number of bed-days according to NHIF* contract	5,63	7,51	7,51
Total number of outpatient examinations	7,00	5,25	7
Number of diagnostic tests (laboratory, image, etc.)	0,00	10,36	10,36
Number of indicators studied by laboratories	7,52	10,03	10,03
Number of diagnostic tests on inpatients	0,00	10,05	10,05
Number of indicators studied by laboratories on inpatients	6,80	9,06	9,06
Risk level	67,44	80,77	100

*NHIF – National health insurance fund

Indicators for quality	Coefficient Hospital A	Coefficient Hospital B	Maximum coefficient
Expenses for treated patients by contracts for external medical services	0,00	0,00	9,49
Frequency of repeated hospitalizations	8,98	8,98	8,98
Relative share of patients transferred to other hospitals	0,00	2,04	10,18
Frequency of post-operative complications	7,52	7,52	7,52
Hospital lethality	5,91	5,91	7,39
Concurrence of final diagnosis with the diagnosis on hospital entry	9,03	6,02	10,03
Average number of clinical and pathology diagnostic tests on a patient	0,00	0,00	8,55
Expenses for treating dangerous hospital waste per patient	9,45	1,89	9,45
Functional diagnosis	0,00	0,00	9,54
Tests for microbial sensitivity	0,00	0,00	7,47
Patient satisfaction (number of complaints, praises, etc.)	0,00	0,00	11,40
Risk level	40,89	32,36	100,00

Indicators for financial stability	Coefficient Hospital A	Coefficient Hospital B	Maximum coefficient
Share of own capital in total capital	0,00	0,00	1,50
Coefficient of repaying short-term debts	0,00	2,50	2,50
Total invested capital	1,50	1,50	1,50

Coefficient of total liquidity	1,76	8,80	8,80
Coefficient of quick liquidity	1,76	8,80	8,80
Coefficient of immediate liquidity	0,00	8,80	8,80
Ratio of claims to liabilities	5,50	5,50	5,50
Conversion of own capital	0,50	2,50	2,50
Turnover of capital	0,00	0,00	2,50
Accounting profit	1,00	0,00	2,50
Profitableness of own capital	0,00	0,00	2,50
Total debt size (long-term and short term passives)	8,19	9,10	9,10
Indicators for financial autonomy	3,48	0,00	8,70
Indicators for effectiveness	5,22	3,48	8,70
Coefficient of debt burden	1,74	0,00	8,70
Financial profitableness	0,00	0,00	8,70
Economical profitableness	0,00	0,00	8,70
Risk level	30,65	50,98	100,00

Indicators for efficacy	Coefficient Hospital A	Coefficient Hospital B	Maximum coefficient
Bed usage (in days)	5,78	5,78	9,63
Bed turnover	5,96	5,96	9,94
Average length of stay	3,93	3,93	9,83
Average number of beds per physician	8,48	3,77	9,42
Average number of beds per nurse	6,44	2,86	7,16
Number of admitted inpatients after an examination in the outpatient ward	0,00	3,11	7,78
Number of admitted inpatients after emergency	8,31	8,31	8,31
Average number of treated patients per physician	9,35	3,74	9,35
Average number of treated patients per nurse	12,60	5,04	12,60
Number of laboratory tests run on an inpatient	3,02	4,54	7,56
Number of diagnostic tests (laboratory, image, etc.) per patient	0,00	8,42	8,42
Risk level	63,88	55,46	100,00

| Indicators for economical effectiveness	Coefficient Hospital A	Coefficient Hospital B	Maximum coefficient
Cost of a bed-day	1,80	3,59	10,63
Cost of a medication-day	3,59	0,00	10,18
Cost of a medical consumables-day	5,39	1,80	11,06
Cost of a nutrition-day	3,59	0,00	9,94
Cost of expenses for staff and sick-benefits per bed-day	3,59	3,59	9,83

Cost per patient	0,00	0,00	10,87
Share of expenses for external services (medical and other activities)	0,00	0,00	10,11
Average cost of a laboratory test	0,00	0,00	9,24
Average cost of an image procedure	0,00	5,39	9,36
Ratio incomes/expenses	3,59	7,18	8,78
Risk level	21,55	21,55	100,00

Indicators for organizational stability	Coefficient Hospital A	Coefficient Hospital B	Maximum coefficient
Structure	12,00	20,00	20,00
Accreditation	2,40	12,00	12,00
Building and equipment	16,00	16,00	16,00
Human resources	20,00	20,00	20,00
Work organization	12,80	12,80	16,00
Patients admittance and serving	12,80	16,00	16,00
Risk level	76,00	96,80	100,00

The result for total average risks of hospitals A and B:

Group of indicators	Significance	Risk level Hospital A	Coefficient of the risk Hospital A	Risk level Hospital B	Coefficient of the risk Hospital B
1. Indicators for activities	Activities during medical care	Average risk	32,56	Low risk	19,23
2. Indicators for efficacy	Efficacy of activities	Average risk	36,12	Average risk	44,54
3. Indicators for quality	Quality of medical services	High risk	59,11	High risk	67,64
4. Indicators for economical effectiveness	Economical effectiveness of activities	Very high risk	78,45	Very high risk	78,45
5. Indicators for financial stability	Financial and economical state	High risk	69,35	Average risk	49,02
6. Indicators for organizational stability	Organizational stability	Low risk	24,00	Very low risk	3.20
Total risk	Total risk level for the hospital	**High risk**	50,50	**Average risk**	43,75

Hospital A vs. B risk coefficients:
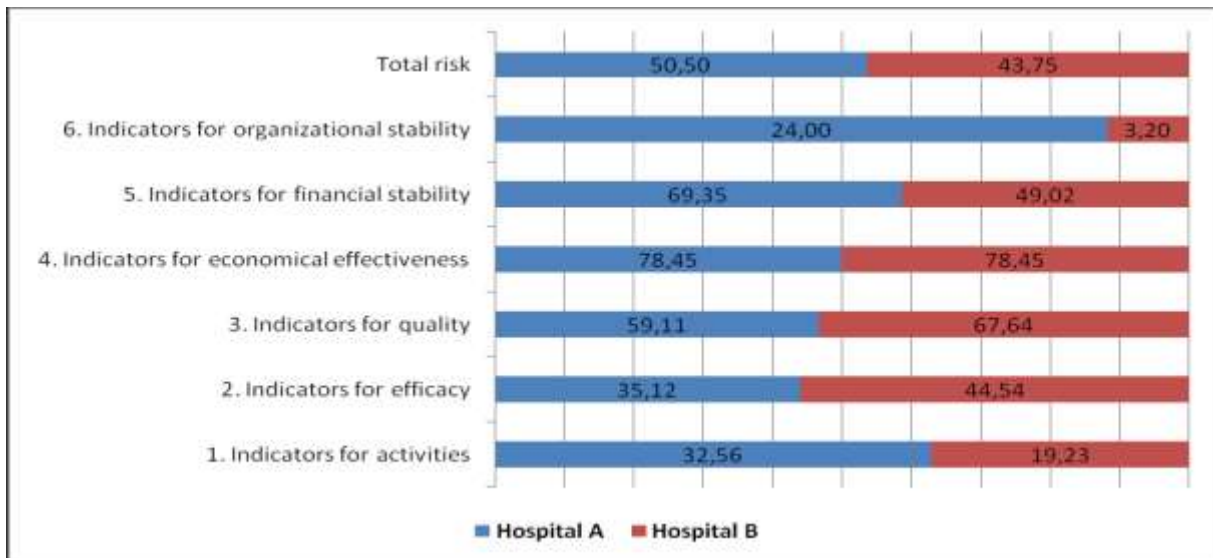
Hospital A vs. B: interpretation of possible results and final risk estimate

Very low risk level	Low risk level
Practically no risk of losses	Minimal risk of losses
Activities above average	Good activities
High efficacy of functioning	Good efficacy of functioning
Good level of quality of offered services	Qualitative offered services
Economically stable hospital	The hospital is relatively stable economically
Financially stable hospital	Low financial risk
Good management and stable structure	Management is stable
Average (moderate) risk level	**High risk level**
Some risk of losses	High risk of losses – immediate actions are needed
Average activities level	The activities are unsatisfactory - loss of market share and trust
Satisfactory efficacy, but needs improvement	Efficacy is low
Unclear financial tendencies (first signs of risk)	Funding is unstable and uncertain
Quality of offered services needs improvement	Low quality of services offered
Problems in economical effectiveness	Low economic effectiveness
Problems in organizational stability and management	Low organizational stability and bad management – lack of desire to change
Very high (unacceptable) risk level	**The risk estimate for the organization is:**
Danger of liquidation or bankruptcy	**Risk coefficient**
Real and evident losses	**50,50 (Hospital A)**
Loss of assets	**43,75 (Hospital B)**
Lack of economical effectiveness	**Level of risk**
Bad management	**High risk (Hospital A)**
Organizational chaos	**Average (moderate) risk (Hospital B)**

Discussion

Our results suggest that many hospitals in Bulgaria operate at borderline levels of stability and have no reserves or resilience in the plausible event of a sudden crisis. A routine methodology to test hospital stability seems sensible. The Ministry of Health should monitor especially vulnerable hospitals and the general public and government should also be kept informed about the possibility of a hospital to run into insolvency or staff drain. We recommend the introduction of a regular stress testing system for hospitals, analogous to those used in the banking system.

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