



# Restructuring of Gynecology-Obstetric Services Provision Based on Diagnosis-Related Groups Model

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## Abstract

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**BACKGROUND:** The implementation of the diagnosis-related groups (DRGs) model in public hospitals in Republic of Macedonia started in 2009. Purposes were data collection, cost management, standardization of services, and budget allocation. Of all DRG-coded health services, about 25% are related to gynecology/obstetric and neonatology.

**AIM:** Of this research was to investigate, analyze, and evaluate possible restructuring of gynecology-obstetric services on a national level using the existing DRG model in place, focused on deliveries as a benchmark for service provision. We used the health insurance fund DRG database for health services, populated online by medical professionals. Data were retrieved retrospectively for the period 2015–2019, with focus on 2018 as mid-point year.

**STATISTICAL METHODS:** Methods were used to describe the structure of the gynecology/obstetric and delivery services as per the DRG model.

**RESULTS:** This showed poor structure of the health network for organized provision of delivery service. Transfers to other health facilities (about 18%) and transfers toward tertiary health care (about 22%) showed low capacity of coping with the demand for provision of services (deliveries). Simulation model presents possible restructuring of services and improved hospitals' efficiency.

## Introduction

Republic of Macedonia has a well-established health care system, but inefficient in a number of ways: abundance of old and robust health facilities, inappropriate distribution of medical professionals, poor organizational scheme, and inadequate financing [1]. Health insurance is centralized, which provided through the health insurance fund (HIF), including wide benefits package. Emerging private insurance companies provide health insurance for selected services in private hospitals. Thus, the public health sector faces many challenges: increased costs, competition with private sector, low efficiency, migration of the health personnel to the private sector, and poor mechanisms of payment models in hospitals [2].

Gynecology-obstetric and neonatology services are organized through primary health care gynecologists and secondary and tertiary level clinics and wards for gynecology and obstetrics within public and private hospitals. All general hospitals and specialized hospitals (SHs) provide services at secondary level of care. Only clinic centers and university clinics (UCs) are defined as tertiary level of care. Provision

of services can be made at all levels of care, except for deliveries, which have to be performed in adequate setting of minimum secondary level of care [3], [4]. The diagnosis-related groups (DRG) model (AR-DRG version 5.2) was introduced in 2009. The model is used for specification and standardization of services and partially for payment [5]. All health services are grouped into 678 DRG codes, of which 62 are directly related to gynecology-obstetrics and neonatology services. Payment (or the price) is defined by the complexity of the service ("weight") and the level of service provision (secondary or tertiary). All services listed in the DRG groups can be performed and consecutively coded in all public hospitals. Only UC in Skopje and three clinical hospitals (CH) in Bitola, Tetovo, and Shtip have the highest complexity level of cases and additional payment of 10% (on top of the defined DRG price) for the tertiary level of care hospitalizations, including transfers from other facilities [5].

Objective of the research is to analyze the existing network for provision of gynecology-obstetric and neonatology services, focusing on deliveries, through analysis of the existing DRG model. Simulation model for re-structured services' provision will estimate improved outcomes and suggest possible effects of

improved efficiency of restructured services in public hospitals.

## Materials and Methods

For this retrospective study, data on selected parameters were obtained from the HIF DRG system (National DRG Grouper) database in MS Excel table format. Data were retrieved retrospectively for 17 public hospitals for the period of 5 years (2015–2019), focusing on 2018, as a mid-year in number of cases and volume of resources. Sixty-two DRG codes related to payment of hospital services for gynecology/obstetric and neonatology were analyzed: 20 “N” codes related to gynecology (codes N01Z-N62B), 17 “O” codes related to obstetric (O01A-O66B), and 25 “P” codes related to neonatology (P01Z-P67D). Data for the selected DRG codes were analyzed for 17 public hospitals: One UC (UC for Gynecology and Obstetrics, Skopje), three – CHs (CH Bitola, CH Tetovo and CH Stip), 12 general hospitals – GHs (GH Veles, GH Gevgelija, GH Gostivar, GH Debar, GH Kavadarci, GH Kicevo, GH Kocani, GH Kumanovo, GH Ohrid, GH Prilep, GH Struga and GH Strumica), and one SH (SH for Gynecology and Obstetrics “Chair” Skopje).

For the simulation exercise, the same dataset for 17 public hospitals was used. Simulation exercise involved analysis of selected services, whereby deliveries were selected as a specific benchmark for gynecology-obstetric and neonatology services (for year 2018). Data set was evaluated in terms of number of transfer of patients to tertiary level of care or transfer to another hospital, human resource allocation, and simulated re-allocation. Comparison was made between total deliveries (all deliveries recorded at the municipality level) and deliveries actually performed in the hospitals. Difference in deliveries marks transfer toward or from another hospitals.

Data were analyzed using excel pivot tables. Descriptive statistical methods were used for analysis of utilization of selected services in hospitals and transfer to higher level of care.

## Results

### **DRG model and distribution of cases related to the level of care**

For the analyzed 5-year period (2015–2019), there are on average about 50,000 cases per year related to the 62 gynecology-obstetric and neonatology DRG codes N, O, and P; this accounts for about 25%

of all DRG-coded health services across all public hospitals.

Pregnancy and puerperium were present with 12.9% of all DRG coded cases and newborn-related services with 9.1% of all DRG coded cases (year 2018). Number of gynecology-obstetric and neonatology related cases shows decreasing trend between 2015 and 2017 and light increase in year 2019, as presented in Figure 1. Data show that about 6% of all DRG coded cases are coded at the UC for Gynecology and Obstetrics in Skopje.

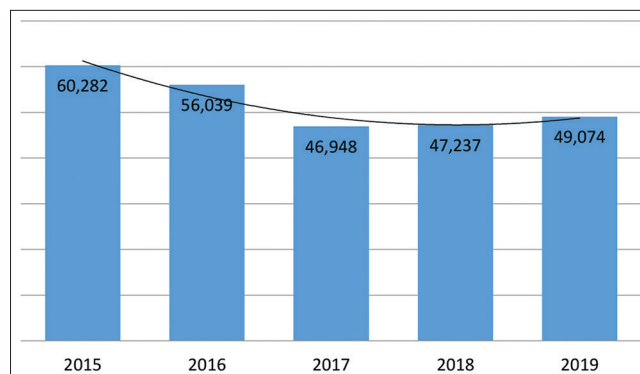


Figure 1: Trend of gynecology-obstetric and neonatology related cases (2015–2019)

Analyzed gynecology-obstetric and neonatology cases have very unequal distribution throughout hospitals, where one-third of all cases have been recorded at the UC in Skopje. Two CH (CH Bitola and CH Shtip) show under 5% distribution of cases each, which for tertiary level of care is linked to inefficiency and underuse of resources. CH Tetovo has similar distribution of cases as the SH Chair which is above 10%. Majority of general hospitals have normal trend of distribution of cases during the 5-year period, except GH Kavadarci which has a slightly declining trend. Two hospitals have distribution of cases below 1% which is about 450 cases per year (GH Debar and GH Gevgelija). Distribution of funds follows the distribution of cases, whereby around 30% of cases in UC in Skopje accounts for about 40% of all funds spent.

### **Distribution of cases related to the level of complexity**

The distribution of cases and financial resources for the selected 62 DRG codes for gynecology-obstetric and neonatology related services is shown in Table 1 for the period of 2015–2019.

Distribution of cases linked to the level of service provision, that is, the type and complexity of cases, showed the same unequal distribution. UC in Skopje provides care to nearly one-third of cases, almost same to the total number of cases in all GHs combined. All three CHs have only about 18% of all cases, which show a declining trend in the past 2 years (2018–2019). The use of financial resources linked to UC of Skopje

**Table 1: Distribution of cases as per 62 DRG codes (2015–2019)**

Public health hospitals	2015		2016		2017		2018		2019	
	% of cases	% of funds	% of cases	% of funds	% of cases	% of funds	% of cases	% of funds	% of cases	% of funds
UC Skopje <sup>a</sup>	32.17	41.51	31.57	39.35	25.13	33.4	31.08	40.33	32.99	41.33
CH Bitola <sup>a</sup>	4.59	4.5	4.44	4.58	5.2	4.72	3.96	3.8	3.85	3.81
CH Shtip <sup>a</sup>	4.39	3.37	4.3	3.44	5.02	4.27	4.48	3.67	3.82	3.44
CH Tetovo <sup>a</sup>	11.11	8.75	10.63	8.4	11.62	9.3	10.18	7.71	9.29	6.92
SH Chair Skopje <sup>b</sup>	11.85	11.22	13.95	12.98	18.08	17.29	18.31	16.89	18.8	17.7
GH Prilep <sup>c</sup>	3.68	3.24	3.81	3.75	2.51	2.43	3.21	3.09	3.57	3.45
GH Strumica <sup>c</sup>	5.54	5.49	5.43	5.72	5.02	4.99	4.81	5.03	4.53	4.66
GH Gevgelija <sup>c</sup>	0.97	0.86	0.4	0.32	1.22	1.1	0.95	0.8	0.52	0.36
GH Ohrid <sup>c</sup>	2.58	2.45	2.88	2.85	3.13	3.28	2.42	2.28	2.09	1.93
GH Struga <sup>c</sup>	3.75	3.24	3.96	3.51	4.04	3.62	3.87	3.38	4.05	3.46
GH Kicevo <sup>c</sup>	1.55	1.13	1.55	1.17	1.37	1.08	1.05	0.72	0.94	0.66
GH Veles <sup>c</sup>	2.91	2.33	2.81	2.27	3.37	2.75	2.27	1.71	2.4	1.82
GH Kocani <sup>c</sup>	1.52	0.93	1.31	0.83	1.17	0.71	1.09	0.67	1.24	0.83
GH Kavadarci <sup>c</sup>	2.71	2.14	2.54	2.05	2.46	1.91	2.3	1.8	2.17	1.79
GH Gostivar <sup>c</sup>	3.62	3.35	3.19	3.12	3.34	3.2	3.06	2.93	2.9	2.68
GH Debar <sup>c</sup>	0.54	0.31	0.36	0.18	0.45	0.24	0.46	0.25	0.53	0.28
GH Kumanovo <sup>c</sup>	6.52	5.18	6.87	5.48	6.9	5.72	6.51	4.96	6.32	4.89

<sup>a</sup> Tertiary level hospital; <sup>b</sup> Specialized hospital; <sup>c</sup> general hospital

is about 40%. Funds related to CHs show underuse of financial resources linked to the tertiary level of care.

### Distribution of deliveries

Deliveries were taken as a benchmark for provision of gynecology-obstetric and neonatology services. Deliveries require defined specific conditions and multidisciplinary team of medical professionals: Gynecologist-obstetrician, neonatologist, anesthesiologist, and a nurse [4]. Levels of maternity and newborn care are defined in accordance with international recommendations on stratification of perinatal care services. The level of care is determined by the capability of individual facility: Infrastructure, equipment, availability, and competencies of medical personnel [6].

Related to deliveries in the selected year 2018, the following DRG codes were analyzed: O01A, O01B, O01C, O02A, O02B, O60A, O60B, and O60C. Description of the DRG codes and distribution of cases is presented in Table 2. Terminology used in description of codes complexity of AR DRG version 5.2, in which we used, differs from the last version of AR DRG 10.0. The old version uses terminology of graduating complexity levels from: without, heavy and to catastrophic complications; in the latest version, terminology was changed to minor, intermediate, and major complexity.

**Table 2: Gynecology-obstetric and neonatology DRG codes' description and distribution of cases (2018)**

DRG code	Description	Number of cases	% of cases
O01A	Cesarean delivery with catastrophic complications (CC)	205	1.11
O01B	Cesarean delivery with heavy complications (CC)	480	2.59
O01C	Cesarean delivery without complications (CC)	6.160	33.30
O02A	Vaginal delivery with procedure in operation theater with catastrophic or heavy complications (CC)	46	0.25
O02B	Vaginal delivery with procedure in operation theater without catastrophic or heavy complications (CC)	416	2.25
O60A	Vaginal delivery with catastrophic or heavy complications (CC)	336	1.82
O60B	Vaginal delivery without catastrophic or heavy complications (CC)	783	4.23
O60C	Vaginal delivery single, simple, without other conditions	10.071	54.45
Total		18.947	100.00

Complexity levels show that out of 18.947 deliveries, about 10% have been coded with heavy or catastrophic complications.

Distribution of deliveries in hospitals and comparison between total deliveries (whereby total deliveries is defined as all deliveries recorded at the municipality level) and deliveries actually performed in the hospitals is presented in Table 3. Difference in deliveries shows net migration, that is, transfer of patients to and from another hospital, or deliveries performed in private hospitals not part of the national DRG-system.

Regarding the distribution of deliveries, one-fourth of cases (25%) are performed at tertiary level (UC Skopje) and half of all deliveries are performed in Skopje. Regarding case migration, 60% of all cases recorded at the UC of Skopje were transfers from another facility. In SH Chair in Skopje, about half of the cases were transfers from another hospital. GH Debar has only 21 delivery performed at the local hospital on a yearly basis. All other cases from Debar municipality were transferred to another hospital, where percentage of transfer is more than 700. Looking into absolute numbers of performed deliveries, many hospitals have <500 deliveries per year, which is <2 deliveries per day. Majority of deliveries (about half of all deliveries) are performed at tertiary level of care (UC in Skopje and CHs), with higher complexity of cases (Table 4).

Medical teams were counted and compared to the total number of deliveries at municipality level (for year 2018). Comparison showed that the number of medical professionals is directly related to the number of deliveries.

## Discussion

The analysis of gynecology-obstetric and neonatology services using relevant DRG codes and deliveries as benchmark indicator has shown a very unequal distribution throughout public hospitals, where burden of cases is mostly on the UC in Skopje. This can be observed in the period of 5 years consequently, which explains the underuse of other hospitals (both GHs and CHs) for provision of services. Inefficiency of hospitals

**Table 3: Distribution of deliveries and transfers between public hospitals (2018)**

Public health hospital	Total municipality deliveries	Actual hospital deliveries	% of municipality deliveries	% of actual hospital deliveries	transfer	% of transfer
UC Skopje	4.630	1.844	25.03	17.55	2.786	60.17
SH Chair Skopje	4.132	2.162	22.34	20.58	1.970	47.68
CH Bitola	765	484	4.14	4.61	281	36.73
GH Prilep	720	468	3.89	4.45	252	35.00
GH Strumica	1.013	466	5.48	4.44	547	54.00
GH Gevgelija	140	88	0.76	0.84	52	37.14
GH Ohrid	481	316	2.60	3.01	165	34.30
GH Struga	767	486	4.15	4.63	281	36.64
GH Kicevo	218	161	1.18	1.53	57	26.15
CH Shtip	878	778	4.75	7.40	100	11.39
GH Veles	505	300	2.73	2.86	205	40.59
GH Kocani	169	101	0.91	0.96	68	40.24
GH Kavadarci	400	215	2.16	2.05	185	46.25
CH Tetovo	1.734	1.448	9.37	13.78	286	16.49
GH Gostivar	673	414	3.64	3.94	259	38.48
GH Debar	21	21	0.11	0.20	163	776.19
GH Kumanovo	1.251	755	6.76	7.19	496	39.65
Total	18.497	10.507			8.153	

**Table 4: Distribution of deliveries by level of care (2018)**

Public hospitals	Total municipality deliveries	Actual hospital deliveries	% of deliveries
UC GAK Skopje	4.630	1.844	25.03
SH Chair Skopje	4.132	2.162	22.34
CHs	3.377	2.710	18.26
GHs	6.358	3.791	34.37
Total	18.497	10.507	100.00

is not seen only in terms of lack of service delivery, but also in terms of inefficient use of funds, where every transfer requires more funds, especially if on the tertiary level of care. There is a serious issue of professional inefficiency if half of the gynecology-obstetric and neonatology cases require highest level of care, which should be provided only for the most complex cases [7]. CHs (Bitola, Shtip and Tetovo) provide services at the same level as the GHs, which also presents inefficient use of their resources. Some GHs with extremely low number of cases per year, pose the question of sustainability, both in terms of human resources and finances. Due to the inefficiency of the secondary level of care hospitals, there is significant trend of transfer of cases to UC in Skopje, posing huge burden on the tertiary level with cases that would otherwise have to be accepted at the secondary level of care. This suggests financial overspending, knowing that tertiary level of care has 10% higher price for the same service provided at secondary level of care. Roughly estimated, for about half of the services provided, the price is 10% higher and the costs are at least 10% increased on a yearly basis.

Deliveries follow the same trend of other services in gynecology-obstetric and neonatology, majority performed at the highest level of care. About 22% of all deliveries in the country are performed at the UC in Skopje. All other hospitals transfer patients to another facility on a regular basis (about 2%), or women predefine their place for delivery and migrate for delivery to other hospitals. Usually, those transfers are towards hospitals in bigger cities, private hospitals or UC in Skopje. If we look at the actual number of deliveries, 11 out of 17 hospitals (more than 50%) perform under 500 deliveries per year, which is an extremely low threshold for maintaining continuity of adequate professional competence and adequate quality of health service provision [7].

Overspending is evident in paying for deliveries at a higher level of care which could have been provided at lower level of care. Burden of cases of the UC in Skopje can also lead to inefficiency in provision of adequate services for more complex cases that actually require tertiary level of care, due to the huge number of lower-level cases (deliveries) versus limited number of health professionals.

Human resources are unevenly distributed and follow the number of cases. Lack of trained medical professionals, lack of complete medical teams (borrowing doctors and doctors on the call) add to the inefficiency of the majority of hospitals.

Financial overspending in public hospitals is also evident from the inappropriate organization of health services, overuse of resources for provision of medical consumables, and payment for indirect fixed costs of health facilities (water, energy, cleaning, etc.). Inefficiency of hospitals can be marked as inadequate organization of services in huge poorly structured old facilities, lack of medical professionals and inadequate, and overspending for health services.

It can be argued that those are some of the major reasons for migration of women to a higher level of care, or hospital in bigger city, exercising their right to choice of health facility for a specific service. In addition, the lack of clear instructions or criteria for management – and thereof transfer – of patients at each level of care contributes to this trend and further spurs the underuse of GHs [7].

On the other hand, women should ask services where most appropriate: adequate trained medical professionals, high quality of service, and adequate capacity of the hospital. This will prevent eventual complications and provide best quality of care [8], [9].

### **Simulation model for re-organization**

Reorganization of gynecology-obstetric and neonatology services can be a starting point for improving access to adequate and efficient services [9]. It will strengthen capacities of health facilities and enable better use of the available resources, both human,

and financial [10]. Reorganization should be made on valid analysis of the existing capacities and based on realistic demands of the population [11], [12], [13]. Other measures of improved efficiency may include good organization and strengthening of the professional capacities of medical teams; improved working conditions in the health facilities (such as downsizing of unneeded health facilities), provision of adequate equipment and medical consumables; improved use of financial resources; and defined rules and instructions for managing patients at different levels of care [12], [14], [15].

Restructuring of health services is the first step towards improved use of resources. Analysis of the existing 17 centers for gynecology-obstetric and neonatology wards and hospitals showed extremely disproportional distribution of provided services, medical staff and financial resources. Thus, more than 50% of all facilities showed underused facilities' capacities. As a result, one tertiary-level hospital has huge burden of cases, which poses a challenge to the quality of services provided due to overuse of the available resources. Proposed model of reorganization is based on downsizing the number of facilities from 17 different types of hospitals into eight centers for gynecology-obstetric and neonatology in the country; out of which four are to be at the tertiary level (UC in Skopje and the three CHs, strategically located across the country), one SH in Skopje and three municipality centers at GH level (GHs in Kumanovo, Strumica and Ohrid). This reorganization will enable improved use of available health professionals and their most efficient utilization. Number of medical professionals should be adequately re-distributed for anticipated flow of patients and complexity level of the cases. Re-allocation of funds should follow patients' flow.

Comparison of deliveries and modeled re-distribution of respective services based on 2018 data is presented in Figure 2. Line for distribution of deliveries (2018) is very jagged, with peaks at UC and SH, both in Skopje. Re-distribution is expected to reduce the peaks and enable more even distribution, where it is estimated that 35–40% of all deliveries will be performed in Skopje. CHs should have more even distribution of cases (about 15% of all cases

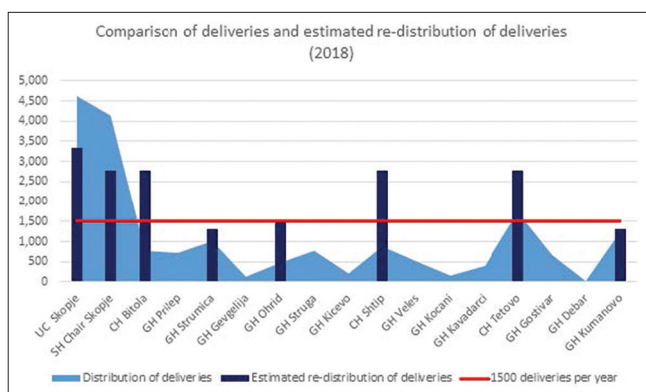


Figure 2: Comparison of deliveries and modeled re-distribution of deliveries based on 2018 data

each), same as SH in Skopje. Re-distribution enables coverage of 60% of all deliveries at tertiary level of care, but the load of cases is distributed between the three regional CHs.

Estimated re-distribution of cases should enable output of minimum 1500 deliveries per year per hospital. This number is acceptable for keeping continuity of relevant professional expertise in provision of services.

Out of all deliveries, about 10% are with heavy and catastrophic complications, in which absolute number accounts for about 2000 deliveries per year. If the transfer and migration occurs only when medically indicated in high complexity cases, it will reduce additional payment for transfer of up to 40% of all payments for delivery services.

Accompanied with appropriate on-the-job trainings and refurbished facilities, these measures should strengthen professional medical teams for provision of services and will ensure sufficient capacities and standardized quality of care in all hospitals. This, in turn, would likely limit the transfer of patients to predefined high complexity cases, which would decrease both direct and indirect costs for services. Due to the nature of pregnancy and if relevant clinical guidelines for pre-natal care have been followed, in most part deliveries can be predicted or planned in advance, and so patients' pool can be kept at the municipality level, enabling provision of high quality health services [16], [17].

## Conclusions

DRG model is used to standardize and systematize services and partially to define hospital payment levels. Therefore, the model can be used as a benchmark of types and quantity of services provided [18]. Within the model, all public hospitals are defined in accordance with the type, volume of services and complexity level. Analysis of the system's network and the capacities of hospitals using the existing DRG model gives an insight into the utilization of services in all health facilities at all levels of care.

Republic of Macedonia needs to optimize and build up on the existing network for gynecology-obstetric and neonatology services using available resources. New approach toward restructuring of the system and resource re-allocation should be considered when developing evidence-informed health policy [19].

This research evaluates some components of the national DRG model for gynecology-obstetric and neonatology services and its effects [20]. It proposes a solution for improved use of services in hospitals and can be used as a basis for additional analysis of other

hospital segments, where restructuring of services might be deemed needed.

Improved model can be used for benchmarking with other countries and comparison between structure and organization of the services (national versus regional level) [21], [22], [23]. This model can also be used and adapted in other countries with limited resources, for rationalization of resources' utilization and improvement of system's efficiency.

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