

# Neonatal Intensive Care Units in Istanbul (2014-2015)

Sinan Uslu<sup>1</sup>, Asli Yuksel<sup>2</sup>, Aysegul Uslu<sup>3</sup>, Bekir Turan<sup>4</sup>, Ali Bulbul<sup>1</sup>, Memet Taskin Egici<sup>5</sup>, Selami Albayrak<sup>4</sup>, Guven Bektemur<sup>6</sup>

## ABSTRACT:

### Neonatal intensive care units in Istanbul (2014-2015)

**Objective:** The aim of the study was to determine the changes and current status of neonatal intensive care units (NICUs) in process in Istanbul between 2014 and 2015.

**Material and Method:** The study was performed and evaluated by considering the current data belonging to years of 2014 and 2015 of NICUs from the Public Inpatient Health Services and Emergency Health Services Branch Offices of Istanbul Provincial Health Directorate.

**Results:** The total number of neonatal beds in Istanbul was 1870 by the year 2014 [Level I: 290 (15.5%), Level II: 555 (29.7%), Level III: 1025 (54.8%)] while this number rose up to 2268 [Level I: 365 (16.1%), Level II: 685 (30.2%), Level III: 1228 (53.7%)] with an increase of 21.2% in 2015. Approximately 27.3% of these beds were located in public health institutions and the rate of neonatologists available was about 40.5% of neonatal beds in Istanbul. More than half of patients were treated in Level III beds. In 2014 18.2% and in 2015, 16.1% of newborn in Istanbul received inpatient treatment during the neonatal period and it is noteworthy that nearly half of them (in 2014 47.8%, in 2015 45.3%) were monitored in Level III beds.

**Conclusions:** The number of neonatal beds and neonatologists has increased substantially (21.2%) in Istanbul last year. But when it was considered at the international level, the distribution of the number of the neonatal beds was distorted, and the number and working order of neonatologists were inadequate. Regionalization of perinatal care for Istanbul must be performed immediately. The updating of official regulations for ensuring service delivery is required with considering realistic goals and determination of emergency action plan in terms of health policies for newborn health with all participants that give newborn care.

**Keywords:** Newborn, intensive care, Istanbul

## ÖZET:

### İstanbul'da yenidoğan yoğun bakım üniteleri (2014-2015)

**Amaç:** Çalışma İstanbul ilinde Yenidoğan Yoğun Bakım Ünitelerinin (YYBÜ) 2014 ve 2015 yıllarındaki mevcut durumu ve değişikliklerini ortaya koymak amacıyla yapıldı.

**Gereç ve Yöntem:** Çalışma İstanbul İl Sağlık Müdürlüğü Kamu Yataklı Sağlık Hizmetleri ve Acil Sağlık Hizmetleri Şube Müdürlüklerinin YYBÜ'lere ait 2014 ve 2015 yılı güncel verileri eşliğinde gerçekleştirildi.

**Bulgular:** İstanbul'da toplam yenidoğan yatak sayısı 2014 yılı itibarı ile 1870 [1.düzye:290 (%15,5), 2. düzey: 555 (%29,7), 3.düzye: 1025 (%54,8)] iken bu sayı 2015 yılında %21,2'lik bir artış ile 2268'e [1.düzye: 365 (%16,1), 2. düzey: 685 (%30,2), 3.düzye: 1228 (%53,7)] yükselmiştir. Bu yatakların yaklaşık %27'si kamuya ait sağlık kuruluşlarında yer almaktadır ve ancak %40'ında neonatolog mevcuttur. Hastaların yarısından fazlası 3. düzey yataklarda tedavi görmüştür. İstanbul'da bir yılda doğan bebeklerin 2014 yılında %18,2'sinin 2015 yılında ise %16,1'inin yatarak tedavi aldığı ve bu yenidoğanların da yaklaşık yarısının (2014 yılında %47,8, 2015 yılında %45,3) 3. düzey yataklarda izlendiği dikkati çekmektedir.

**Sonuç:** İstanbul'da yenidoğan yatağı ve neonatoloji uzmanı sayısı son 1 yılda ciddi oranda (%21,2) artmıştır. Fakat uluslararası düzeyde ele alındığında yenidoğan uzmanı sayısının yetersiz, çalışma düzeyinin ve yatak sayılarının dağılımının bozuk olduğu saptanmıştır. Perinatal bakımın bölgeselleştirme çalışmaları acilen başlanmalıdır. Yenidoğan hizmet sunumunun akılcı koşullarda tüm paydaşların katılımı ile değerlendirilerek temel sağlık politikalarında acil eylem planı olarak ele alınması gereklidir.

**Anahtar kelimeler:** Yenidoğan, yoğun bakım, İstanbul

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<sup>1</sup>Sisli Hamidiye Etfal Training and Research Hospital, Neonatal Intensive Care Unit, Istanbul - Turkey

<sup>2</sup>Istanbul Provincial Health Directorate, State Inpatient Health Services Branch Directorate, Istanbul - Turkey

<sup>3</sup>Kağıthane State Hospital, Pediatric Clinic, Istanbul - Turkey

<sup>4</sup>Istanbul Provincial Health Directorate, Istanbul - Turkey

<sup>5</sup>Beyoğlu State Hospitals Association General Secretary, Head Medical Services, Istanbul - Turkey

<sup>6</sup>Beyoğlu State Hospitals Association General Secretary, Turkey State Hospitals Association Istanbul Coordinator, Istanbul - Turkey

Address reprint requests to / Yazışma Adresi: Sinan Uslu, Sisli Hamidiye Etfal Training and Research Hospital, Neonatal Clinic, Istanbul - Turkey

E-mail / E-posta: sinanuslum@hotmail.com

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## INTRODUCTION

The data of infant and newborn mortality in Turkey has improved significantly in the recent years due to the positive developments in the NICUs technologically and in the qualified labour force (1,2). Not only targeting keeping alive, but also targeting the quality of live, the perinatal care also handles the data associated with morbidity beside mortality. The modern countries achieved to reach these goals by regionalization programs of the perinatal care(3). It is emphasized that in international platforms and in our country, the strategy of regionalization and the applications are the basic approaches in the improvement of newborn mortality and morbidity (4,5). The organization of neonatal service delivery in the perinatal care regionalization program is of great importance (6,7).

The most populous and having a high population density and population growth rate and a complex sociodemographic structure of our country, Istanbul province needs a transdisciplinary systematic approach in neonatal health care organization. The study was conducted in Istanbul province between 2014-2015, to determine the current status and the changes of NICU services, and to reveal the stunning results associated with the NICU organization, accompanied with the literature.

## MATERIAL AND METHOD

In the study, data from Istanbul Provincial Health Directorate Emergency Medical Services Branch Offices and Public and Private Health Services NICUs between 2014-2015 were evaluated. The data from the Health Directorates were confirmed with the Hospital Information Management Systems (HIMS) of the public hospitals that are included in Istanbul Public Hospitals Association, and systems of the other hospitals that are not included in the union. Following the control of the records, the data of 2014 and 2015 were evaluated on a comparative basis accompanied by tables which have been prepared in specific subtitles pattern. In the analysis and comparison of the data (ratio, mean and standard deviation), MedCalc Turkey medical statistics program was used.

## RESULTS

The total number of neonatal beds in Istanbul was 1870 by the year 2014 [Level I: 290 (15.5%), Level II: 555 (29.7%), Level III: 1025 (54.8%)] while this number rose up to 2268 [Level I: 365 (16.1%), Level II: 685 (30.2%), Level III: 1228 (53.7%)] with an increase of 21.2% in 2015. Compared to the previous year, the newborn bed capacity in levels I,II and III increased by 25.9% - 23.4% and 19.8%, respectively. About 70% of Level I beds in Istanbul; 60% of Level II; and 80% of Level III are present in the private sector.

In 2014, 511 beds of newborn (27.3%-511/1870) were in 20 public hospitals within the health care provider, and in 2015 633 (27.7%-633/2268) were in 24 public hospitals within the health care provider. While in 2014, the distribution of newborn beds within the public hospitals according to the levels were [Level I: 87 (17.0%), Level II: 218 (42.7%), Level III: 206 (40.3%)], in 2015 the distribution was Level I: 149 (23.5%), Level II: 267 (42.1%), Level III: 217 (34.4%). The number of newborn beds at the public hospitals in the last one year increased in a total of 122 (23.9%), largely at Level I and Level II. The newborn bed occupancy rates of public hospitals in 2014 and 2015 were 86.6% and 87.2%, respectively.

In 2014 in the total of 142 medical institutions that include the private hospitals and the private university hospitals, 1359 newborn bed (72.7%-1359/1870) were present [Level I: 203 (14.9%), Level II: 337 (24.8%), Level III: 819 (60.3%)]. In 2015, in 141 institutions, this number reached to 1635 (72.3%-1635/2268) beds [Level I: 209 (12.8%), Level II: 415 (25.4%), Level III: 1011 (61.8%)]. In the private hospitals, the number of newborn beds, all consisting Level II and Level III, increased in a total of 276 (20.3%) beds. The newborn bed occupancy rates in the private hospitals in 2014 and 2015 were detected as 46.4% and 47.6%, respectively.

In 2014, 758 (40.5%-758/1870) beds of the newborn beds in the hospitals that have NICU in Istanbul, and in 2015, 901 (39.7%-901/2268) beds were under control of the neonatologists. In 2014, 450 (59.4%) of these beds and in 2015, 559 (62%) were located in the public hospitals.

In the public hospitals in which a neonatologist was working, in 2014, 450 newborn beds [Level I: 62 (13.8%), Level II: 186 (41.3%), Level III: 202 (44.9%)] were present, while in 2015, this rate increased by 24.2% and reached to 559 [Level I: 110 (19.7%), Level II: 232 (41.5%), Level III: 217 (38.8%)]. In 2014 and 2015, 85% and 88.3% of the newborn beds within the Public Hospitals in Istanbul were served by a neonatologist, respectively, and their occupancy rates were >90%.

In 2014 in the private health institutions where the neonatologists serve, there were 308 newborn beds [Level I: 9 (2.9%), Level II: 24 (7.8%), Level III: 275 (89.3%)] present, while in 2015, this number increased by 11% and reached to 342 beds [Level I: 10 (2.9%), Level II: 38 (11.1%), Level III: 294 (86%)].

In 2014, 40.5% of the newborn beds in Istanbul

(758/1870) [Level I: 24.5% (71/290), Level II: 37.8% (210/555), Level III: 46.5% (477/1025)], and in 2015 39.7% (901/2268) [Level I: 33.5% (120/358), Level II 39.6% (270/682), Level III 41.6% (511/1228)] were being controlled by the neonatologists.

Of the newborn beds that were being controlled by the neonatologists in Istanbul; in 2014, 9.4% (71/758) were Level I, 27.7% (210/758) were Level II, and 62.9% (477/758) were Level III, while in 2015, 13.3% (120/901) were Level I, 30% (270/901) were Level II and 56.7% were (511/901) Level III.

The distribution of newborn beds in Istanbul in 2014 and 2015, by the public (Ministry of Health Türkiye Public Hospitals Association and State University Hospitals) and private health institutions (Private Hospitals and Private University Hospitals) and their changes according to the years were shown

**Table-1: The distribution of NICU beds in 2014 and 2015 in Istanbul**

Level of Beds		State Hospitals* number of beds		Private Health Institutions** number of beds		Total
		Neonatologist (+) number of beds (%)	Neonatologist (-) number of beds (%)	Neonatologist (+) number of beds (%)	Neonatologist (-) number of beds (%)	
Level I	2014	62 (13,8)	25 (41)	9 (2,9)	194 (18,4)	290 (15,5)
	2015	110 (19,7)	39 (52,7)	10 (2,9)	199 (15,4)	358 (15,8)
Level II	2014	186 (41,3)	32 (52,5)	24 (7,8)	313 (29,8)	555 (29,7)
	2015	232 (41,5)	35 (47,3)	38 (11,1)	377 (29,2)	682 (30,1)
Level III	2014	202 (44,9)	4 (6,6)	275 (89,3)	544 (51,8)	1025 (54,8)
	2015	217 (38,8)	-	294 (86)	717 (55,4)	1228 (54,1)
Total	2014	450 (100)	61 (100)	308 (100)	1051 (100)	1870 (100)
	2015	559 (100)	74 (100)	342 (100)	1293 (100)	2268 (100)

\*State Hospitals: Türkiye State Hospitals Association and University Hospitals

\*\*Private Health Institutions: Private Hospitals and Private University Hospitals

**Table-2: The newborn patients that are treated with hospitalization in 2014 and 2015 in Istanbul**

Level of Beds	State Hospitals		Private Health Institutions		Total	
	Number of Hospitalized Patients (%)		Number of Hospitalized Patients (%)		Number of Hospitalized Patients (%)	
	2014	2015	2014	2015	2014	2015
Level I	4.844	4.996	7.132	7.196	11.976	12.165
	(33,7)	(34)	(24,3)	(23,7)	(27,4)	(26,9)
Level II	5.521	5.669	5.330	5.689	10.851	11.358
	(38,4)	(38,6)	(18,2)	(18,6)	(24,8)	(25,1)
Level III	3.997	4.033	16.907	17.651	20.904	21.684
	(27,9)	(27,4)	(57,6)	(57,7)	(47,8)	(48,0)
Total	14.362	14.698	29.369	30.536	43.731	45.234
	(100)	(100)	(100)	(100)	(100)	(100)

\*State Hospitals: Türkiye State Hospitals Association and State University Hospitals

\*\* Private Health Institutions: Private Hospitals and Private University Hospitals

in Table-1. The data of newborn patients who received inpatient treatment in 2014 and 2015 were presented in Table-2.

## DISCUSSION

Regionalized perinatal care concept seems to be the most important step to prevent serious morbidities, beside newborn mortality in Turkey and in general and in Istanbul, as in the modern countries (7-9). The complex cosmopolitan structure of Istanbul points out that the perinatal centers should be positioned, paying attention to the sociodemographic structure, as in the studies conducted in the developing countries (10,11).

Turkey's population based on the address-based population registration system is approximately 76.7 million by the end of 2013 (1). Istanbul is the city that contains 18.5% of all Turkey's residents, and has the highest population growth rate and is the most populated province. The population of Istanbul was 14.160.467 in 2013, while in 2014, it reached to 14.377.018 with a 1.53% rise, and by 2015, 14.657.434 with a 1.95% rise. The birth numbers were 228.395 in 2013, while in 2014 with a 5.2% rise, it increased to 240.350 (2,12,13). When the refugee problem is expected to increase both the general population and the current number of births more in Istanbul, under the light of the available data, considering Istanbul as a stand-alone model in our country and the need for the management of perinatal care with the regionalization strategy within the province, is evident.

One of every 5 newborn beds in our country is located in Istanbul (14). In the document published in 2010 with the title of "the planning of intensive care units", of Ministry of Health Treatment Services General Directorate to standardize the number of NICU beds; for every 1000 live births in the region, 1 Level III and 4 Level II incubator (or open bed with radiant heater) was proposed. Level I planning was performed as 1 incubator for every 500 live births. In addition, in hospitals that include Level II or Level III NICU within, Level I units ranging from 2-10 in number, in proportion to the size of the unit, was planned. It is suggested that in the planning of

intensive care units, 60% of the total of required beds would be provided by the State Hospitals, and 40% by the university and private hospitals. Pursuant to this planning, in 2014 in Istanbul where 240.350 births happened, 240 of Level III, 960 of Level II, and at least 480 of Level I newborn beds were suggested to be determined. In the Statement of Procedures and Principles of Application Regarding The Intensive Care Facilities in Health Services with Beds, however in regions where birth numbers are below 1000/year, it is mentioned to place Level I NICUs. The literature shows that according to the formulas in which various factors were discussed, the number of newborn beds ranged between 0.7-6.5 for every 1000 live births (15-18). In the statistical analysis of Goodman et al. (19), they identified the minimum number of beds as 23.5 for every 10000 live births for the minimum newborn deaths. In the light of our study data, in Istanbul, Level I and Level II beds [Level I: 290 (15.5%), Level II: 555 (29.7%), Level III: 1025 (54.8%)] were insufficient numerically, whereas for Level III beds, it is seen that the number of beds are above these planning and assessments. Of the live newborn births in Istanbul, even they are repeated hospitalizations, 18.2% (43.731/240.350) were treated as inpatient, and about half of these newborns (47.8%) were monitored at Level III beds. All these results suggest that the distribution of neonatal beds in Istanbul is distorted.

We suggest that the scientific arrangement of the definition of the levels of beds that were stated in the newborn care and treatment standards in the Statement of Procedures and Principles of Application Regarding The Intensive Care Facilities in Health Services with Beds, the realistic determination of the number of newborn beds of the health institutions pursuant to the planning that would be carried out regarding the regional sociodemographic structures in Istanbul, developing a system that determines the reimbursement of the Social Security Institution (SSI) according to the mortality and morbidity results of the patients and regularly controls, and making all of the planning under the rational conditions with the scientific societies which would include Turkish Neonatology Society, would contribute to the improvement of the

distribution of the newborn beds in Istanbul.

Various calculations of neonatologists in their professional platforms in different countries, were performed based on different facts such as the ratio of the number of neonatologists to the number of births or number of children, the aim to achieve to reach to the numbers that would be effective on neonatal mortality, and to determine the number of neonatologists per unit. In England, for each 10.000 live births 5.83, in USA 10.37, and in Germany 21.16 neonatologists were detected (20-22). However in İstanbul, by year 2014 the ratio was 2.1, and for 2015 when the fertility rate is accepted as the same, it has risen up to 2.6. According to these calculations, the required neonatologist number in İstanbul may be determined as 140 (based on England), 249 (based on USA) and 509 (based on Germany), respectively. Goodman et al. (19) stated that to raise the number of neonatologists from 2.7 to 4.3 for each 10.000 live births had significant effect on reducing the neonatal mortality. According to this assessment, the number of neonatologists in İstanbul may be calculated as 103. The calculation of the number of neonatologists per each unit is another methodology (23). However, due to reasons such as the condition in which the hospitals placed in İstanbul should be at 3B level to host a neonatologist, and the lack of a standardization of the levels of beds that was defined with a regionalization model within the hospitals, this calculation seems not realistic. The number of neonatologists in İstanbul is inadequate, even with the 3 methods. In addition, about more than 70% of the newborn beds are in private institutions, whereas more than 60% of the newborn beds that are monitored by the neonatologists are monitored by state hospital staff. For this reason, the newborns with risk and who are ill may be transferred to the hospitals that do not have neonatologists, from the hospitals that have neonatologists. It is a serious opposition that even though the number of neonatologists is insufficient and its distribution is distorted in İstanbul, and in the Statement of Procedures and Principles of Application Regarding The Intensive Care Facilities in Health Services with Beds, reaching to the sufficient number of

neonatologists in our country is underlined, the number of the neonatology subspecialty students are limited.

While the public institutions in İstanbul mostly serve Level I and II newborn bed services, the private health institutions serve mostly Level III services. This situation may be explained by the service delivery to patients who require Level III intensive care, of the state hospitals' inadequate beds. However the higher amount of reimbursement of SSI to Level III newborn services and the hospitalization of every one of 5 babies born in İstanbul at neonatal clinics, cause a serious complexity to approach to this issue.

The limitations of our study were the lack of reliable data for the newborn mortality and morbidities, and the lack of putting forth the current situation of the secondary health professionals, including nurses which is mentioned as the most critical task in the newborn care (6).

The most important statistics that determine the modernization of the society are the data of the newborns, thus to continue the approachment of our statistics of newborn deaths to the developed countries in the recent years under rational conditions and the creation of schemes that provide not only to be alive, but also sustenance of the quality of life, would be possible with the increase of the number of the neonatologists that would be basically trained (9,20). When all the data is evaluated, it is detected that the definition of the levels of the newborn beds in İstanbul couldn't be done realistically and their distribution was distorted, the number of the neonatologists was insufficient and their work order was scattered, and they were detected to monitor a high number of newborn beds. The official statements, circulars and regulations should be updated taking in to consideration the realistic targets in providing the service provision and the neonatal health policies should be determined with the participation of all stakeholders that perform neonatal health services. As in all developed countries, in a large cosmopolitan city as İstanbul, the support of perinatal care with both regionalized approaches and addressed by central governments in the fundamental health policies stands out as a prerequisite.

## REFERENCES

1. Hacettepe Üniversitesi Nüfus Etütleri Enstitüsü, "2013 Türkiye Nüfus ve Sağlık Araştırması". Hacettepe Üniversitesi Nüfus Etütleri Enstitüsü, T.C. Kalkınma Bakanlığı ve TÜBİTAK, Ankara, Türkiye, 2014.
2. İstatistiklerle Çocuk 2014, Türkiye İstatistik Kurumu, Türkiye İstatistik Kurumu Matbaası, Ankara, 2015.
3. American Academy of Pediatrics Committee on Fetus And Newborn. Levels of neonatal care. *Pediatrics* 2012; 130: 587-97. **[CrossRef]**
4. Uslu S, Aldudak B, Özdemir H. Diyarbakır'da hasta yenidoğanın taşınması konusunda yapılan iyileştirme çalışmaları ve bebeklere yansımaları. *Türk Ped Arş* 2011; 46: 196-201. **[CrossRef]**
5. Neto MT. Perinatal care in Portugal: Effects of 15 years of a regionalized system. *Acta Paediatrica* 2006; 95: 1349-52. **[CrossRef]**
6. American Academy of Pediatrics. American College of Obstetricians and Gynecologists. Organization of perinatal health care. In: Lockwood CJ, Lemons JA (eds). *Guidelines for Perinatal Care*. 6<sup>th</sup> ed. Elk Grove Village, IL: American Academy of Pediatrics; 2007. p.1-18.
7. Rashidian A, Omidvari AH, Vali Y, Mortaz S, Yousefi-Nooraie R, Jafari M, et al. The effectiveness of regionalization of perinatal care services—a systematic review. *Public Health* 2014; 128: 872-85. **[CrossRef]**
8. Lindmark G, Langhoff-Roos J. Regional quality assessment in perinatal care. *Semin Neonatol* 2004; 9: 145-53. **[CrossRef]**
9. Bode MM, O'shea TM, Metzguer KR, Stiles AD. Perinatal regionalization and neonatal mortality in North Carolina, 1968-1994. *Am J Obstet Gynecol* 2001; 184: 1302-7. **[CrossRef]**
10. Paul VK, Singh M. Regionalized perinatal care in developing countries. *Semin Neonatol* 2004; 9: 117-24. **[CrossRef]**
11. Atasay B, Arisan S. Organization of neonatal care services and its importance. *J Perinat Med* 2003; 31: 392-4. **[CrossRef]**
12. Türkiye Cumhuriyeti İç İşleri Bakanlığı, Nüfus ve Vatandaşlık İşleri Genel Müdürlüğü, Türkiye İstatistik Kurumu Haber Bülteni, Doğum İstatistikleri 2014, Sayı:18621, 2015.
13. Bora BB, Güler C, Yentür GK. eds. T.C. Sağlık Bakanlığı, Sağlık Araştırmaları Genel Müdürlüğü, Sağlık İstatistikleri Yıllığı 2013, Sentez matbaacılık, Ankara, 2014.
14. Türkiye Kamu Hastaneleri Kurum, Kamu Hastaneleri İstatistik Yıllığı 2014. Sağlık Bakanlığı Yayın No: 1000. Ankara, 2015.
15. Morriss FH Jr, Adcock EW 3<sup>rd</sup>, Denson SE, Stoerner JW, Malloy MH, Johnson CA, et al. Determination of newborn special care bed requirements by application of queuing theory to 1975-1976 morbidity experience. *J Pediatr* 1978; 92: 668-71. **[CrossRef]**
16. Gouyon-Cornet B, Bréart G, Chabernaud JL, Dehan M, Foucaud P, Gigonnet JM, Gouyon JB, et al. Assessment by a national survey of needs for NICU and intermediate NICU in France. *Arch Pediatr*. 2003; 10: 969-78. **[CrossRef]**
17. Cooper PA, Rothberg AD, Davies VA, Herman AA. Needs for special-care beds for the newborn in the Witwatersrand area. *S Afr Med J* 1987; 71: 645-7.
18. Neogi SB, Malhotra S, Zodpey S, Mohan P. Is the number of beds in special care newborn units in India adequate? *Natl Med J India* 2014; 27: 102-4.
19. Goodman DC, Fisher ES, Little GA, Stukel TA, Chang CH, Schoendorf KS. The relation between the availability of neonatal intensive care and neonatal mortality. *N Engl J Med* 2002; 346: 1538-44. **[CrossRef]**
20. Jürges H, Juliane K. First Do No Harm. Then Do Not Cheat: DRG Upcoding in German Neonatology. *CESifo Working Paper No.4341*. DIW Berlin, 2013.
21. Royal College of Paediatrics and Child Health. *RCPCH Medical Workforce Census 2011*. London, 2013.
22. ABP Workforce data: American Board of Pediatrics, 2013.
23. Optimal Arrangements for Neonatal Intensive Care Units in the UK including guidance on their Medical Staffing. A Framework for Practice. *British Association of Perinatal Medicine*, 2014.