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The Burden of Malnutrition in the Disease Burden Recorded in Children Aged 3 To 12 Months of Mothers with SARS-Cov-2

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Abstract -The aim of the study was to identify the risk factors for neonatal morbidity associated with the four main causes of mortality in Morocco. Intrauterine hypoxia, prematurity, perinatal infection and neonatal jaundice account for 90% of neonatal deaths in Morocco. Factors associated with intrauterine hypoxia include: maternal anemia (OR :1.8 CI to 95% :1.5,3.2), placental infarction (OR :1.2 CI to 95%:1.1,2.2), parental smoking (OR :3.9 CI to95% :3.2,6.9), intrauterine growth retardation (OR :5. 6 CI to 95%:5.1,7.3) and gestational diabetes (OR :4.9, CI to95% :5.01,7.5), with regard to neonatal jaundice, the risk factors gravitate around hyperbilirubinemia (OR :1.6 CI to95% :1.2,2.5), premature birth less than 37weeks (OR :4. 6 CI to 95% :3.4,7.1), congenital hemolytic anemia (OR :3.2 CI to 95% :3.1,4.2), and blood group incompatibility (OR :2.4 CI to 95% :2.2,3.9). For risk factors of perinatal infection, the study highlighted the association with maternal age less than 25years (OR :3. 5 CI to 95% :2.7,4.3), bacterial vaginosis (OR :4.2 CI to 95% :3.9,7.5), Placenta Previa (OR :7.2 CI to 95% :5.3,8.5), and prenatal consultation frequency less than two visits (OR :6.4 CI to 95% :5.2,6.9. With regard to risk factors for neonatal infection, Escherichia coli, isolated by Cyto-Bacteriological examination, was the cause of 973 (31.9%) neonatal infections. The study highlighted several factors: premature rupture of membranes beyond 12 hours, (OR:5. 4 CI to95%:4.2,6.3), gestational age less than 37 weeks of amenorrhea (OR:4.6 CI to 95%:3.4,7.1), on the other hand, cesarean section was a protective factor against puerinatal infection (OR:0.3 CI to 95%:0.1,0.4).

Keywords: intrauterine hypoxia, neonatal jaundice, perinatal infection, and prematurity

1. Introduction

Indicators of neonatal mortality due to events occurring from birth to 28 days testify that, in certain respects, newborn survival is more determined by maternal factors, genetics, other environmental factors inherent in lifestyles and the family's socio-economic status. Knowing that indicators of preventable newborn deaths record the fragility of the performance of health system services in reducing unavoidable neonatal deaths [1]. According to the United Nations Children's Fund, newborns who die in the neonatal period present with conditions and diseases associated with the absence of quality care at birth or the absence of care provided by qualified personnel immediately after birth and in the first days of life [2]. Premature births, complications during childbirth due to birth asphyxia or lack of breathing, and infections are the cause of most neonatal deaths [3]. According to the world Bank, Morocco ranks 15th in terms of mortality rate per thousand live births [4], and the performance of hospital neonatal services largely determines the survival time of newborns. One study identified factors linked to facility management, as well as difficult working conditions marked by a low ratio of sick staff to newborn admissions, and high mortality among newborns under 7 days of age, as in most studies in our environment, the lack of mastery of emergency obstetric and neonatal care and neonatal resuscitation, as well as the delay in referring newborns referred from other health structures, present a significantly higher mortality rate, which can be explained by the delay in the decision to refer newborns to appropriate structures for their care, as well as the availability of means of transport that are not suitable for ensuring adequate and immediate care as soon as the newborn is referred

to an appropriate neonatology unit [5].By its nature, neonatal infection is considered to be alterations of the organism mainly due to group B streptococcus and Escherichia-coli, generally contracted during or after birth [6]. In Morocco, ore particularly infections bacterial neonatal infections which constitute a public health problem, since their incidence varies from 0.5 to 1% of births in industrial countries but remains higher (3 to 5%) in developing countries. In Morocco, neonatal infection is the cause of more than 16% of perinatal mortality [7]. The evaluation of the performance of management of neonatal infections involves the choice of criteria to demonstrate this, then of indicators allowing these criteria to be measured. In this regard, the world health organization has established standards to measure the performance of the hospital service in terms of average length of stay (ALS), average occupancy rate (AOR), rotation interval (RT) in order to evaluate the effectiveness, efficiency and quality of care for each hospital service [8]. These measures are linked by a functional relationship between them and are used to identify or evaluate the efficiency of a hospital such as the average occupancy rate and the average length of stay, on the one hand and the average length of stay and rotation interval (RT) of the other. However, separately, they provide only an incomplete partial picture of hospital effectiveness and efficiency [9] (see Table 1,2), and figure 1.

Table 1: Effectiveness measurement

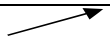
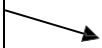
Average occupancy rate				
Average length of stay				
Efficiency level	Efficiency total	No efficiency	Efficiency doubtful	Debatable effectiveness

Table 2: Measurement of efficiency and quality

Average length of stay				
Rotation interval				
Efficiency and care quality	Efficiency but poor care quality	Poor efficiency and quality of care	Efficiency and better quality of care	Poor efficiency and better quality of care

2. Materials and Methods

2.1 Study design and setting

A cross-sectional observational study was conducted on 360 newborns born at the twelve regional pediatric centers of Morocco, admitted to the neonatology unit at the regional pediatric services of Morocco, from May 1 to July 31, 2023

2.2 Study population

The sample selected for this study was designed to reflect as closely as possible the heterogeneity represented in the target population. Cluster-type probability sampling seemed to be the most appropriate for this study. This type of sampling allows researchers to divide the population into internal heterogeneous and external homogeneous sub-populations. The sample size depended on the representativeness of newborns less than 29 days from birth, the desired degree of precision, and the 95% confidence level, i.e. anα risk of 5%. The formula for determining the sample size (n) depends on: α= risk set at 5%, so Zα=1.96, i=precision level of 5%. The expected proportion is unknown, due to the absence of similar studies has been set at 50%.

2.3 *Data collection*

The study included newborns admitted to the neonatal unit of twelve neonatal units of regional pediatric services

in Morocco. They were followed for up to 28 days to determine their chances of survival. The study was based on Neonatal Unit Management Criteria: DMS, TOM, IROT used pragmatic criteria to define the eligible population [10]. As well as pragmatic criteria (birth weight, gestational age in weeks) and management criteria (use of therapeutic intravenous antibiotics, phototherapy within the first 24 hours, cardiopulmonary resuscitation, vasoactive drugs, anticonvulsants, administration of surfactants, blood products, steroids to treat refractory hypoglycemia) [10]. Data were extracted using a pre-tested structured questionnaire. Variables likely to assess the performance of the 12 neonatal units in maintaining newborn survival, ,premature infants at service level, included maternal age, socio-economic status, level of education, occupation, social security coverage, place of residence, references, marital status, parity, antenatal care visits (ANC), history of abortion, stillbirth, premature rupture of membrane (PROM), gestational age (GA), mode of delivery presentation, birth weight, APGAR score at birth and 5 minutes after birth, use of therapeutic intravenous antibiotics, continuous nasal positive airway pressure, intubation, phototherapy within the first 24 hours, cardiopulmonary resuscitation, vasoactive drugs, anticonvulsants, administration of surfactants, blood products, steroids to treat refractory hypoglycemia, and any surgical intervention.

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3.3 *Statistical analysis*

Prior to analysis, data entry was double-checked to increase validity and accuracy. Data were then entered into Epi Data and exported to Statistical Software for the Social Sciences (SPSS version 23.0, IBM Corp., Armonk, NY), and descriptive and analytical procedures were implemented, followed by descriptive statistics such as frequencies and cross-tabulations. Data analysis was performed using the chi-square test and Fisher's exact test where appropriate, with a significance level of 5%. Results were presented in text and table format.

3.4 *Ethical considerations*

study protocol was approved by the Ethics Committee of the Faculty of Medicine and Pharmacy, Mohammed University, Rabat, Morocco. Data collectors and supervisors were trained and a pre-test was carried out. Approximately 20 participants were informed of the study objectives and methods, and oral and written consent was obtained. The confidentiality of their participation and the anonymity of their data were assured. Throughout the data collection process, data collectors were supervised and regular meetings were held to resolve any problems.

4. Results

Among the 3048 mothers of newborns admitted to the twelve neonatal intensive care units, 1982(66%) were under 25 years of age, 1372(45%) of the newborns of mothers with low socio-economic status, of whom 1371.6 (45%) lived in rural areas. With regard to the educational level of mothers of newborns1372(45%) have a primary level in 884(29%) cases. As for the social status of mothers, 1371(45%) are single. In terms of social security coverage, 58% of the study population belonged to the lowest social class in Morocco (Table 1).

5. Results

5.1 *Sociodemographic characteristics of the study population*

Table1: Sociodemographic characteristics among mother's population

Age of mother in years and percentage (%)	Effectif
<25	1982(66)
>25	1066(34)
Residence	
Urban	1676.4(55)
Rural	1371.6(45)
Socioeconomic status	
Low	1372(45)
Medium	1066(35)
Higher	609(20)
Educational level	
University	183(6)
Secondary	610(20)
Primary	1372(45)
illiterate	884(29)
Marital status	
Married	1677(55)
Single	1371(45)
Medical coverage	
No	701(23)
Medical assistance regime	1066(35)
National fund of social Welfare Organizations	457(15)
National social security Fund	640(21)
Private insurance	182(6)

5.2 Gyneco-obstetric characteristics of mothers

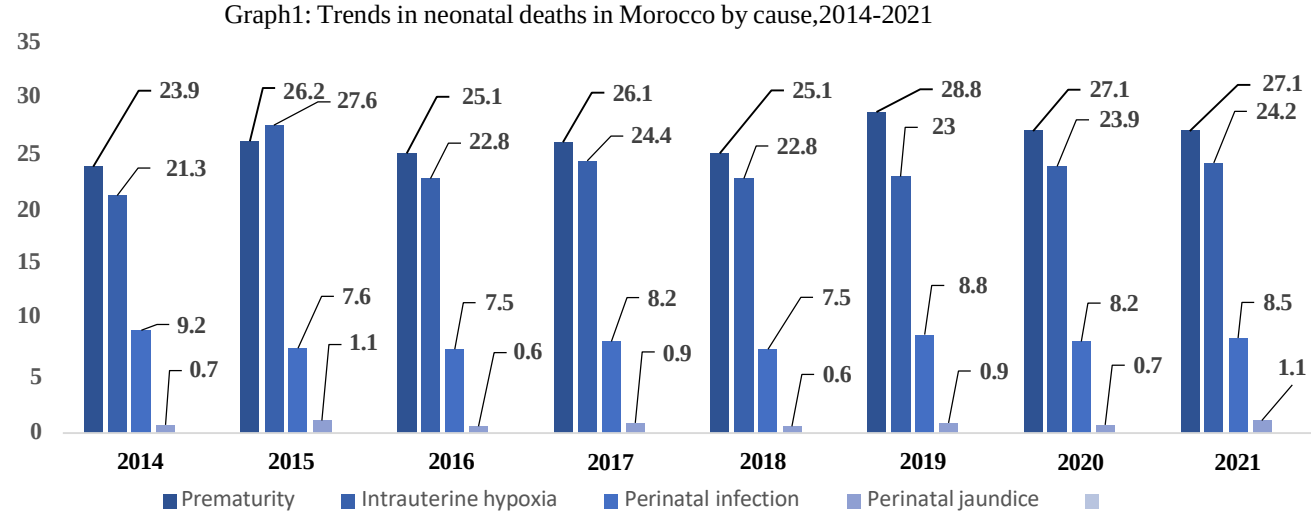
Table 2 : Obstetric characteristics of mothers

Parity	
Primiparous	1280,16(42)
Multiparous	1767.84(58)
Antenatal care follow-up	
≤2	2148(70.5)
≥2	900(29.5)
During of labor	
≤12 Hr.	345(16.2)
≥12 Hr.	2704(83,8)
Mode of delivery	
Vaginal deliveries	2286(75)
Cesarean section	762(25)
Appearance of amniotic fluid	
Meconium	1075(35.3)
Clear	1972(64.7)

Approximately 1468(58%) of the mothers participating in the study were multiparous, 900 (70.5%) had antenatal consultations, of which more than three thirds (1859, 78.5%) had incomplete antenatal consultations 2148(70.5%) (<4). Some 2704(83.8) experienced a duration of labor during delivery that exceeded 12h. With regard to mode of delivery, 2286(75%) gave birth vaginally, however, 762(25%) were cesareanized. Mothers had pathologies during pregnancy: hypertension (25%), diabetes (34%), complications leading to caesarean delivery (25.4%) and PROM (18.5%).

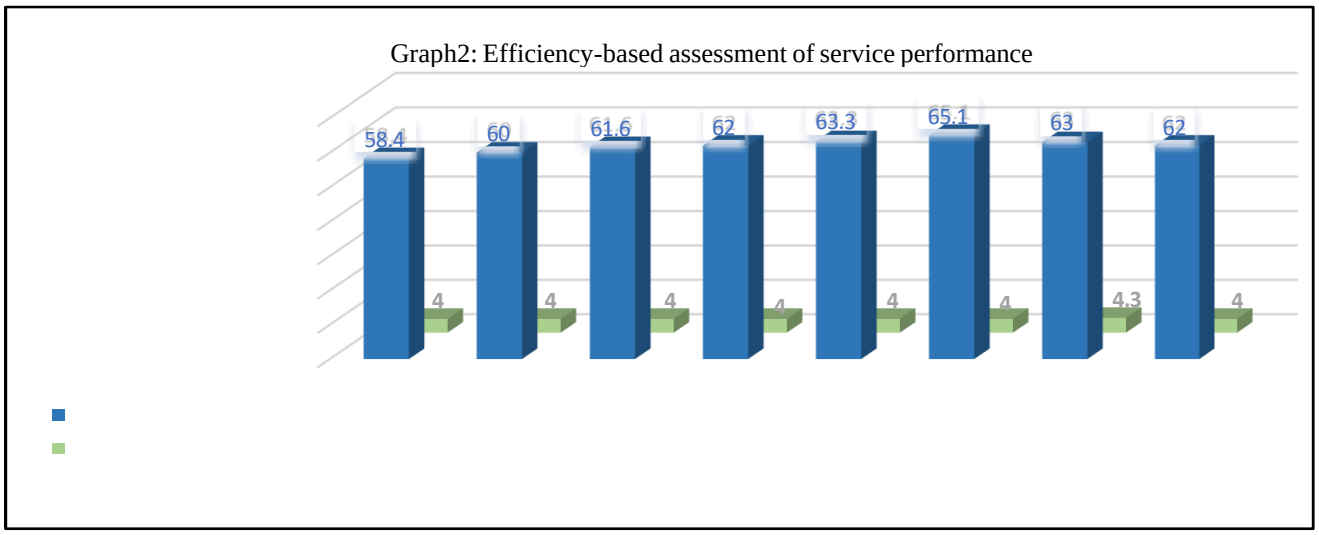
5.2. *Performance results for twelve neonatal units in Morocco*

Graph1: Trends in neonatal deaths in Morocco by cause,2014-2021



The main causes of neonatal mortality in Morocco are prematurity in 28% of cases, followed by intra- uterine hypoxia in 24.2% of cases, perinatal infection in 8.5% of cases, and neonatal jaundice in 1.1% of cases.

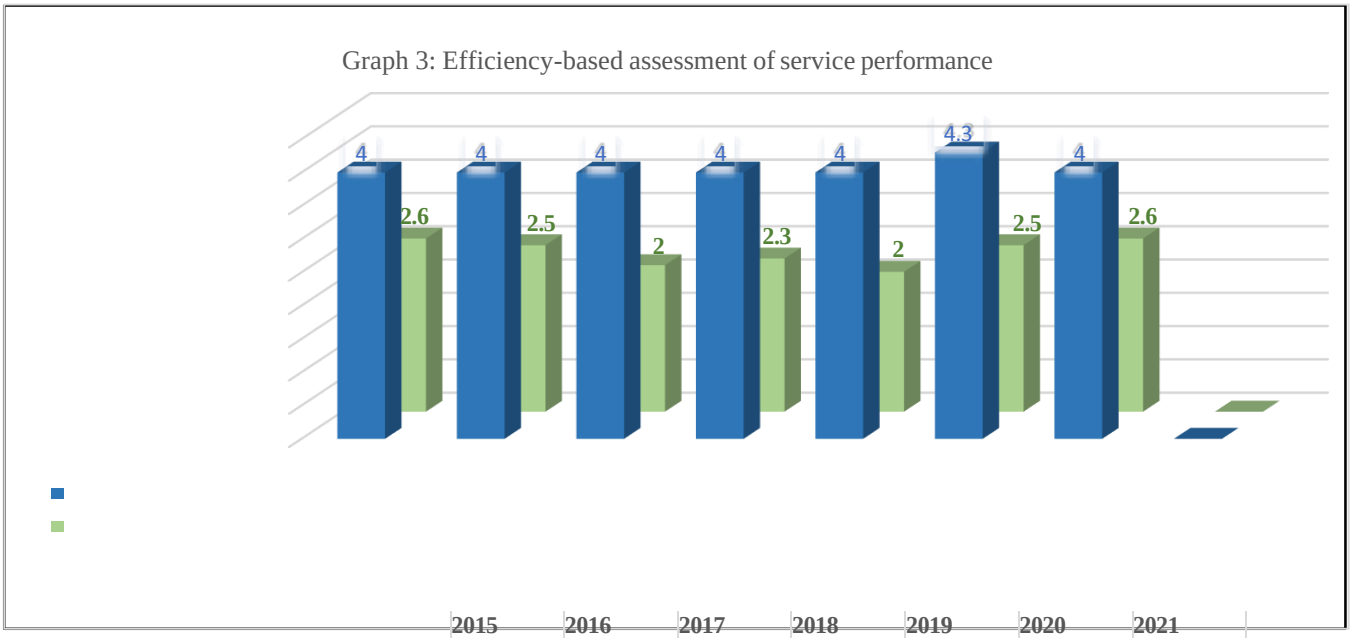
Graph2: Efficiency-based assessment of service performance



	2014	2015	2016	2017	2018	2019	2020	2021
Average occupany rate	58.4	60	61.6	62	63.3	65.1	63	62
Mean length of stay	4	4	4	4	4	4	4.3	4

The neonatology service at the 12 regional units in Morocco have seen the average occupancy rate rise steadily, with estimates from the Ministry of Health noting that 6034763 newborns were hospitalized at the twelve Moroccan regional neonatal units. However, the average occupancy rate stagnated from 2014 until 2019, which but from 2019, the rate fell until 2021, this said, the efficiency of the neonatology care service notes a questionable efficiency

Graph 3: Efficiency-based assessment of service performance



	2015	2016	2017	2018	2019	2020	2021	
Mean length of stay	4	4	4	4	4	4.3	4	0
Rotation Interval	2.6	2.5	2.2	2.3	2.1	2.5	2.6	0

The graph above shows a stable average length of stay from 2015 to 2019, followed by an increase from 2019 to 2020. However, the rotation interval experienced a regression from 2015 to 2019, followed by an ascent in MDS

from 2019 to 2021.the period from 2020 to 2021, which demonstrates a better degree of quality of care, this while efficiency remains questionable at the level of Morocco's twelve regional neonatal units 24h/24h medicalized, it ends at 16h.

5.3 . *Risk factors*

5.3.1 Intrauterine hypoxia

Table1: Logistic regression analysis of the association between intrauterine hypoxia and risk factor in Morocco from 2017 to 2021.

	Cases No. %	Controls %	No.OR	95%CI	Adjusted OR[a]	95%CI	*P*
Gestational age (37–38)	1395(45%)	1653(54%)	2.3	[1.1,2.5]	2.1	[1.07,2.5]	<0.001
Hb<12g/dl	856(28%)	2192(72%)	2.7	[2.7,3.4]	1.8	[1.5,3.2]	<0.005
Placental infarction	319(10.46%)	2729(89.54)	1.9	[1.4,2.5]	1.2	[1.1,2.2]	<0.001
Umbilical cord occlusion	793(26.01%)	2255(73.99)	2.3	[2.1,3.8]	2.2	[1.01,2.3]	<0.001
Epidural analgesia	219(7.18%)	2829(92,82)	2.1	[1.9,8.5]	1.9	[1.52,7.4]	<0.001
Apgar score at 5 minutes <7	956(31.3%)	2092(68,7)	2.12	[2.1,6.5]	1.7	[1.1,2.5]	<0.003
Apgar score at 10 minutes <5	729(23.91%)	2319(76.09)	3.4	[2.2.4,9]	3.2	[3.1,4.2]	<0.005
Smoking	682(22.37%)	2366(77,63)	4.5	[4.3,7.5]	3.9	[3.2,6.9]	<0.005
Depression	1563(51.2%)	1485(48,8)	3.4	[3.1,5.8]	2.5	[2.3,4.6]	<0.001
Intrauterine growth retardation	765(25%)	2283(75)	6,5	[6.4,9.7]	5.6	[5.1,7.3]	<0.001
Gestational Diabetes	974(31.9%)	2074(68,1)	5.2	[5.1,9.5]	4.9	[4.01,7.5]	<0.001

Abbreviations and acronyms: CI, confidence interval; OR, odds ratio; Hb Hemoglobin, a: Adjusted for intrauterine hypoxia: gestational age, Hemoglobin, placental infarction, Umbilical cord occlusion, Epidural analgesia, Apgar score at 5 minutes <7, Apgar score at 10 minutes <5, Smoking, Depression, Intrauterine growth retardation and gestational diabetes, Values may not sum to totals because of missing data.About half (45%) of newborns from 3048 births had intrauterine hypoxia; born between 37 and 38 weeks' amenorrhea, first risk factor [Odds ratio: 2.1, 95% confidence interval (CI): 1.07,2.1]. In bivariate analysis, the factors associated with intrauterine hypoxia included the rate of hemoglobin<12g/dl, [OR:1.8; CI to 95%:1.5,3.2]; Placental infarction [OR:1.2, CI to 95%:1.1,2.2], Umbilical cord occlusion [OR:2.2; CI to 95%:1.01,2.3], Epidural analgesia [OR:1.9, CI to 95%: 1.52,7.4], Apgar score at 5 minutes <7[OR:1.7: CI to 95%: 1.1:2.5],Apgar score at 10 minutes <5 [OR:3.2,CI to 95%:3.1,4.2],Smoking[OR: 3.9,95% CI: 3.2,6.9],Depression[OR: 2.5,CI to 95%: 2.3, 4.6], Intrauterine growth retardation[OR: 5.6,CI to 95%:5.1,7.3],and Gestational Diabetes [OR:4.9,CI to 95%:4.01,7.5],Hypoxia, was confirmed by culture. Note that intrauterine hypoxia is inextricably linked to a variety of maternal, placental and fetal conditions that can appear differently, namely preplacental hypoxia and uteroplacental hypoxia, where maternal oxygenation is normal. Recall that one of the main complications of chronic hypoxia is the inability of the fetus to reach its genetic growth potential [10], therefore researchers have suggested classifying hypoxic conditions into 3 subtypes: l preplacental

hypoxia, where the mother and fetus are both hypoxic, particularly in cases of cyanotic maternal heart disease; uteroplacental hypoxia, where maternal oxygenation is normal but uteroplacental circulation is impaired, Pre-eclampsia characterized by placental insufficiency, post placental hypoxia [11].

5.3.2 puerinatal jaundice

Table 2 : Logistic regression analysis of the association between puerinatal jaundice and neonatal Risk factors in Morocco from 2017 to 2021.

	Cases No. %	Controls No. %	OR	95%CI	Adjusted OR[a]	95%CI	*p*
Spontaneous vaginal delivery	973(31.9)	2075(68)	4.3	[3.1,6.5]	3.7	[2.6,4.9]	<0.001
Hyperbilirubinemia	356(11.6)	2692(88)	2.7	[1.9,3.2]	1.6	[1.2,2.5]	<0.003
Premature birth<37WG	723(24)	2325(76)	5.9	[3.9,7.1]	4.6	[3.4,7.1]	<0.001
Umbilical cord occlusion	345(11.3)	2703(73)	6.1	[5.1,9.4]	5.4	[4.2,6.3]	<0.001
Breech foetal presentation	495(16.24)	2553(83)	7.3	[4.7,8.3]	6.2	[6.1,8.4]	<0.003
Sibling history	537(17.6)	2511(82)	2.2	[2.1,3.5]	1.4	[1.3,1.9]	<0.005
Congenital hemolytic anemia	914,4(30)	2319(70)	3.4	[2.2.4,9]	3.2	[3.1,4.2]	<0.001
Intrauterine growth retardation	691(22.37)	2357(77)	5.3	[4.3,7.5]	4.9	[4.3,7.9]	<0.001
Poor sucking or feeding	867(28.4)	2172(71)	7.9	[6.3,8.5]	6.3	[5.2,7.1]	<0.005
Intrauterine growth retardation	908(25%)	2140(75)	9,2	[6.4,9.7]	7.4	[4.3,7.9]	<0.001
Blood type incompatibility	323(10.5)	2725(89)	3.1	[2.7,4.5]	2.4	[2.2,3.9]	<0.005

Almost a third (31.9%) of the 3048 newborns with jaundice resulted from spontaneous vaginal delivery [OR:3.7; 95% CI:2.6,4.9]. In bivariate analysis, factors associated with neonatal jaundice included hyperbilirubinemia [OR:1.6.; 95% CI :1.2,2.5]; history of umbilical cord occlusion [OR:5.4; 95% CI:4.2,6. 3], breech fetal presentation[OR:6.2; 95% CI:6.1,8.4]; sibling history of neonatal jaundice[OR:1.4; 95% CI:1.3,1.9], congenital hemolytic anemia[OR:3. 2; 95% CI:3.1,4.2],intrauterine growth retardation[OR:4.9, 95% CI:4.3,7.9],Poor sucking [OR:6.3; 95% CI:5.2,7.1] and blood group incompatibility[OR:2.4; 95% CI:2.2,3.9].

Regarding premature births, more than half of births (64.9%) were exposed in utero to passive smoking, either from the mother or the father. In bivariate analysis, factors associated with premature birth included, drug use [OR:1.6; 95% CI:1.4,2.5], Lower socioeconomic [OR:6.2; 95% CI:5.3,9.9], illiteracy [OR:6.9; 95% CI: 6.1,8.4], mother's age less than 25 years [OR: 3.5; 95% CI:2.7,4.3], [OR:1.6; 95% CI:2.3,5.1], bacterial vaginosis [OR:4.2; 95% CI:3.9,7.5],

placenta Previa [OR:7.2; 95% CI:5.3.4,8.5], Gestational diabetes [OR:2.4; CI:2.3,4.2], Antenatal care follow-up<2 [OR:6.4; 95% CI:5.2,6.9].

5.3.3 Premature births

Table3 : Logistic regression analysis of the association between premature and neonatal Period risk factors in Morocco from 2017 to 2021.

	Cases Nob. %	Controls No.OR %	95%CI	Adjusted OR[a]	95%CI	*P*
Smoking	1979(64.9)	1069(35.7) 6.7	[5.9,8.2]	5.3	[4.5,6.7]	<0.000
Female sex of newborn	2134(70)	2692(30) 5.9	[4.8,6.1]	4.6	[4.3,7.3]	<0.001
Drug use	223 (7.3)	2825(76) 2.4	[2.1,3.2]	1.6	[1.4,2.5]	<0.001
Lower socioeconomic	2189(71)	859(29) 9.6	[7.4,9.8]	6.2	[5.3,9.9]	<0.005
Illiterate	879(28.8)	2151(71,2) 7.3	[4.7,8.3]	6.9	[6.1,8.4]	<0.003
Age of Mother ≤25	1997(65.5)	1051(34.5) 4.3	[4.2,5.6]	3.5	[2.7,4.3]	<0.001
Gestational diabetes	914,4(34.5)	2134(70) 3.2	[2.8,4,1]	2.4	[2.3,4.2]	<0.005
Bacterial vaginosis	689(22.6)	2359(77,4) 6.2	[5.3,7.9]	4.2	[3.9,7.5]	<0.001
Placenta Previa	987(67.6%)	2061(91.3) 8,2	[7.3,9.4]	7.2	[5.3,8.5]	<0.005
ANC<2	2150(70.5)	890(29.5) 7.1	[6.7,8.3]	6.4	[5.2,6.9]	<0.001

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5.3.4 puerinatal infection

Table 4: Logistic regression analysis of the association between puerinatal infection and neonatal Period risk factors in Morocco from 2017 t

	Cases Nob. %	Controls No.OR %	95%CI	Adjusted OR[a]	95%CI	*P*
Escherichia coli	973(31.9)	2075(68) 4.3	[3.1,6.5]	3.7	[2.6,4.9]	<0.001
Female sex of newborn	356(11.6)	2692(88) 2.7	[1.9,3.2]	1.6	[1.2,2.5]	<0.001
Gestational age<37WG	723(24)	2325(76) 5.9	[3.9,7.1]	4.6	[3.4,7.1]	<0.001
PROM>12H	345(11.3)	2703(73.99) 6.1	[5.1,9.4]	5.4	[4.2,6.3]	<0.001
Oligohydramnios	495(16.24)	2553(83,7) 7.3	[4.7,8.3]	6.2	[6.1,8.4]	<0.001
Sibling history	537(17.6)	2511(82,4) 2.2	[2.1,3.5]	1.4	[1.3,1.9]	<0.00

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Congenital hemolytic anemia	914,4(30)	2319(70)	3.4	[2.2.4,9]	3.2	[3.1,4.2]	<0.003

Regarding births with puerinatal infection, Escherichia coli was isolated by Cyto-Bacteriological examination of urine, analyzing the mother's urine, as a routine examination upon admission to the maternity ward. More than a third of newborns contracted Escherichia coli [OR:3.7; 95% CI:2.6,4.9]. In bivariate analysis, factors associated with premature birth included, female sex of the newborn [OR:1.6; 95% CI: 1.2, 2.5], the gestational age of the mother less than 37 weeks of amenorrhea [OR: 4.6; 95% CI: 3.4, 7.1], premature rupture of membranes beyond 12 hours, [OR: 5.4; 95% CI:4.2,6.3], Oligohydramnios [OR:6.2; 95% CI: 6.1.8.4], Sibling history [OR: 1.4; 95% CI: 1.3, 1.9], Congenital hemolytic anemia [OR: 3.2; 95% CI:3.1,4.2], Intrauterine growth restriction [OR:4.9 95% CI:4.3,7.9], Poor feeding suction [OR:6.3 95% CI:4.3,7.9], Group incompatibility blood [OR:2.4 95% CI:2.2,3.9], Vaginal births [OR:4.7 95% CI:3.7,5.2], Caesarean section [OR:0.3 95% CI: 0.1,0.4], Use of forceps/aspirator [OR:0.2 95% CI:0.1,0.5], Amniotic fluid appearance Clear [OR:0.2 95% CI:0.3,0.4], Amniotic fluid appearance Meconium [OR:4.2 95% CI:3.2,6.9].

6. Discussion

Many maternal-fetal and hospital management factors can affect the perinatal health of newborns. A range of fetal and maternal factors, including fetal sex, mode of delivery, gestational age at birth, low hemoglobin, adverse pregnancy history, amniotic fluid, umbilical cord occlusion, placenta and Apgar score, were included in this study. This prospective case-control study showed that birth weight, amniotic fluid contamination, 5- minute Apgar score, and 10-minute Apgar score may have some effect on IH. More specifically, gestational diabetes, smoking, as well as epidural analgesia, placental infarction, depression, low 5-minute Apgar score (≤7) and low 10-minute Apgar score (≤5) may increase the risk. HI in infants. Gestational age less than 37 weeks. The study highlighted the association between intrauterine hypoxia and intrauterine growth retardation (OR: 4.9 95% CI: 5.1,7.3), this is in perfect agreement with the results of a systematic review which highlighted abnormal implantation of the placenta in complicated pregnancies due to IUGR, caused by gestational hypertension which increases the risk for the mother and fetus of developing cardiovascular disease later in life [12], [13]. Common complications related to hypoxia include meconium aspiration, cerebral palsy, and cognitive dysfunction [14]. Acute and chronic hypoxia are also associated with a variety of fetal and functional cardiac changes aimed at compensating for reduced oxygenation to vital organs [15]. Smoking and primiparity expose more people to intrauterine hypoxia (OR: 3.9, 95% CI, 3.2, 6.9), this is perfectly consistent with the results of a study which demonstrated that maternal tobacco consumption doubles the risk of intrauterine fetal death in 10% of late intrauterine fetal deaths have been attributed to tobacco [16], as well as to malformations linked to the development of the neural tube [17]. The study results confirmed that gestational diabetes is the primary risk factor for exposure to intrauterine hypoxia (OR: 6.9, 95% CI 5.01, 7.5), but they corroborate the results of a study carried out in Romania which highlighted [18]. Gestational diabetes was diagnosed in 974 (31.9%), as well as depression in 1,563 (51.2%) women and placental infarction 319 (10.46%). Was significantly associated with intrauterine hypoxia, respectively (OR: 6.9, 95% CI 5.01, 7.5), (OR: 2.5, 95% CI 2.3, 4.6) and (OR: 1.2, 95% CI 1.1, 2.2). These

results corroborate a study carried out on intra-partial cardio to graphic patterns linked to hypoxia (OR 1.94, 95% CI 1.64–2.34) as well as the results of Apgar scores (< 5 and 7 min) (OR 6.64, 95% CI 1.84-12.03) were observed in women with gestational diabetes compared to those who did not have it [19], remember that the Apgar score is used as an indicator to judge the degree of neonatal asphyxia.

Regarding the factors relating to neonatal jaundice, this study highlighted a number of associated factors, including gestational age less than 37 weeks (OR:4.6, 95% CI 3.4,7.1) Hyperbilirubinemia (OR:1.6 , 95% CI 1.2,2.5) premature birth (OR:4.6, 95% CI 3.4,7.1) umbilical cord occlusion (OR:5.4, 95% CI 4.2,6.3), congenital hemolytic anemia (OR:3.2, 95% CI 3.1,4.2) blood type incapability (OR:2.4, 95% CI2.2,3.9).In this regard, a study recommended that to reduce the risks associated with neonatal jaundice upon discharge from the hospital,

carried out individualized monitoring for each infant and independently of gestational age at birth [20]. The study revealed that neonatal hyperbilirubinemia was a risk factor for neonatal jaundice (OR

:1.6, 95% CI 1.2,2.5), however, it corroborates with the results of a systematic review study conducted in China, which identified other factors of hyperbilirubinemia which were exclusive breastfeeding (OR = 1.74, 95% CI: 1.42, 2.12, Z = 5 .43, P<0.00001), glucose-6-phosphate

dehydrogenase deficiency (G6PD: OR = 1.62, 95% CI: 1.44, 1.81, Z = 8.39, P<0. 00001), maternal-fetal ABO blood group incompatibility (OR = 1.64, 95% CI: 1.42, 1.89, Z = 6.75, P < 0.00001); and premature birth (PTB: OR = 1.31, 95% CI: 1.17, 1.47, Z = 4.60, P < 0.00001) [20]. Remember that neonatal hyperbilirubinemia is common in healthy newborns and usually disappears spontaneously [21] Excess unconjugated bilirubin in plasma is the result of a transient imbalance between bilirubin production, originating mainly from the breakdown of red blood cells, the concentration of which is higher and whose lifespan is shorter than in adults [22].

Regarding the factors of exposure to the risk of prematurity, the statistical analysis of the following variables

was significantly associated with prematurity: maternal age less than 25 years, tobacco, female sex of the newborn, low socioeconomic status, diabetes, bacterial vaginosis, placenta-previa, and inadequate prenatal care. Remember that premature births, intrapartum complications, discontinuity of care, infections, and congenital malformations are the cause of most neonatal deaths [23].

Maternal age has an influence on the occurrence of premature birth. Women (under 25 years old) presented an association with premature birth, which corroborates the existing literature [24]. A cohort study on the influence of maternal age on the risk of prematurity carried out showed that the risk of premature birth increased with maternal age, reaching a relative risk 7.5 times higher in women up to the age of 16 [25]. In another study, even in places with lower income, women over 40 had 2.6 preterm births [26]. Gestational diabetes and placenta previa were linearly associated with increased exposure to premature births, in multivariate analysis the present study showed that gestational diabetes increases the risk of premature births by 24% (OR: 2.4 95% CI 2.3,5.1), this agrees with the results of a study carried out in Hubei, China (OR 2.5; 95% CI: 2.3, 2.9) [27]. The study also demonstrated that placenta previa exposes you to the risk of prematurity (OR: 7.2, 95% CI 5.3, 8.5), this is consistent with the results of a study on the risk factors for prematurity (OR 1.8; 95% CI).: 1.5, 2.2) [28]. Regarding the effect of prenatal monitoring on the birth of premature babies, the multivariate analysis shows that the risk of prematurity increases by six times (OR: 6.4; CI to 95% :5.2,6.9). The concordant results of a study carried out on a study on morbidity and mortality in Burkina Faso, which focused on the factors of death of prematurity, highlighted that the multivariate analysis that prematurity depends largely on rhythm of consultations prenatal (OR: 3.44; CI to 95% 1.26- 9.35) [29].

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