Iperbilirubinemia neonatale

Applicazione delle raccomandazioni dell'American Academy of Pediatrics (AAP)

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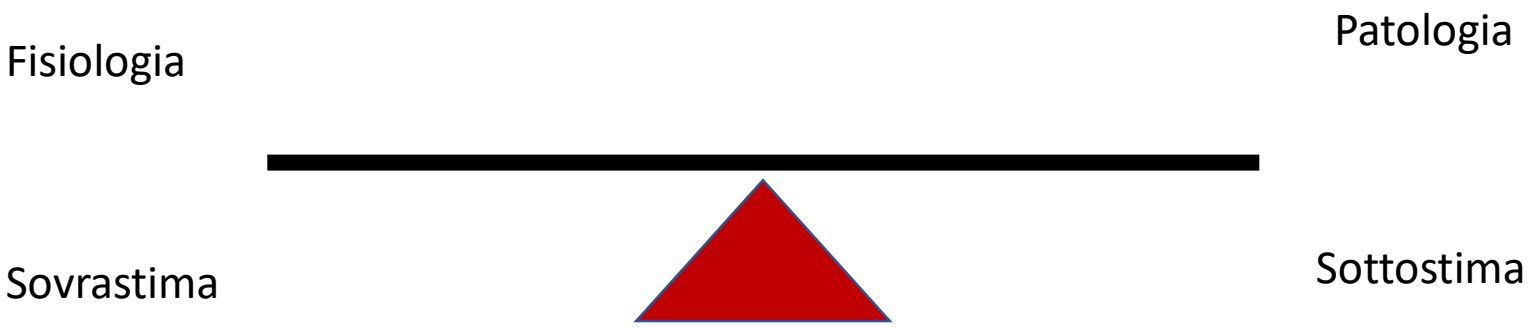
Iperbilirubinemia neonatale

Colpisce il 60% dei neonati a termine e l'80% dei neonati pretermine

Pratiche virtuose come il clampaggio ritardato del cordone ombelicale e l'allattamento al seno esclusivo sembrano aumentare la frequenza dell'iperbilirubinemia neonatale

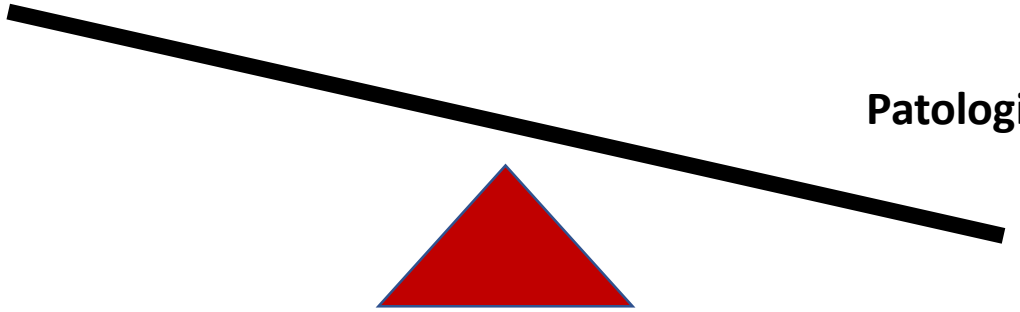
Costituisce la causa del 35% delle riammissioni ospedaliere nel primo mese di vita

Ha ancora un forte impatto in termini di mortalità e morbidità a livello mondiale (114.000 decessi e oltre 63.000 sopravvissuti con sequele neurologiche a lungo termine)



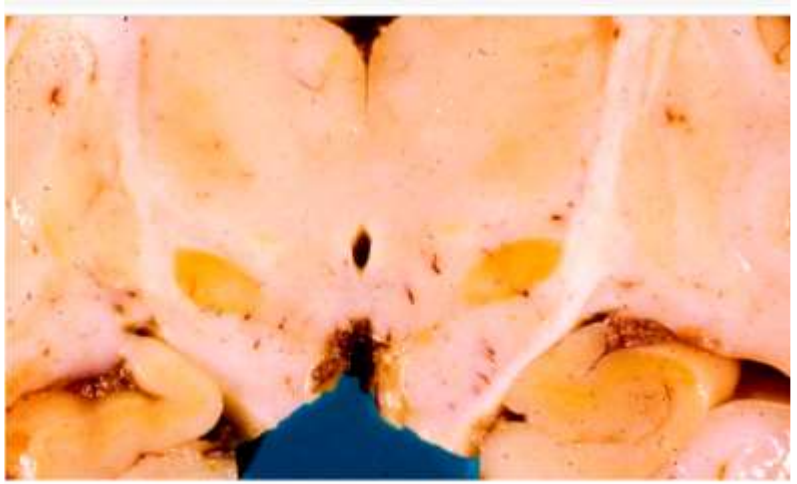
Tossicità da bilirubina

Fisiologia



Patologia

Prematurità
Ipoalbuminemia
Emolisi
Sepsi
Necessità di cure intensive nelle prime 24 h



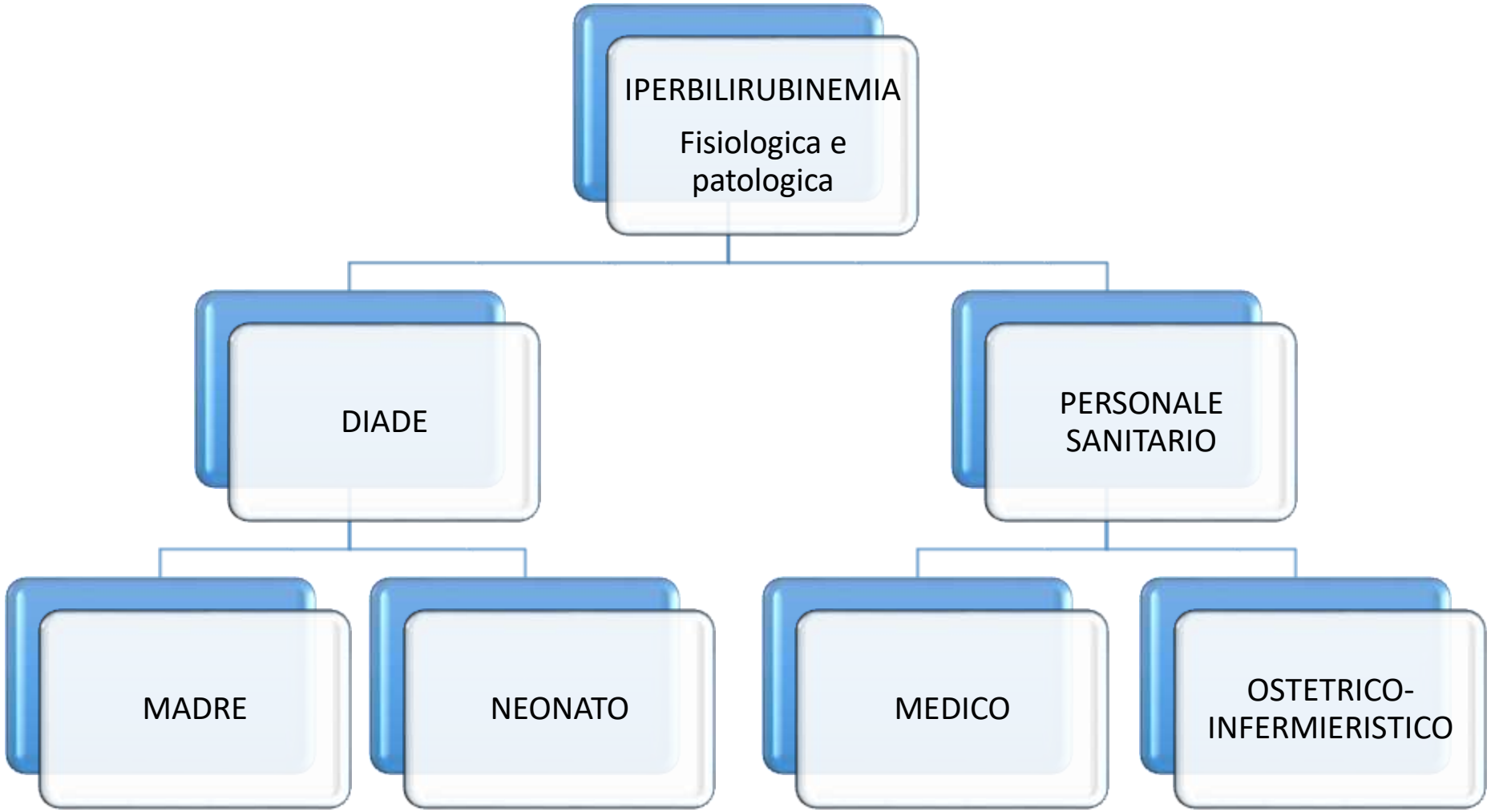
BIND

Bilirubin Induced Neurological Damage: Never Event

Danno neuronale citotossico con apoptosi (nuclei della base)
ABE (*acute bilirubin encephalopathy*)
CBE (*chronic bilirubin encephalopathy > Kernittero)*

Sintomi e segni variabili a carico del linguaggio, della propriocezione, della vista, dello sviluppo cognitivo

“if you can't describe what you are doing as a process, you don't know what you're doing”
W. Edwards Deming



Primum movens

Iperbilirubinemia neonatale
Analisi della qualità

Plus

L’ittero non è misura attendibile del grado di iperbilirubinemia (oggettività)

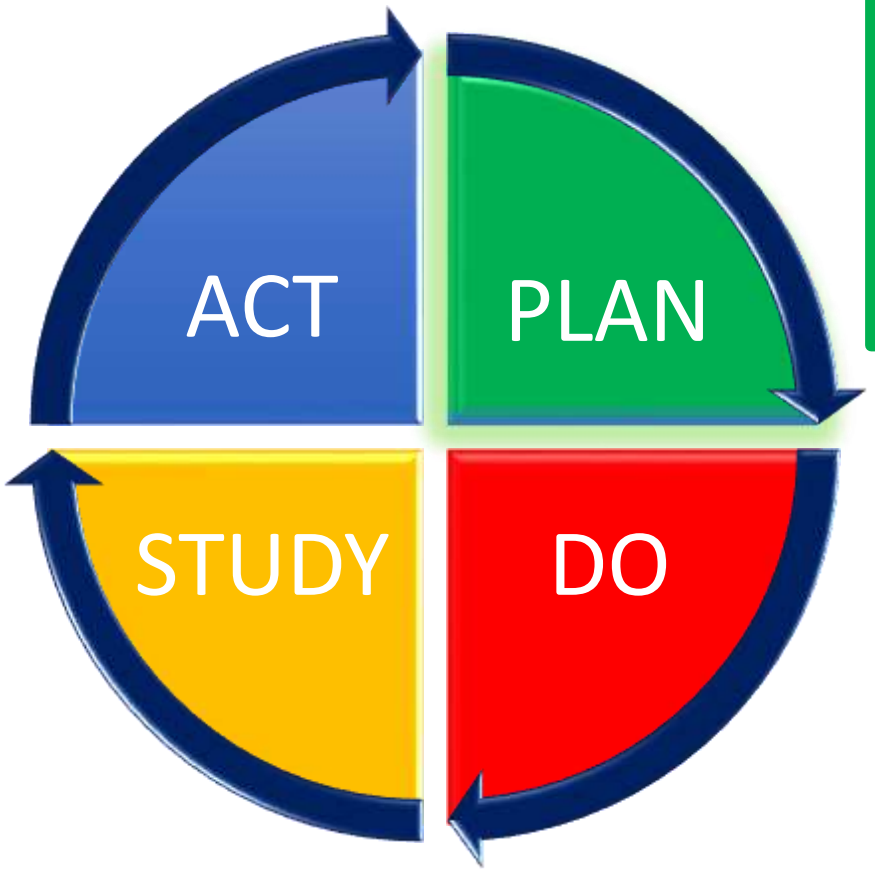
La bilirubina (transcutanea e/o sierica) deve essere dosata a tutti i neonati (universale)

Soglie «dinamiche» (ore di vita, età gestazionale, fattori di rischio)

Previsionalità

Dati

Ciclo di Deming



Studia il tuo setting

Pianifica il cambiamento

Poniti un obiettivo **SMART**

Cosa ti aspetti che accada? Perché?

Il setting

U.O Neonatologia Ospedale Versilia

2° livello base

UTIN + patologia neonatale

Neonati con EG ≥ 29 settimane; ≥ 1000 g

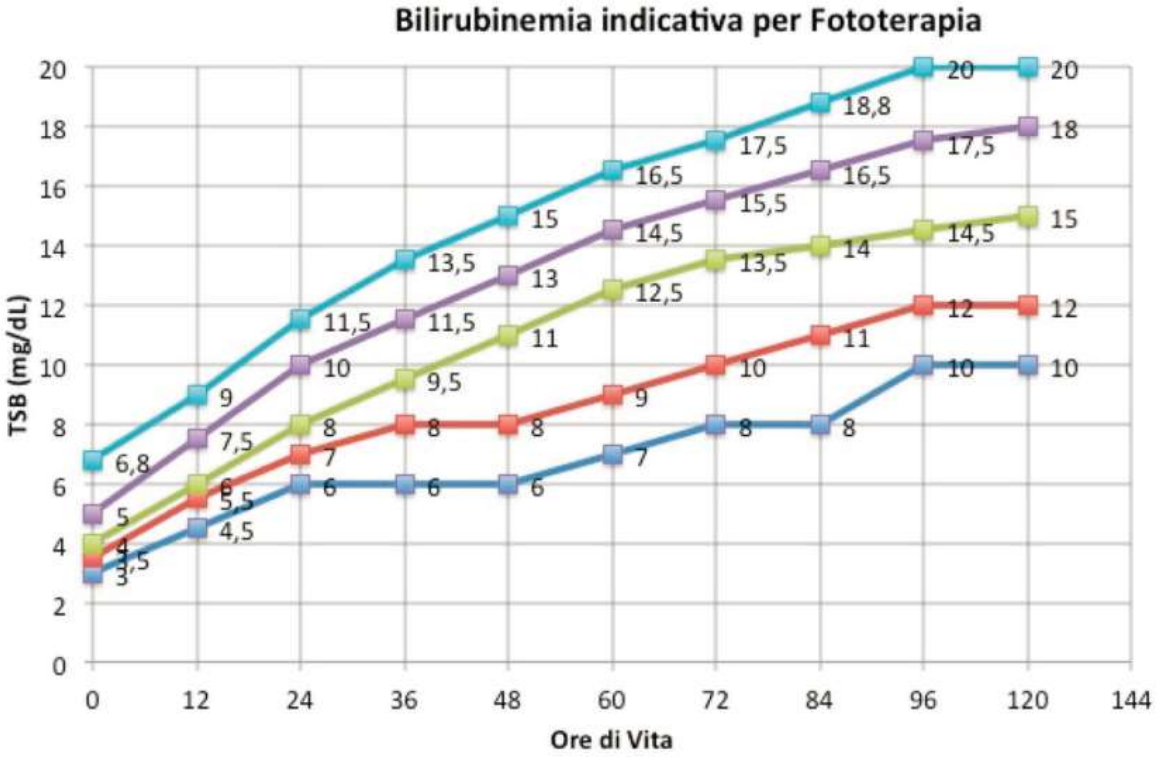
2023: 923 nati

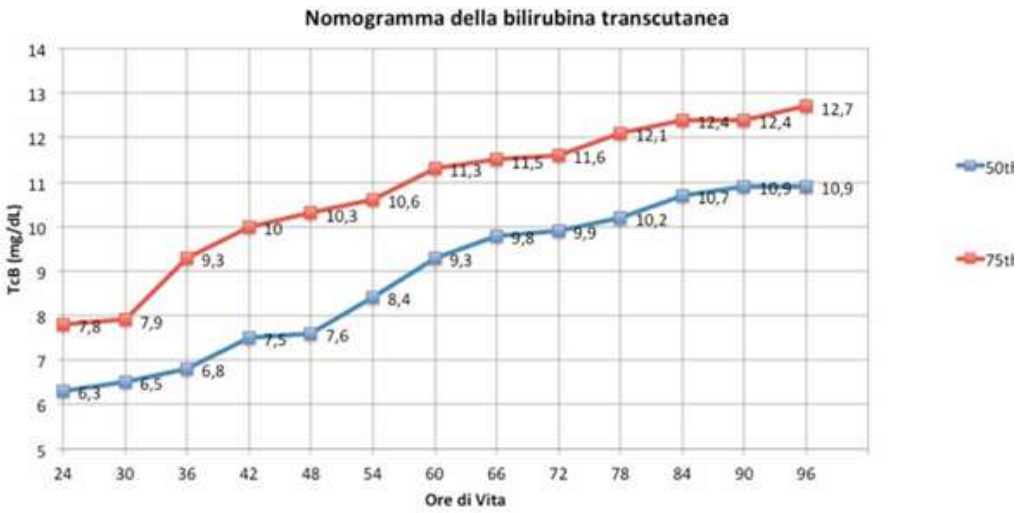
Gestione iperbilirubinemia neonatale (fino al 2022):

Raccomandazioni Società Italiana di Neonatologia

Il setting

Misurazione quotidiana bilirubinemia transcutanea (TcB) e/o sierica (TSB) a tutti i neonati
Decisioni terapeutiche-follow up in base a raccomandazioni SIN 2014.
Fototerapia (LED) eseguita in camera della madre, quando possibile
Controlli post dimissione mattina/pomeriggio 7 giorni su 7 (massimo 2 per turni)



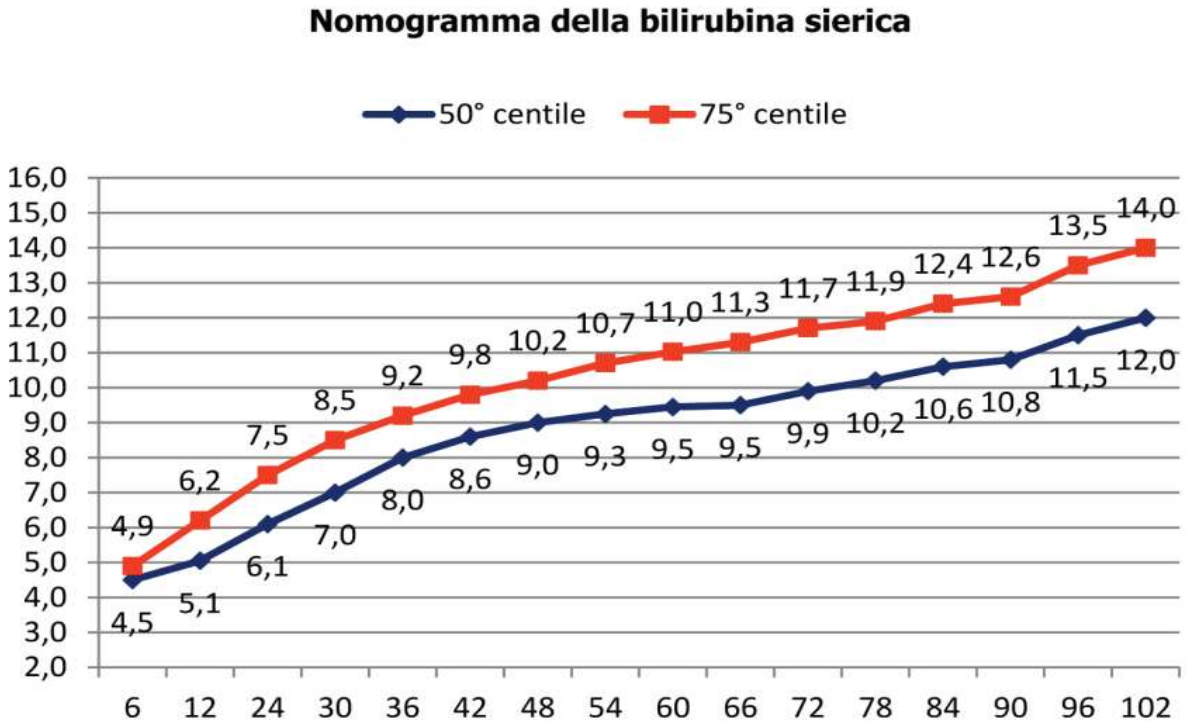


TSB è sempre necessaria nel caso di valori elevati di bilirubinemia. In ogni caso le decisioni terapeutiche si devono prendere solo in base al valore della TSB

Il setting

Valori di TSB > 50° centile nelle prime 48 ore o > 75° centile dopo le 48 ore di vita sono a rischio di iperbilirubinemia clinicamente rilevante e richiedono un controllo rispettivamente a 24 o 48 ore dopo la misurazione in funzione dell'età del neonato e dell'eventuale presenza di fattori di rischio.

Valori di TSB < 50° centile nelle prime 48 ore di vita e < 75° centile dopo le 48 ore di vita non sono a rischio di iperbilirubinemia clinicamente rilevante e quindi <u>non richiedono un ulteriore controllo</u>.



Gli strumenti

When initiating phototherapy, the newborn should be placed supine, with body exposed and the area covered by the diaper minimized. The eyes should be protected with an opaque shield. Care should be taken to prevent the shield from covering the nose or sliding off the orbits. Light should be delivered to as much of an infant's skin as possible with a combination of light sources both above and below the newborn. Effective phototherapy requires an irradiance of at least 30 microW/cm2/nm with light at a blue to blue-green wavelength (460 to 490 nm). This is ideally provided with a narrow-spectrum blue light-emitting diode (LED) light source.

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Tecnica d’uso
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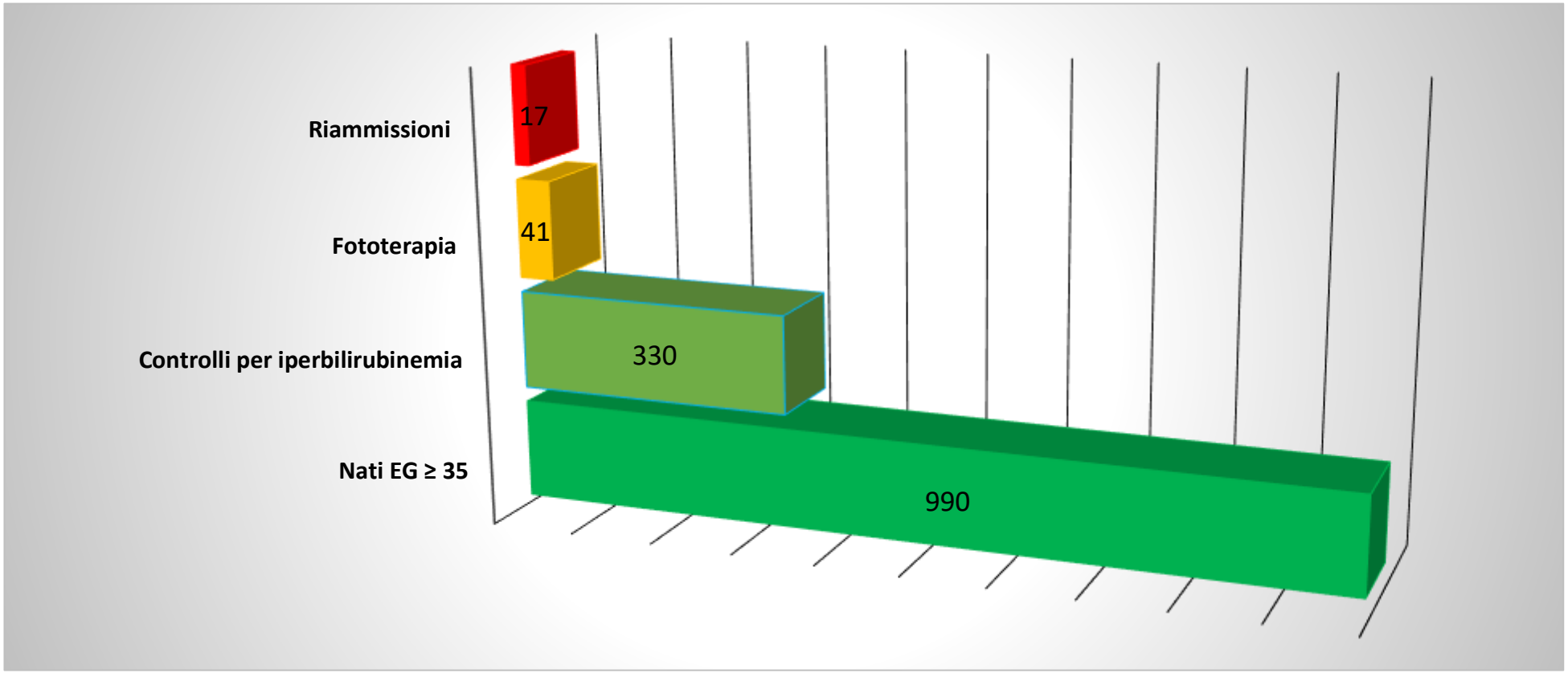
Azienda USL Toscana nord ovest
Servizio Sanitario della Toscana

"Without data, you're just another person with an opinion" W. Edwards Deming

Anno 2021

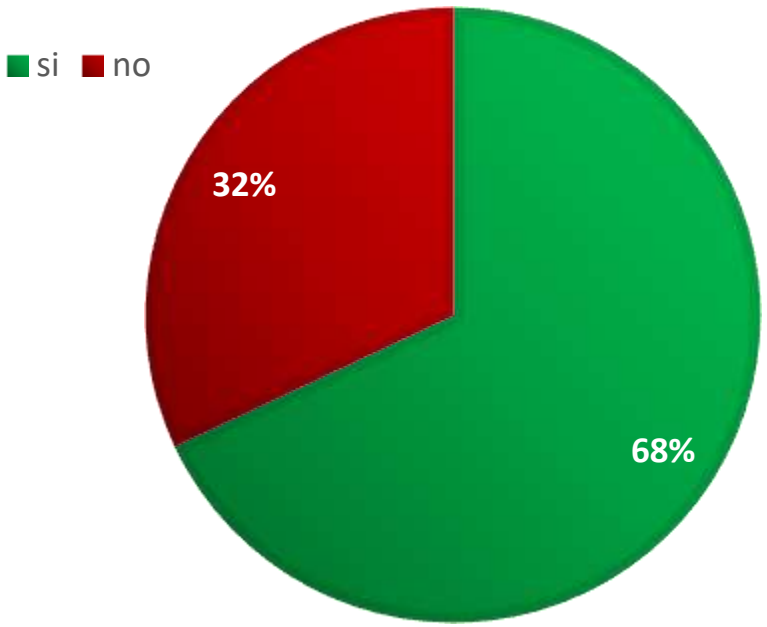
BASELINE



Le Fonti dei dati

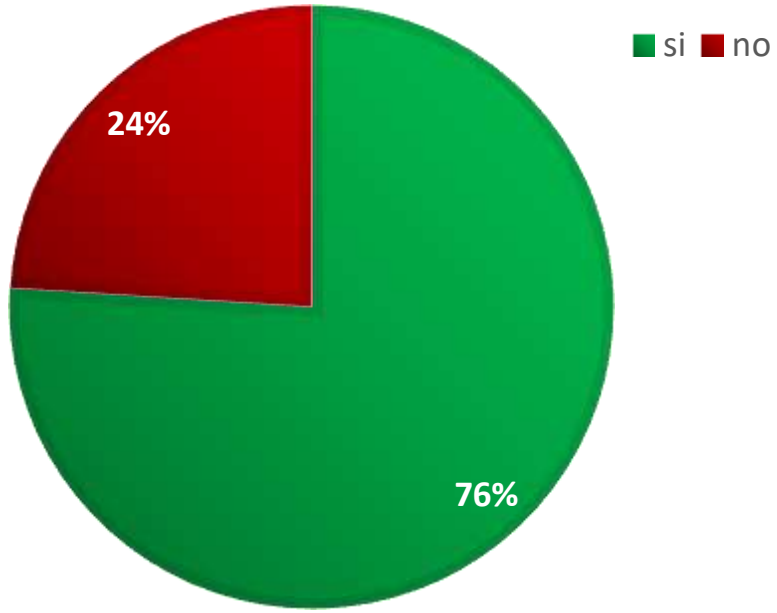
- Diagnosi di ittero e utilizzo fototerapia : SDO
- Controlli post dimissione: registro di reparto
- Cartelle cliniche neonati (cartacee)

Aspettative vs Realtà



FOTOTERAPIA 2021

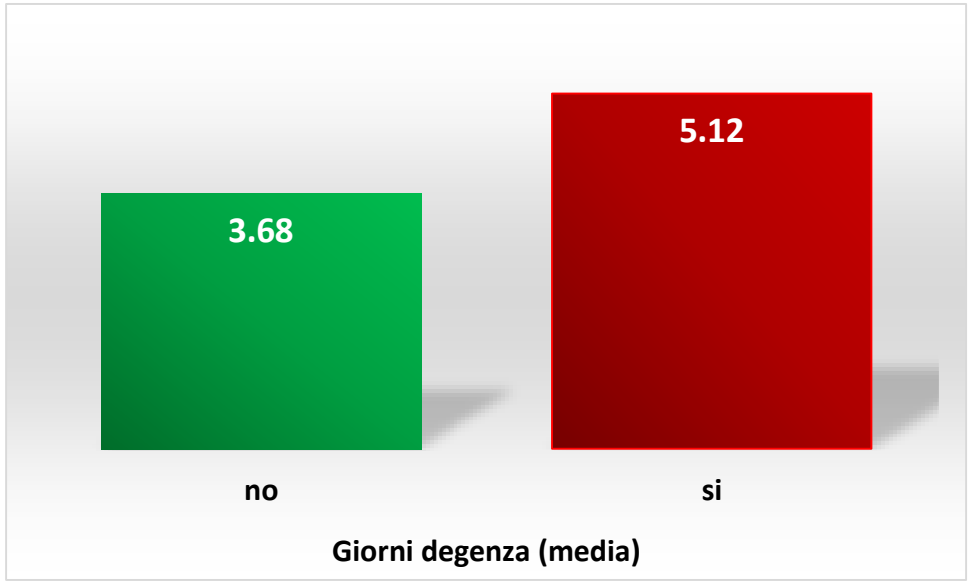
13/41 neonati sottoposti a fototerapia hanno iniziato trattamento con TSB sottoglia

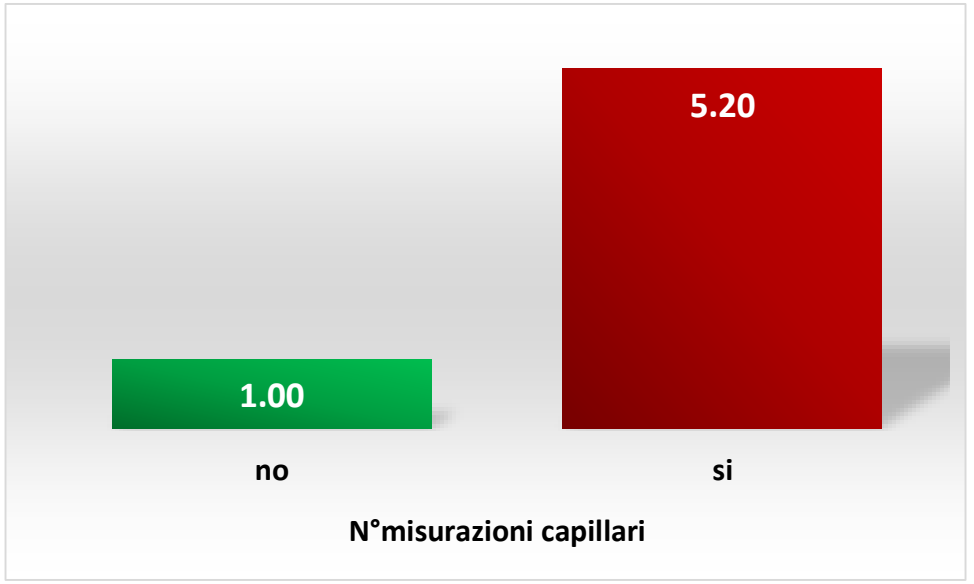


CONTROLLI POST DIMISSIONE 2021

15 neonati non sarebbero dovuti tornare a controllo
Tra questi 1 avrebbe sviluppato iperbilirubinemia rebound

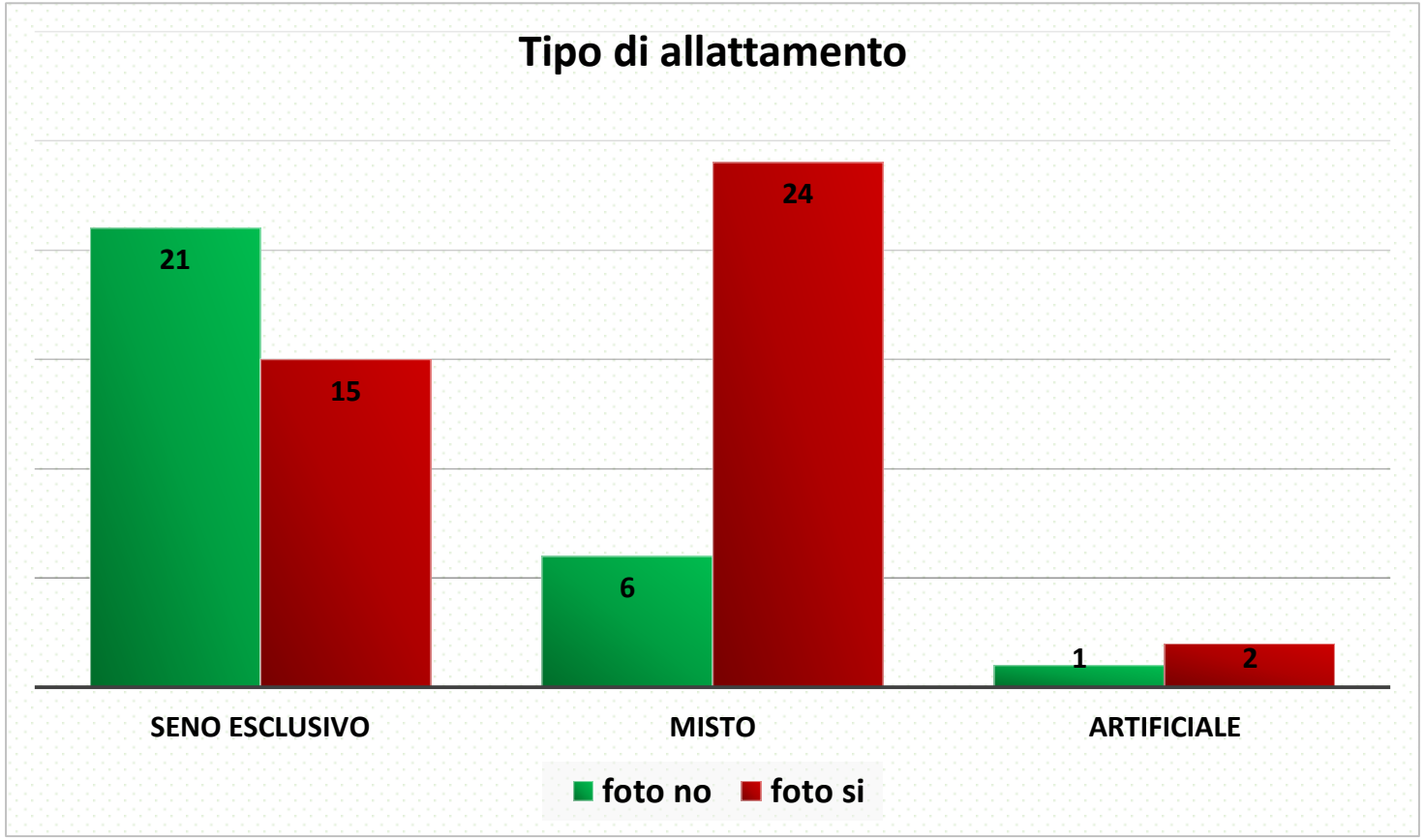
Impatto della fototerapia (1)





I neonati sottoposti a fototerapia hanno avuto degenze più lunghe con una media di 36 ore in più rispetto ai controlli e sono stati sottoposti a un maggior numero di prelievi cruenti.

Impatto della fototerapia (2)



I neonati sottoposti a fototerapia hanno avuto un minor tasso di successo di allattamento al seno esclusivo rispetto ai controlli (37% vs 75%)

→ Ostacolo al Progetto «OSPEDALE AMICO DEL BAMBINO»

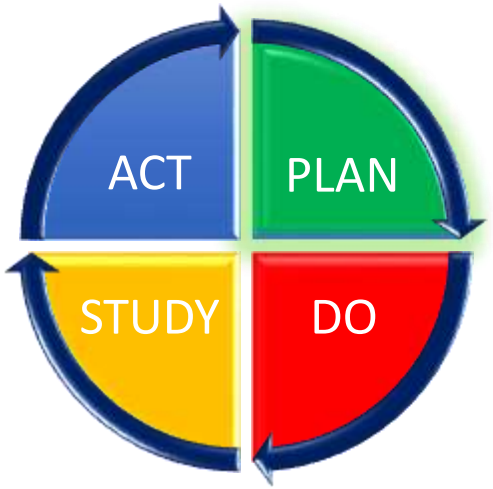
Conclusioni della pre-analisi

Aderenza a raccomandazioni subottimale
(fototerapia e controlli «in eccesso»)

Impatto negativo su diade e personale sanitario

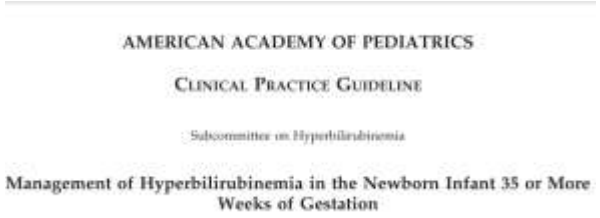
Opportunità di miglioramento?

Discussione condivisa con il personale



Nuove raccomandazioni

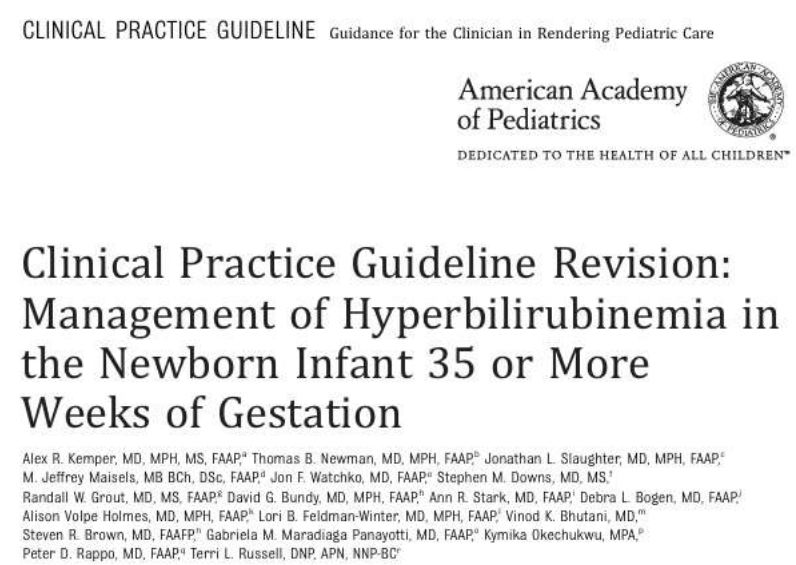
2004


AMERICAN ACADEMY OF PEDIATRICS

CLINICAL PRACTICE GUIDELINE

Subcommittee on Hyperbilirubinemia

Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation


CLINICAL PRACTICE GUIDELINE Guidance for the Clinician in Rendering Pediatric Care

American Academy of Pediatrics

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Clinical Practice Guideline Revision: Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation

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2022

25 raccomandazioni

Nuove soglie per fototerapia

2009

Hyperbilirubinemia in the Newborn Infant ≥35 Weeks' Gestation: An Update With Clarifications

Iperbilirubinemia neonatale

I
- Individuazione fattori di rischio per iperbilirubinemia patologica

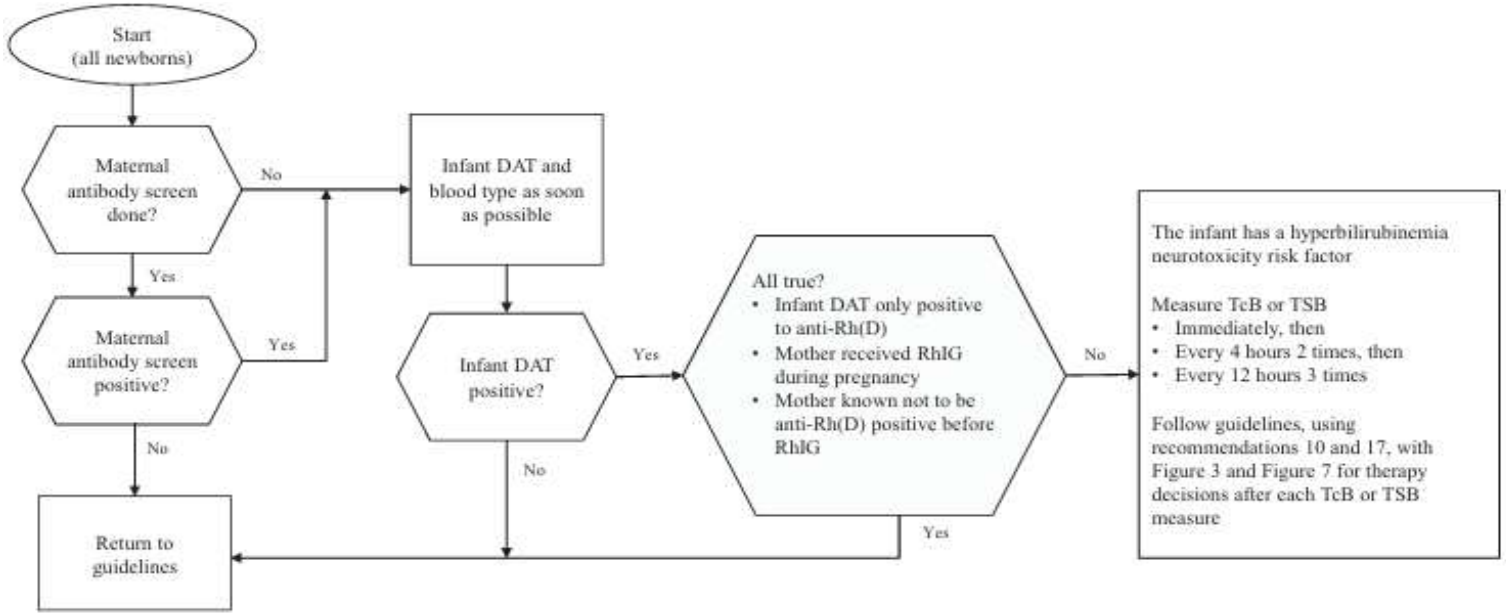
II
- Individuazione neonati a rischio di tossicità da bilirubina

III
- Screening bilirubinemia (transcutanea e/o sierica)

IV
- Terapia (fototerapia/exsanguinotrasfusione)

V
- Follow up

Valutazione del rischio



Prematurity (the risk increases with each additional week below 40 weeks)
Hemolytic disorders (eg, alloimmune HDN, G6PD deficiency, other inherited hemolytic conditions)
Early-onset of jaundice (within first 24 hours after birth)
Parent or sibling who required treatment for neonatal jaundice
Family history or ancestry suggestive of an inherited hemolytic disorder (ie, G6PD deficiency, hereditary spherocytosis)
Bruising, cephalohematoma, or internal bleeding
Macrosomia in a newborn of a diabetic mother
Down syndrome
Exclusive breastfeeding (with suboptimal intake)

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SCREENING IPERBILIRUBINEMIA

- Utilizzo in prima battuta della bilirubinemia transcutanea (TcB)
- La bilirubinemia sierica (TSB) deve essere misurata se il TcB ≤3 mg/dL dalla soglia per fototerapia o se il TcB è >15 mg/dL.
- Ogni scelta terapeutica deve essere basata esclusivamente su TSB

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Fattori di rischio per neurotossicità

Gestational age <38 weeks and this risk increases with the degree of prematurity
Albumin <3.0 g/dL*
Alloimmune HDN (ie, positive DAT)¶, G6PD deficiency, or other hemolytic conditions
Sepsis
Significant clinical instability in the previous 24 hours

*Albuminemia non richiesta di routine, ma solo in caso di grave iperbilirubinemia (TSB > 25 mg/dL o in neonati con sospetta patologia proteino-disperdente ES: S. nefrosica)

** Test di COOMBS negativo non esclude emolisi immunomediata

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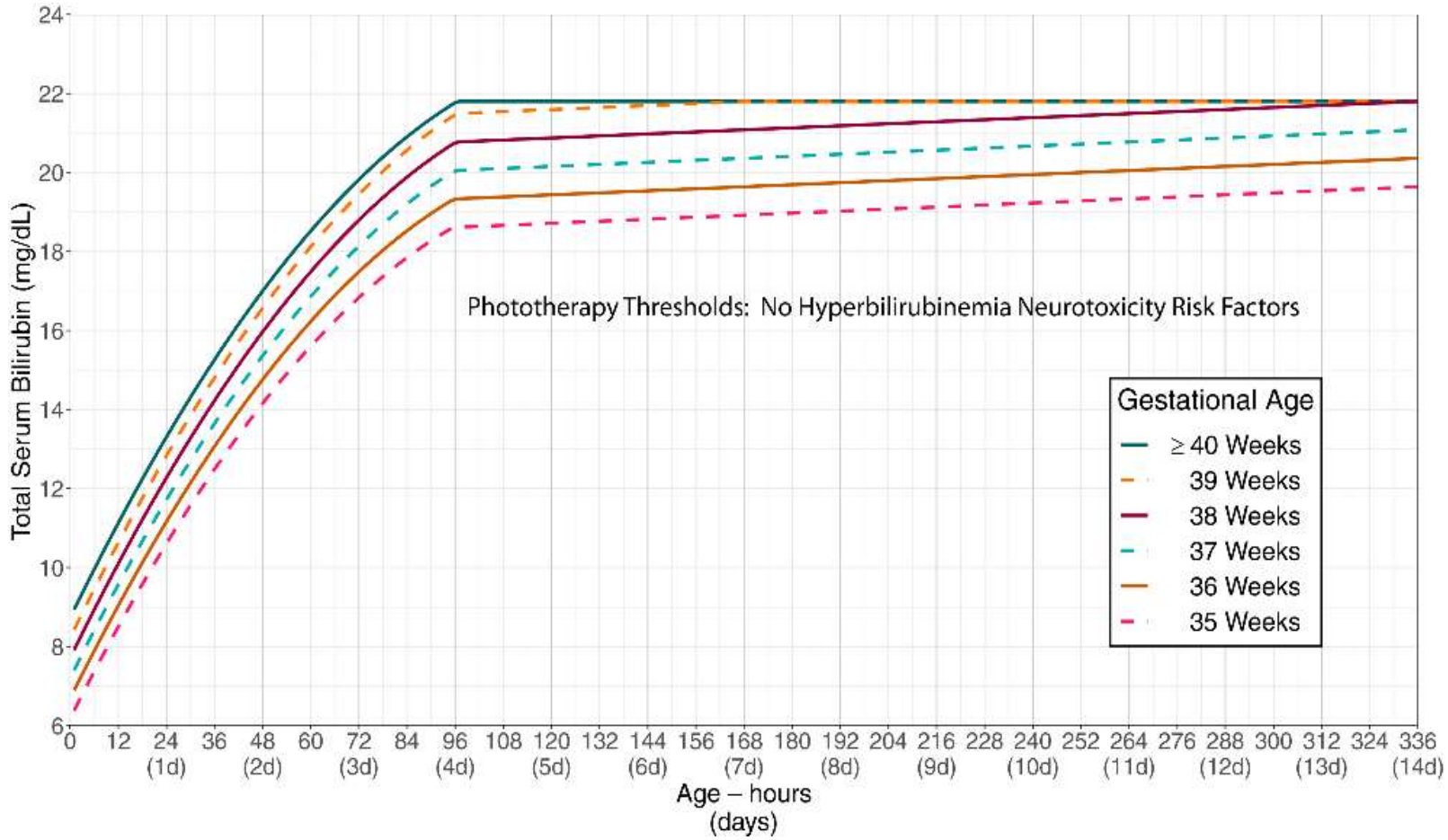
Soglie per fototerapia



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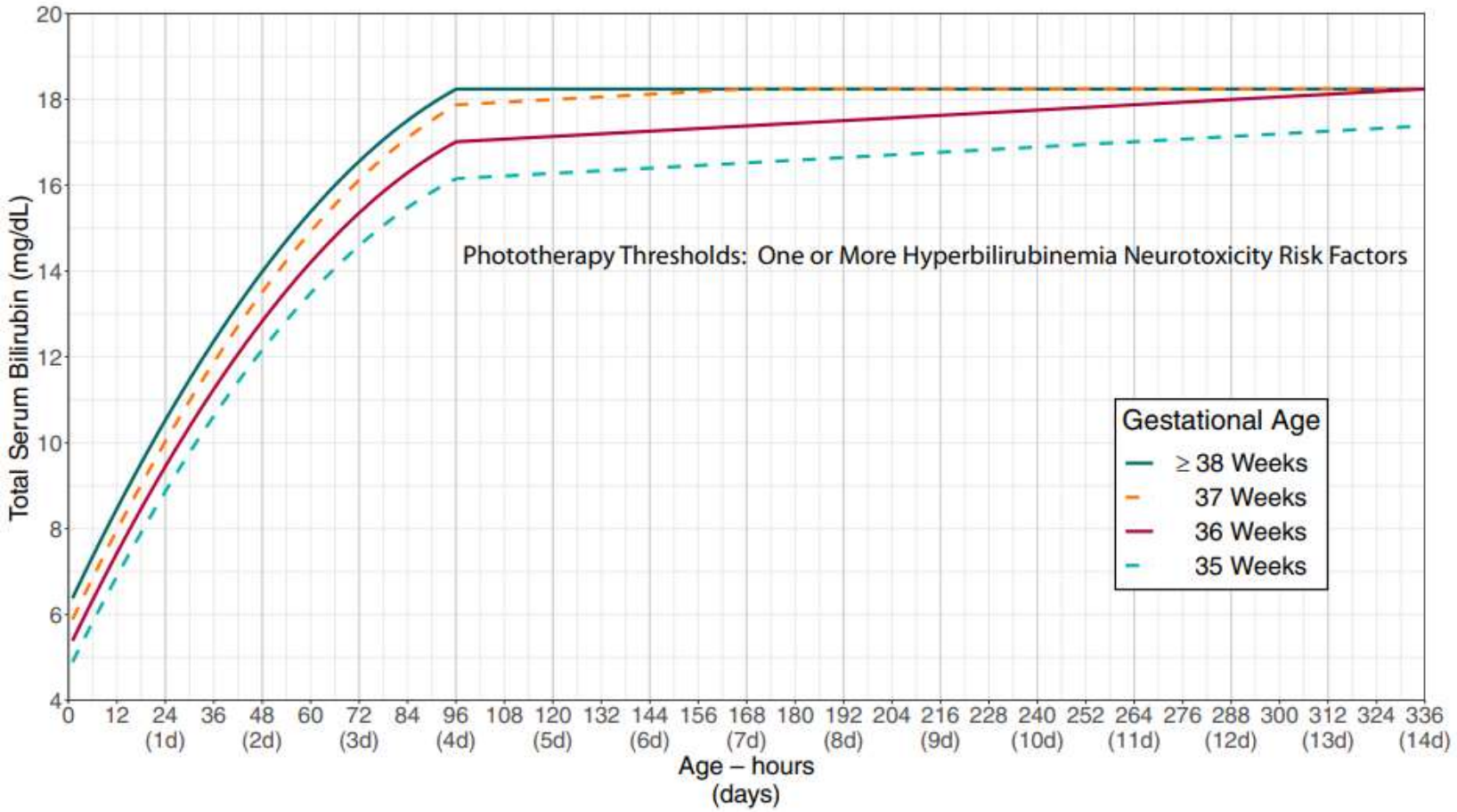
Soglie per fototerapia



Risk factors for neurotoxicity in newborns with hyperbilirubinemia

Gestational age <38 weeks and this risk increases with the degree of prematurity
Albumin <3.0 g/dL*
Alloimmune HDN (ie, positive DAT)¶, G6PD deficiency, or other hemolytic conditions
Sepsis
Significant clinical instability in the previous 24 hours

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Gestione della fototerapia

Controllo TSB entro 12 ore dall'inizio della fototerapia (in base a FR)

Non effettuare fototerapia discontinua (garantire brevi interruzioni per allattamento al seno)

L'interruzione della fototerapia è un'opzione quando TSB < 2 mg/dL al di sotto della soglia per fototerapia

Un periodo più lungo di fototerapia è un'opzione se ci sono fattori di rischio per l'iperbilirubinemia rebound (età gestazionale <38 settimane, età <48 ore all'inizio della fototerapia, malattia emolitica)

Dopo 24 h dalla sospensione possibile utilizzare TcB

Rebound: TSB oltre soglia 72-96 h dopo interruzione fototerapia

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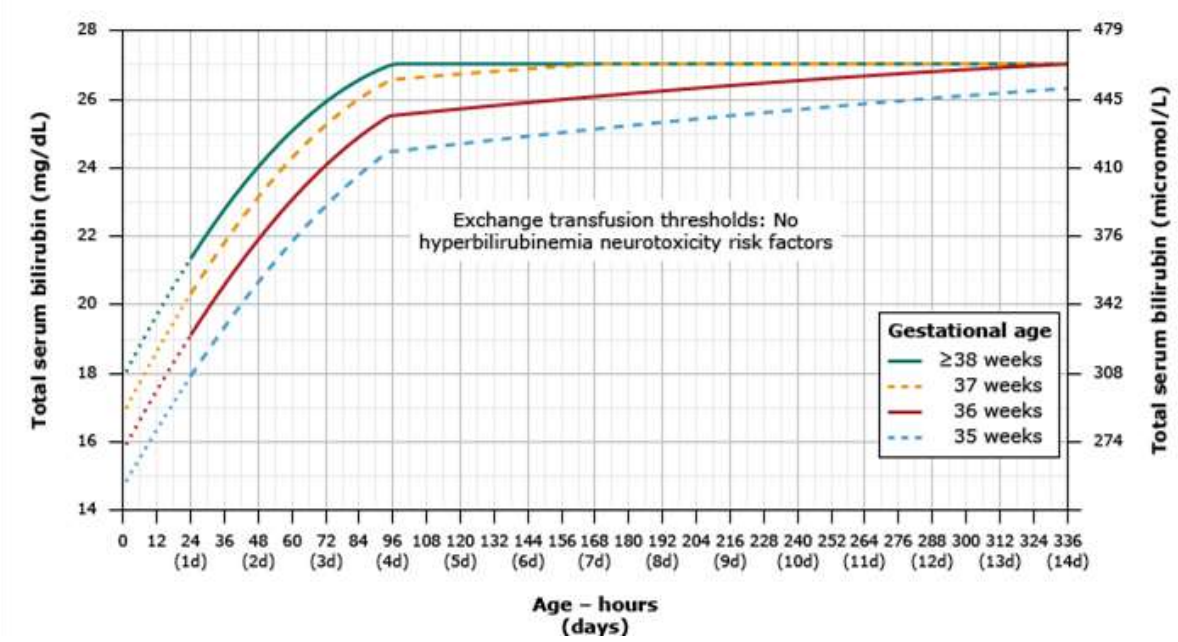
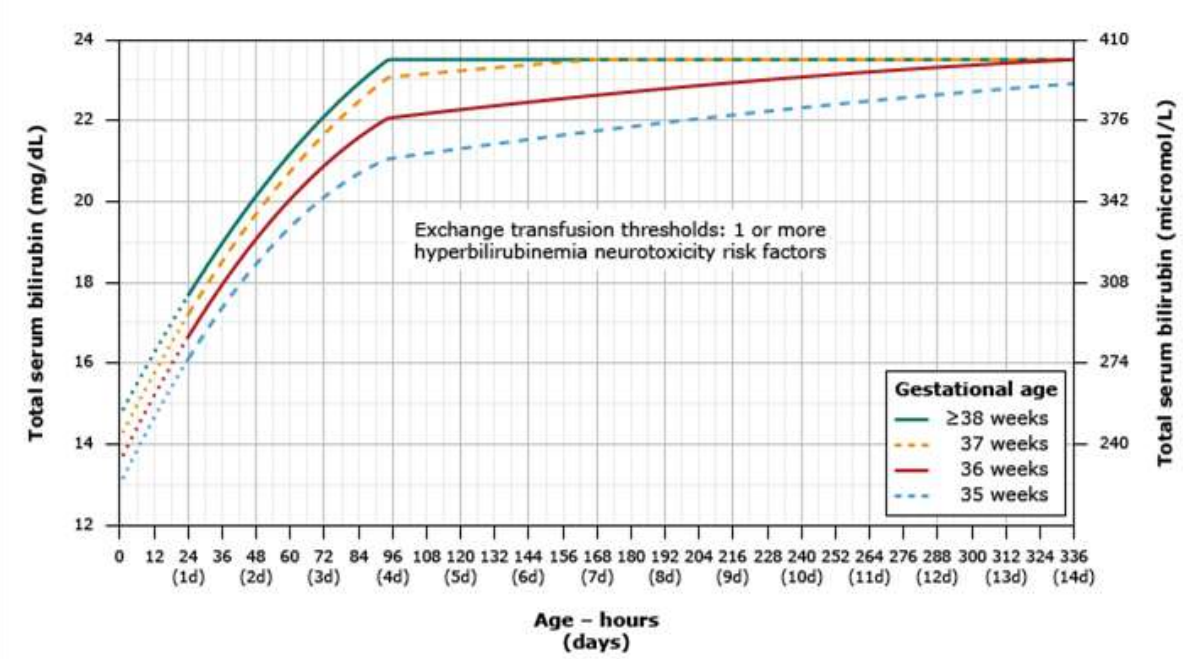
Exsanguinotrasfusione





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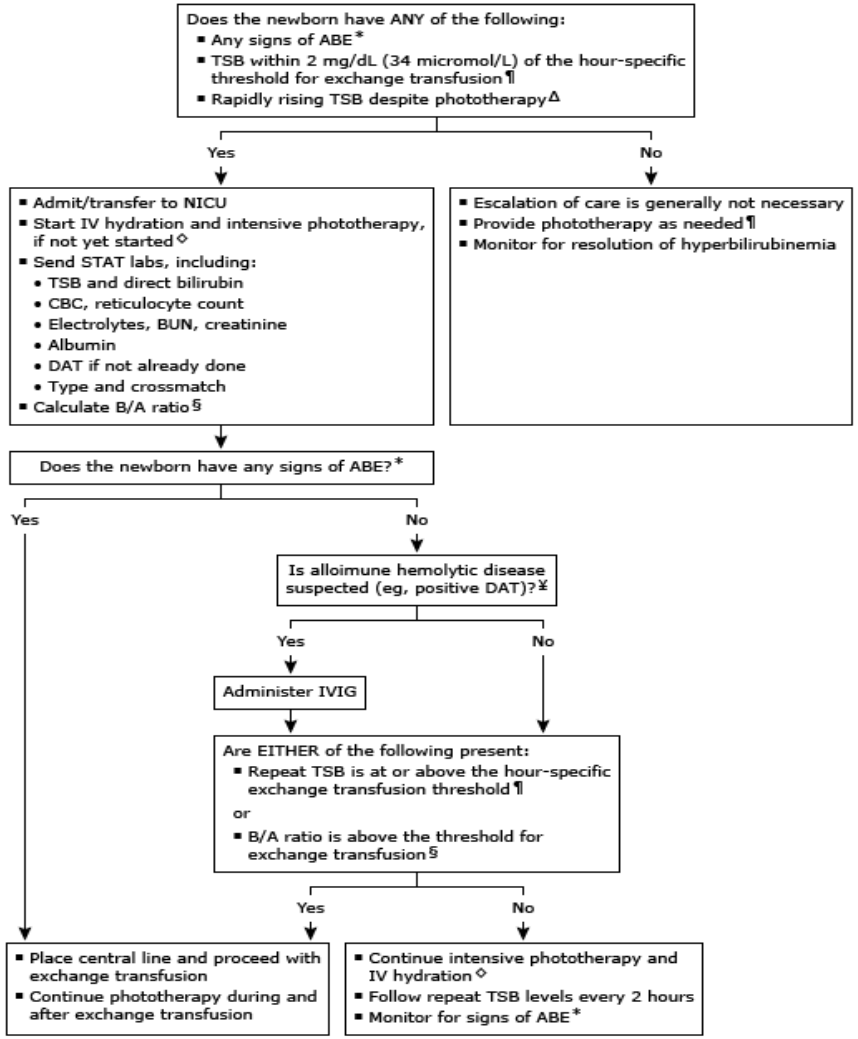
Escalation of care (2 mg/dl < soglia per EXT)



Bilirubin-induced neurologic dysfunction (BIND) assessment (score) for term and late preterm infants

Clinical signs	Score
Mental status	
Normal	0
Sleepy but arousable, decreased feeding	1
Lethargic, poor suck, irritable, and/or jittery	2
Semicomatose to comatose, unable to feed, seizures	3
Muscle tone	
Normal	0
Persistent mild to moderate hypotonia	1
Mild to moderate hypertonia alternating with hypotonia	2
Persistent retrocollis and opisthotonos	3
Cry pattern	
Normal	0
High pitched when aroused	1
Shrill, difficult to console	2
Inconsolable crying or weak/absent cry	3
Total BIND score	

Total scores for BIND determine the presence and severity of acute bilirubin encephalopathy (ABE) for newborns with hyperbilirubinemia without other identifiable causes for neurologic dysfunction.

Interpretation of the BIND score is as follows:
1 to 3: Consistent with subtle signs of ABE
4 to 6: Moderate ABE
7 to 9: Advanced ABE

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Follow up

Delta TSB (mg/dL)

Phototherapy threshold minus TcB or TSB		Discharge Recommendations
0.1-1.9 mg/dL	Age <24 hours	Delay discharge, consider phototherapy, measure TSB in 4 to 8 hours
	Age≥24 hours	Measure TSB in 4 to 24 hours[a] Options: • Delay discharge and consider phototherapy • Discharge with home phototherapy if all considerations in the guideline are met • Discharge without phototherapy but with close follow-up
2.0-3.4 mg/dL	Regardless of age or discharge time	TSB or TcB in 4 to 24 hours[a]
3.5-5.4 mg/dL	Regardless of age or discharge time	TSB or TcB in 1-2 days
5.5-6.9 mg/dL	Discharging <72 hours	Follow-up within 2 days; TcB or TSB according to clinical judgment[b]
	Discharging ≥72 hours	Clinical judgment[b]
≥7.0 mg/dL	Discharging <72 hours	Follow-up within 3 days; TcB or TSB according to clinical judgment[b]
	Discharging ≥72 hours	Clinical judgment[b]

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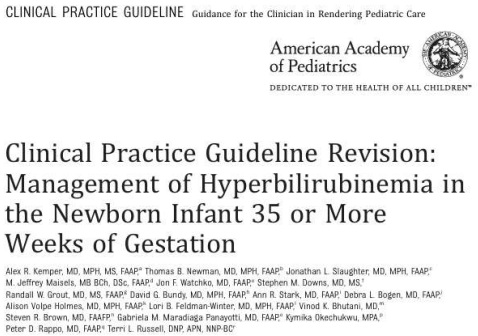
Perché cambiare?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- Bilirubinemia transcutanea e sierica: stesse curve
- Chiare indicazioni per utilizzo TcB - TSB
- Soglie per trattamento più permissive
- Decisioni basate su differenza tra valore «soglia» di bilirubina e valore rilevato (Stop centili; stop classi di rischio)
- Follow up «personalizzato»

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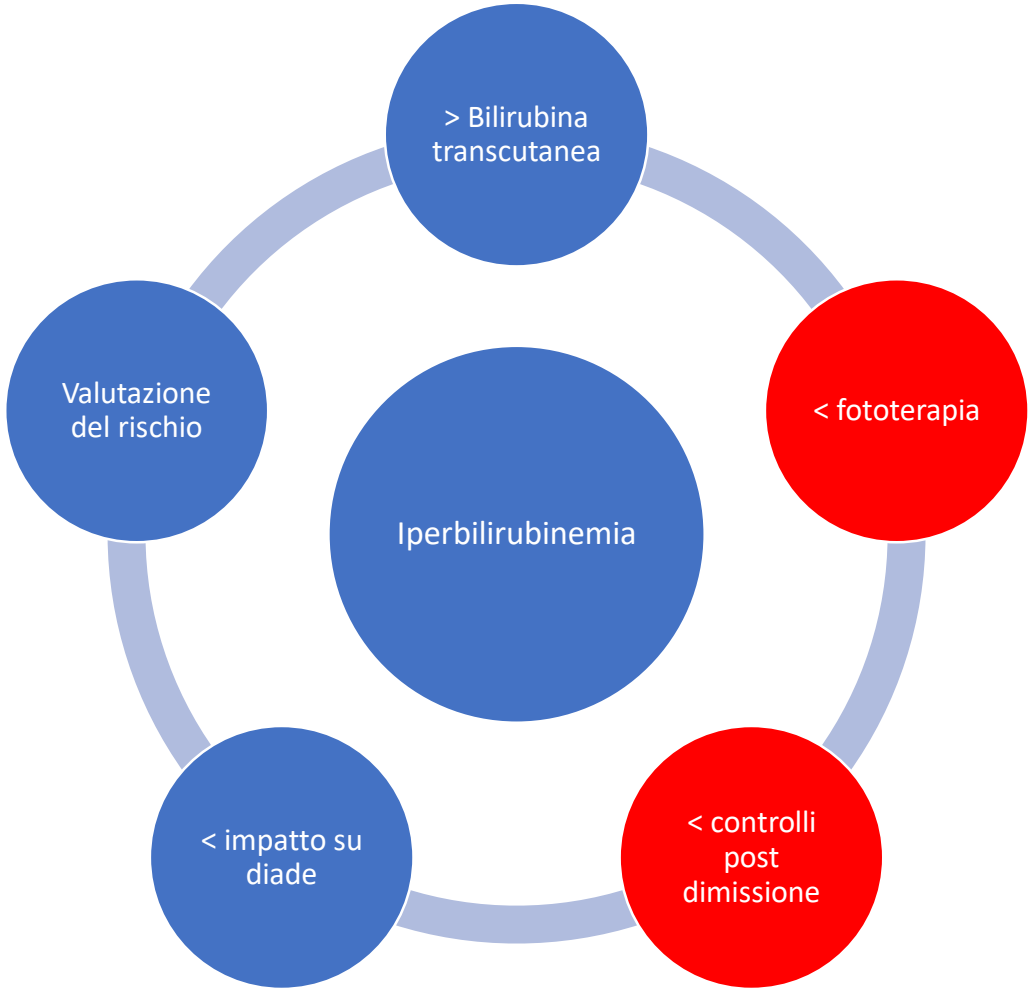


Specific → Measurable → Achieveble → Relevant → Time Based

Fototerapia eseguita

Specific	Be specific about what you want to improve. What do you want to achieve, where/who?	**Ridurre l'utilizzo della fototerapia, quando possibile.**
Measurable	Include a measurement that will evidence improvement. Think about a measure that will show the problem now to create a baseline	**Numero di fototerapie/anno** **2021: 41 neonati**
Achievable	Set a numerical target that can be realistically achieved	**Riduzione del 10% delle fototerapie/anno**
Relevant	Link your aim to the Trust strategic aims - think about how your project will improve patient, carer and staff experience/outcomes.	**Ridurre conseguenze negative della fototerapia (durata degenze, prelievi neonati, allattamento al seno)**
Time-bound	Include a timeframe for your project thinking about when you might see the outcomes	**entro il 2023**

Aderenza raccomandazioni: fototerapia

Specific	Be specific about what you want to improve. What do you want to achieve, where/who?	**Aumentare l'aderenza alle raccomandazioni per l'utilizzo della fototerapia**
Measurable	Include a measurement that will evidence improvement. Think about a measure that will show the problem now to create a baseline	**Aderenza alle raccomandazioni %** **2021: 41 neonati, aderenza 68%**
Achievable	Set a numerical target that can be realistically achieved	**Aderenza > 90% alle raccomandazioni**
Relevant	Link your aim to the Trust strategic aims - think about how your project will improve patient, carer and staff experience/outcomes.	**Ridurre conseguenze negative della fototerapia (durata degenze, prelievi neonati, allattamento al seno)**
Time-bound	Include a timeframe for your project thinking about when you might see the outcomes	**Entro il 2023**

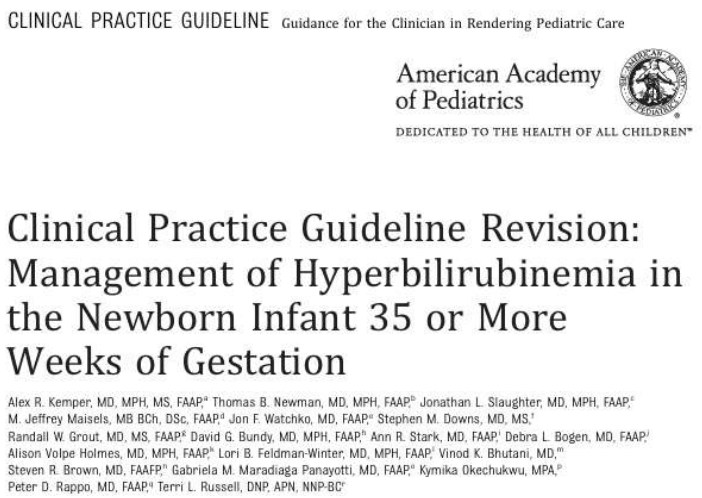
Controlli post dimissione prescritti

Specific	Be specific about what you want to improve. What do you want to achieve, where/who?	**Ridurre il numero di controlli post dimissione per IB.**
Measurable	Include a measurement that will evidence improvement. Think about a measure that will show the problem now to create a baseline	**Numero controlli/anno** **2021: 330 controlli/990 neonati**
Achievable	Set a numerical target that can be realistically achieved	**Riduzione del 10% controlli/anno**
Relevant	Link your aim to the Trust strategic aims - think about how your project will improve patient, carer and staff experience/outcomes.	**Ridurre stress famiglia neonato** **Ridurre carico di lavoro del personale**
Time-bound	Include a timeframe for your project thinking about when you might see the outcomes	**Entro il 2023**

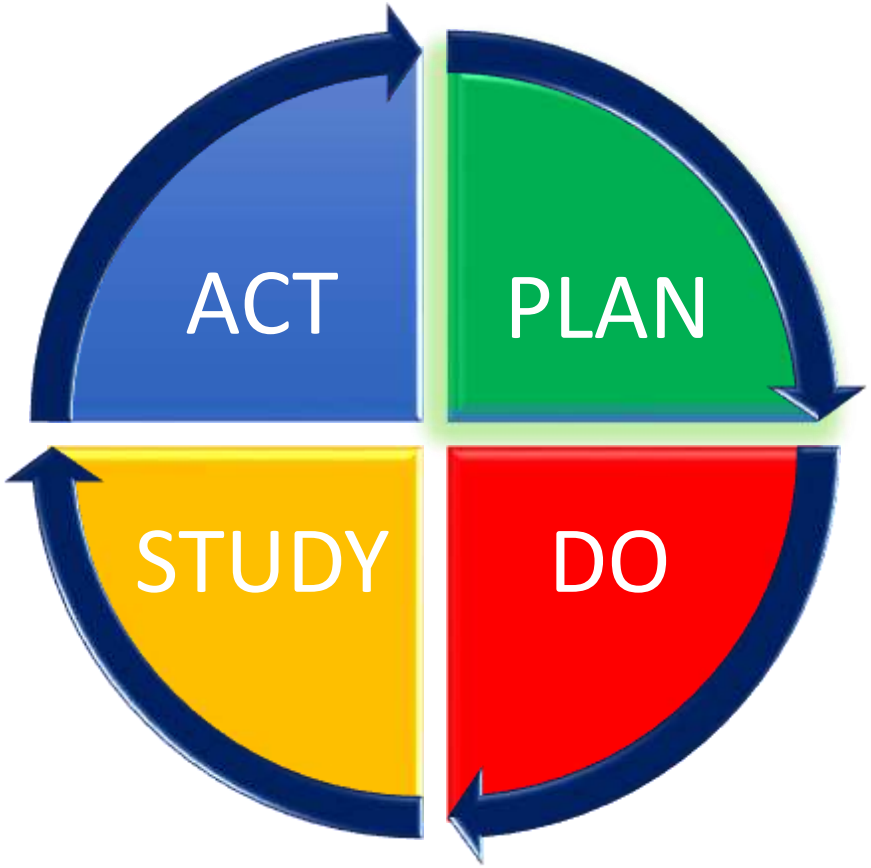
Aderenza alle raccomandazioni: controlli post dimissioni

Specific	Be specific about what you want to improve. What do you want to achieve, where/who?	**Aumentare l'aderenza alle raccomandazioni per la prescrizione di controlli post dimissione**
Measurable	Include a measurement that will evidence improvement. Think about a measure that will show the problem now to create a baseline	**Aderenza alle raccomandazioni (%)** **2021: aderenza 68%**
Achievable	Set a numerical target that can be realistically achieved	**Aderenza > 90% alle raccomandazioni**
Relevant	Link your aim to the Trust strategic aims - think about how your project will improve patient, carer and staff experience/outcomes.	**Ridurre stress famiglia neonato** **Ridurre carico di lavoro del personale**
Time-bound	Include a timeframe for your project thinking about when you might see the outcomes	**Entro il 2023**

Altri obiettivi *achievable*?



- Ridurre numero di prelievi capillari neonati con iperbilirubinemia
- Aumentare % allattamento al seno esclusivo alla dimissione nei neonati sottoposti a fototerapia
- Ridurre riammissioni «non programmate» (evento sentinella)

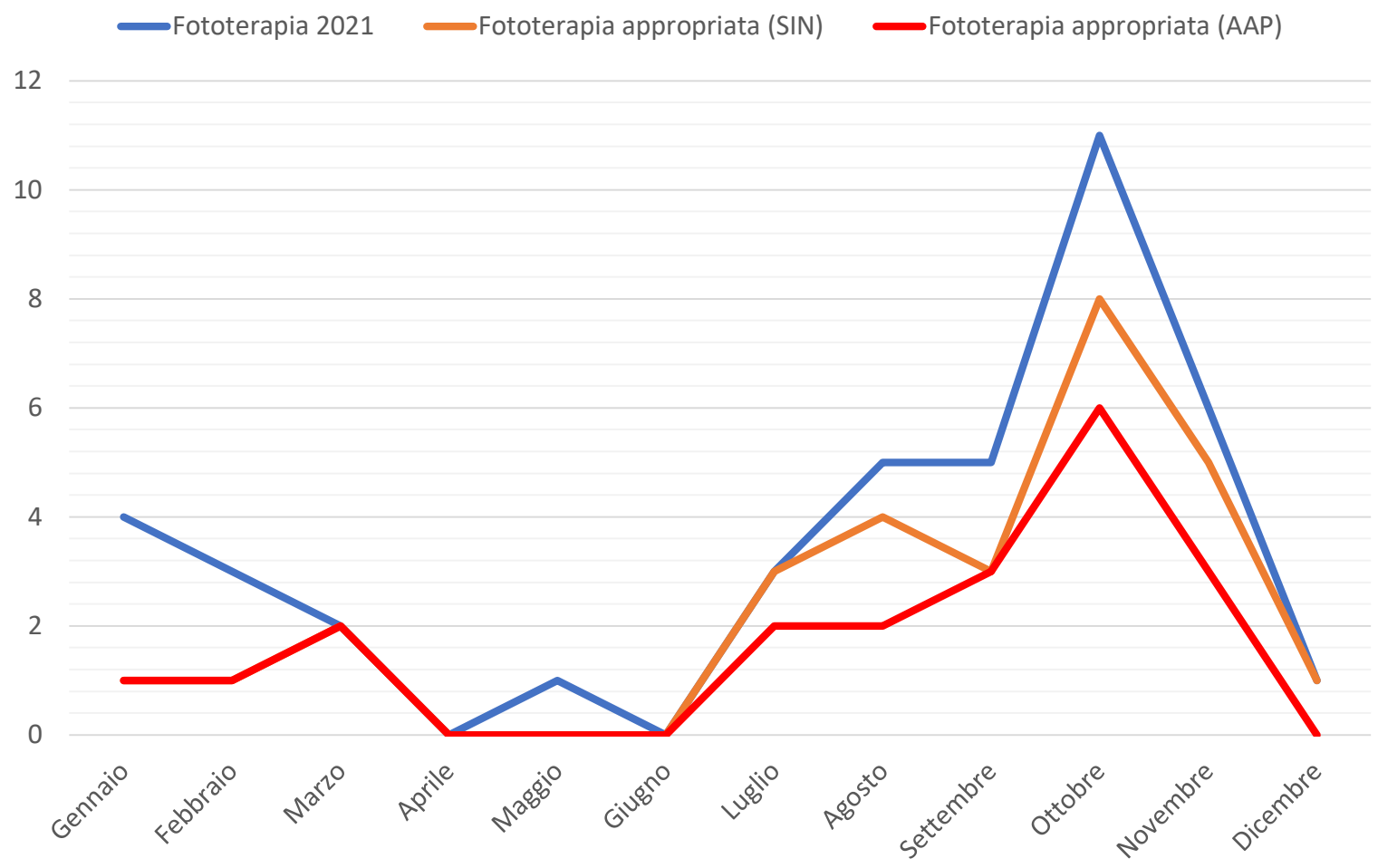


Esegui il test , se possibile su piccola scala

Documenta problemi e osservazioni impreviste

Inizia l'analisi dei dati

Applicazione retrospettiva: Fototerapia 2021

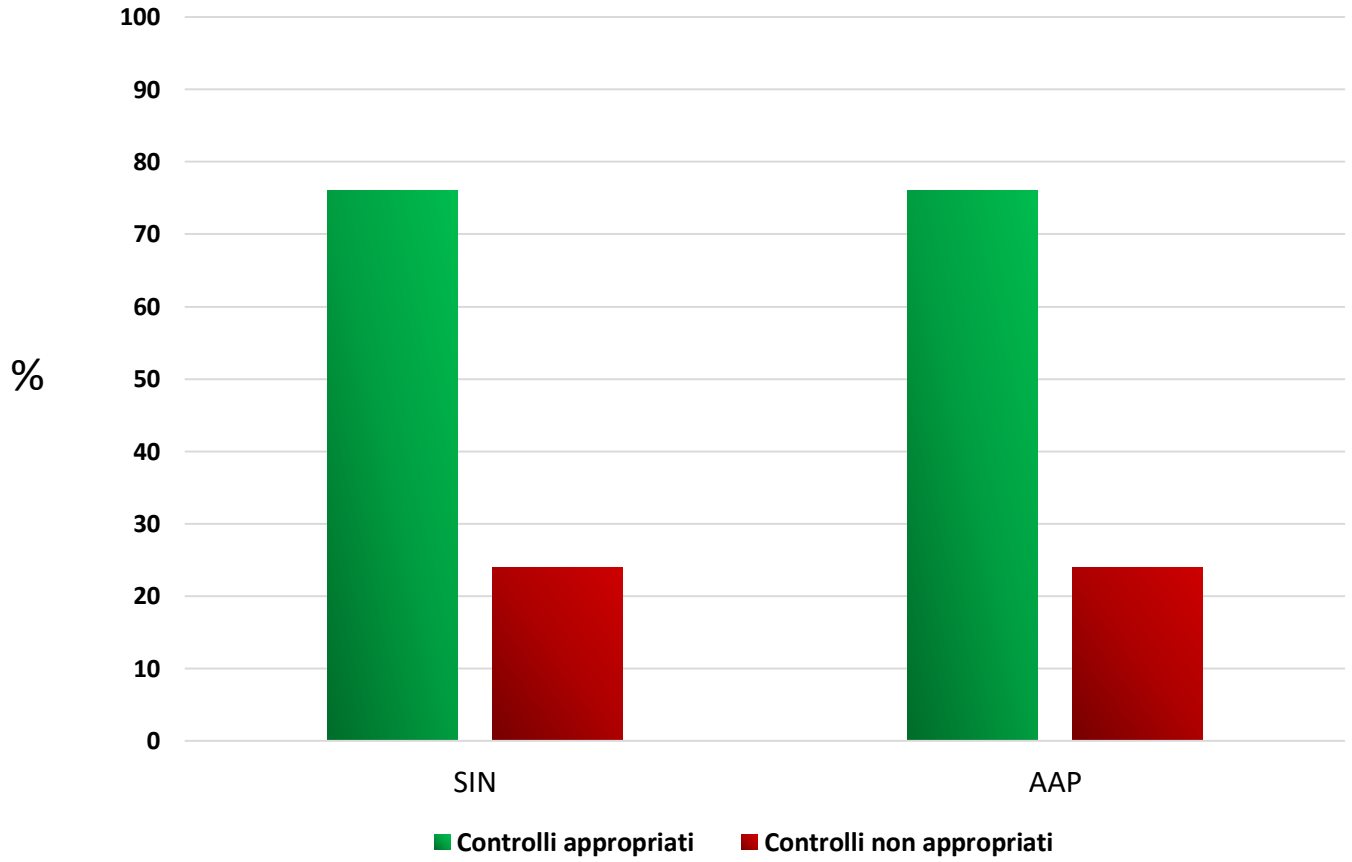


41 fototerapie eseguite

28 necessarie secondo SIN

20 secondo AAP **(-29%)**

Applicazione retrospettiva: controlli post dimissione



Campione rappresentativo di 55 neonati

25% controlli inappropriati secondo SIN (tra i controlli inappropriati 1 riammissione)
25% controlli inappropriati secondo AAP (tra i controlli inappropriati 0 riammissioni)

Applicazione delle raccomandazioni 2023

Discussione condivisa con personale medico, ostetrico e infermieristico

Protocollo di reparto

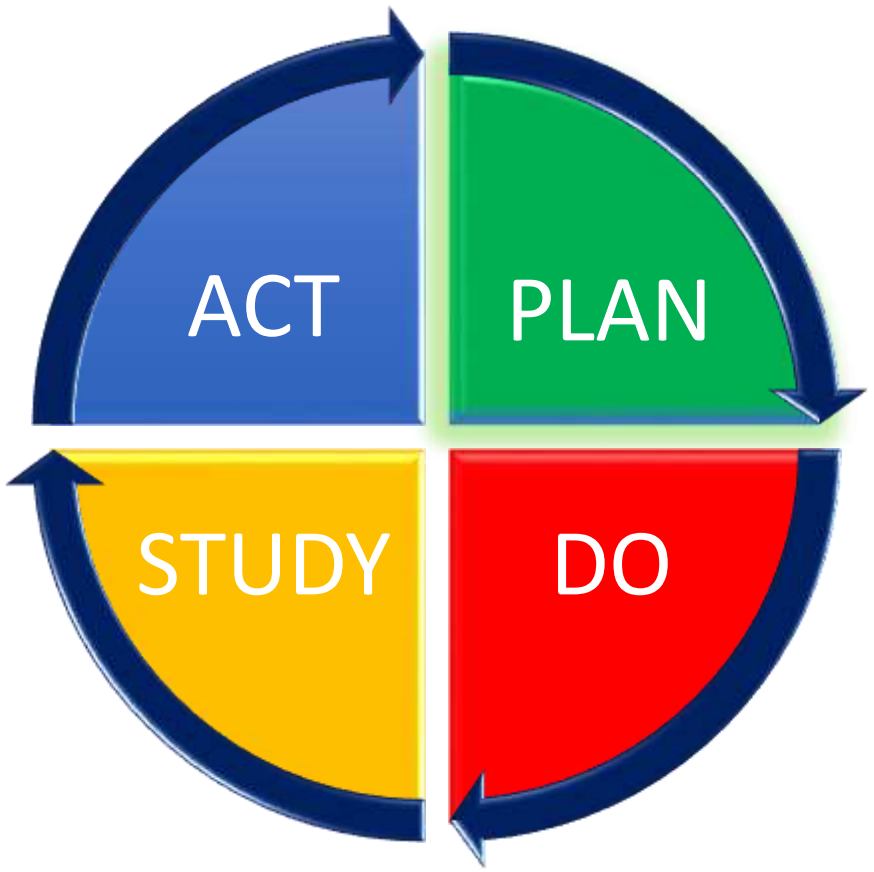
Affissione curve aggiornate (a colori e plastificate)

Per i neonati < 35 settimane : raccomandazioni SIN

Inizio della raccolta dati

Le Fonti dei dati

- Diagnosi di ittero e utilizzo fototerapia : SDO
- Controlli post dimissione: registro di reparto
- Cartelle cliniche elettroniche

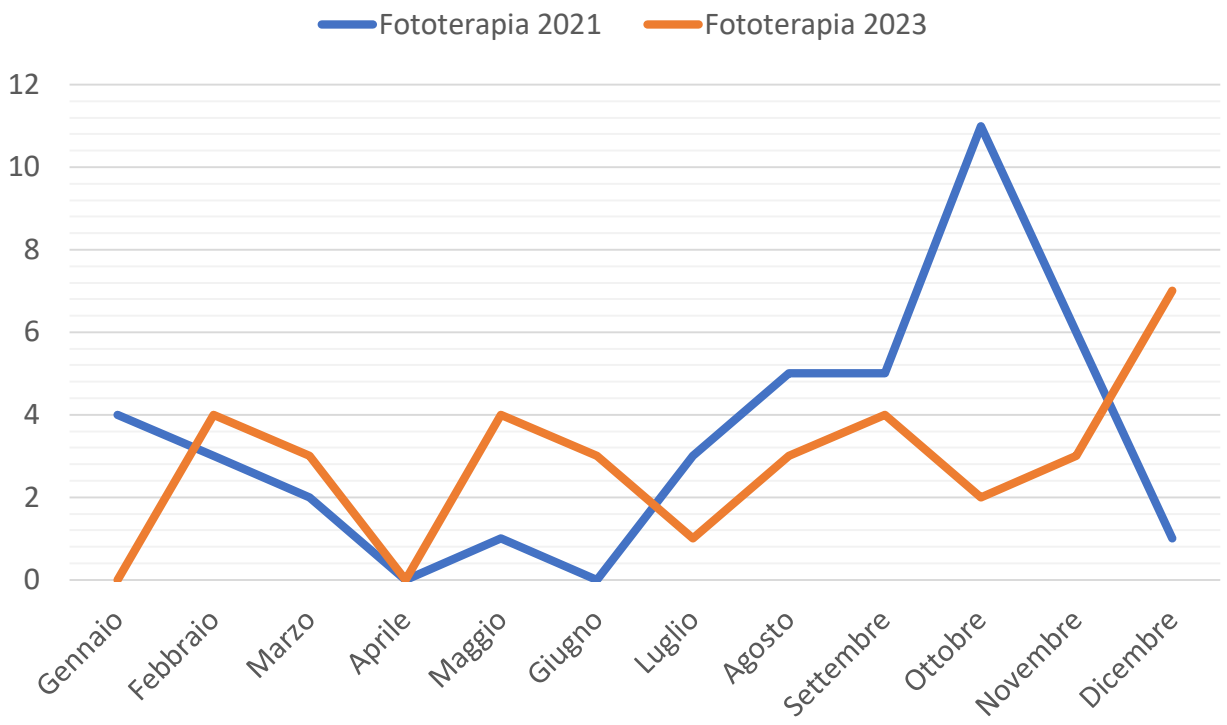


Analizza i dati
Studia i risultati

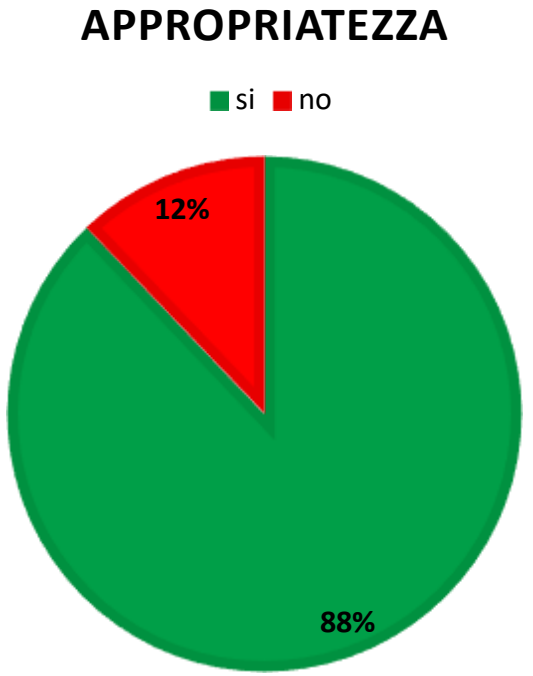
Confronta i dati con le tue previsioni

Cosa hai imparato?

Fototerapia 2023 vs 2021

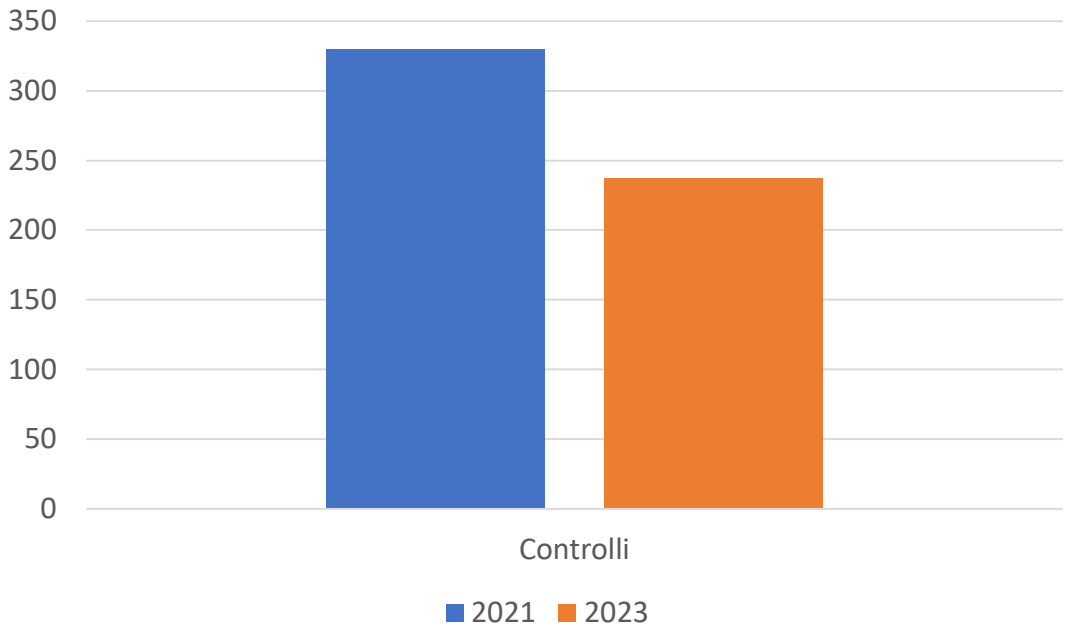


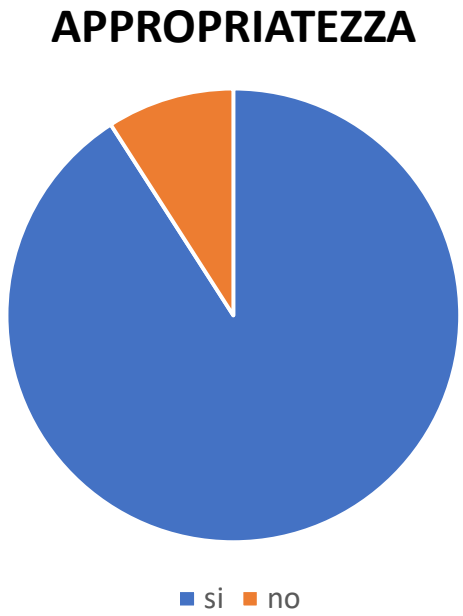
33 fototerapie eseguite nel 2023 *vs* 41 del 2021
-20%



4/33 fototerapie inappropriate secondo AAP
(appropriatezza 88% vs 68% 2021)

Controlli post dimissione





Nel 2023 sono stati eseguiti 237 controlli post dimissione per IB (-28%) rispetto al 2023

L'aderenza alle raccomandazioni è stata valutata su un campione di neonati tornati a controllo (55).
5/55 non avrebbero necessitato del controllo (9% vs 27% del 2021)

Conclusione fase study

L’applicazione delle nuove linee guida AAP ha contribuito a ridurre il numero delle fototerapie eseguite e il numero dei controlli post dimissione : OBIETTIVI RAGGIUNTI

La discussione condivisa e le strategie per migliorare l’aderenza alle raccomandazioni ha portato a un miglioramento dell’appropriatezza nella gestione dell’iperbilirubinemia (l’appropriatezza delle FT risulta ancora subottimale)

… un rinforzo positivo

ARTICLES | MARCH 14 2024

Bilirubin Measurement and Phototherapy Use After the AAP 2022 Newborn Hyperbilirubinemia Guideline

Leela Sarathy, MD; Joseph H. Chou, MD, PhD; Giuseppina Romano-Clarke, MD; Katherine A. Darci, MD; Paul H. Lerou, MD

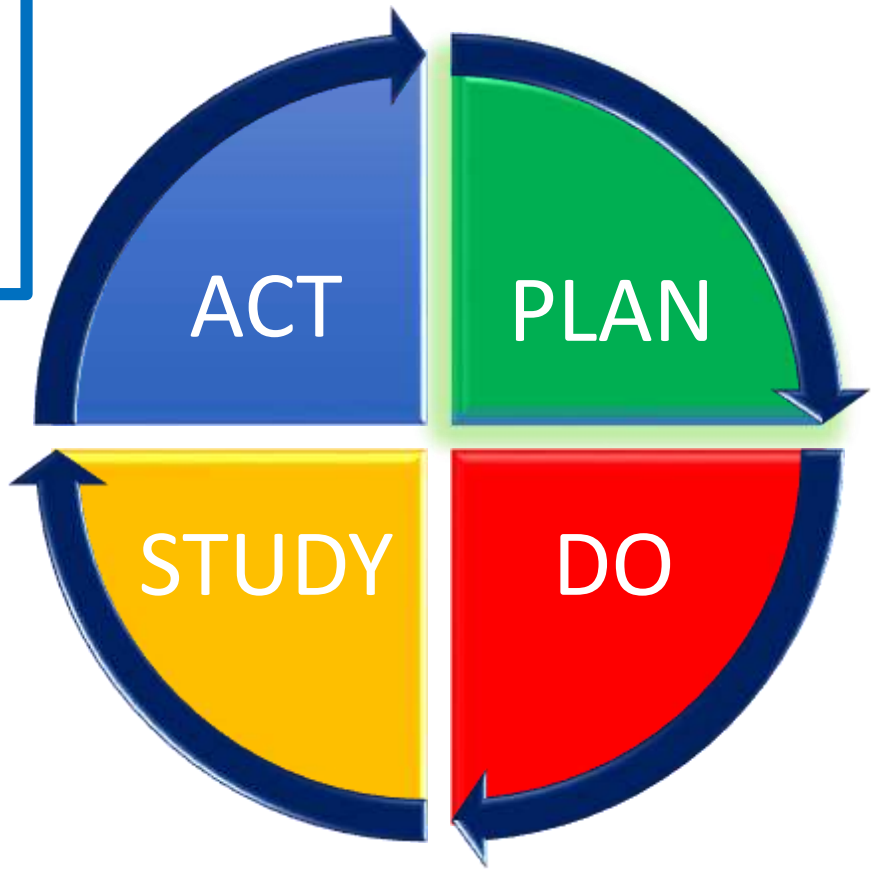
We conducted a retrospective study of newborns born at ≥35 weeks' gestation across a network of 8 hospitals between January 2022 and June 2023. Outcomes included rates of phototherapy and total serum bilirubin (TSB) measurements before and after guideline publication, as well as clinical outcomes, including length of stay, readmissions, and duration of phototherapy.

In our cohort of >22 000 newborns, we observed a 47% decrease in phototherapy utilization, from 3.9% to 2.1% ($P < .001$). TSB measurements were reduced by 23%, from 712 to 551 measurements per 1000 newborns ($P < .001$), without an increase in outpatient TSB measurements. We did not observe an increase in readmissions receiving phototherapy, and length of stay increased by only 1 hour ($P < .001$).

Perfezionare la modifica

Altre modifiche?

Preparare un piano per il test successivo

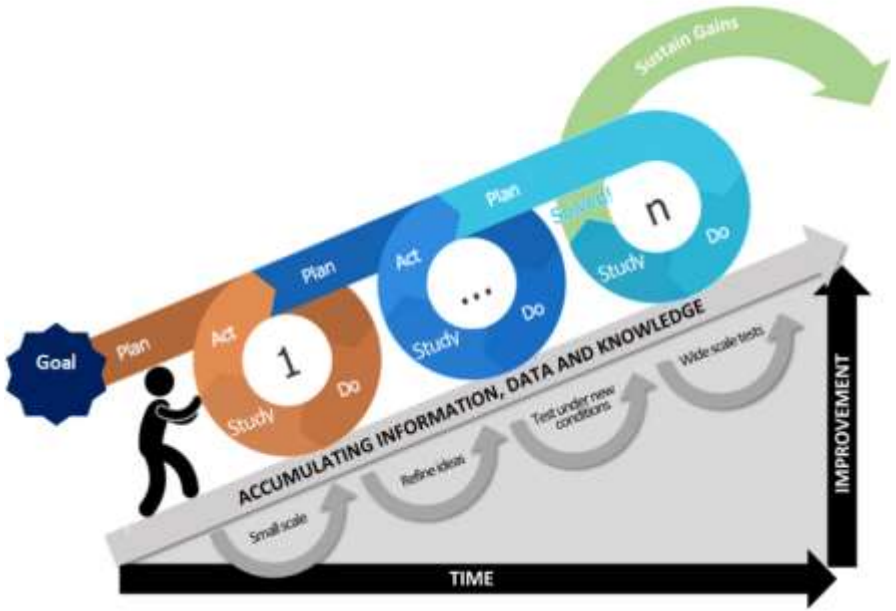


Now this is not the end. It is not even the beginning of the end.
But it is, perhaps, the end of the beginning (W. Churchill)

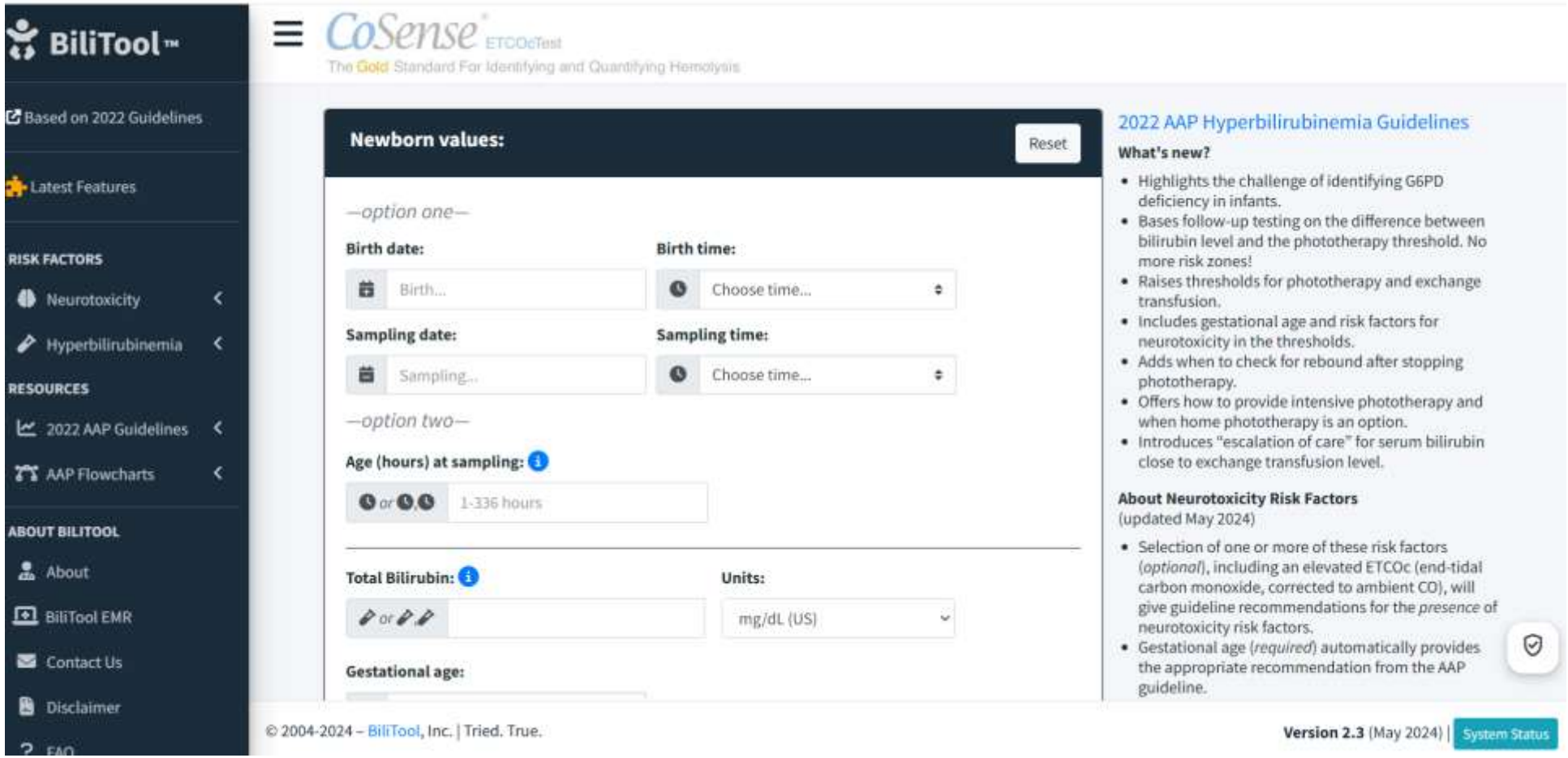
Migliorare aderenza alle raccomandazioni da parte del personale

Ridurre l'inappropriatezza della fototerapia dei controlli post dimissioni e dei prelievi capillari

Migliorare i tassi di allattamento esclusivo



Un aiuto concreto: Bilitool.org



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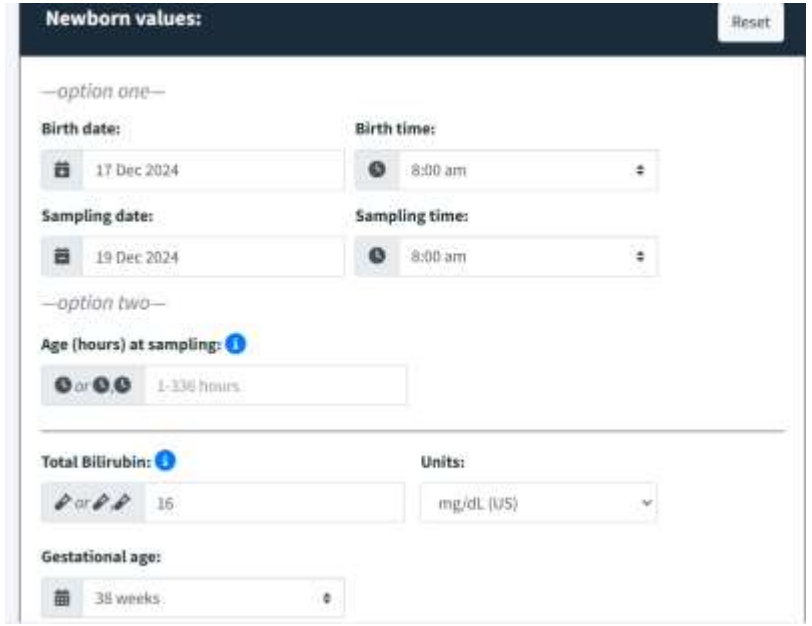
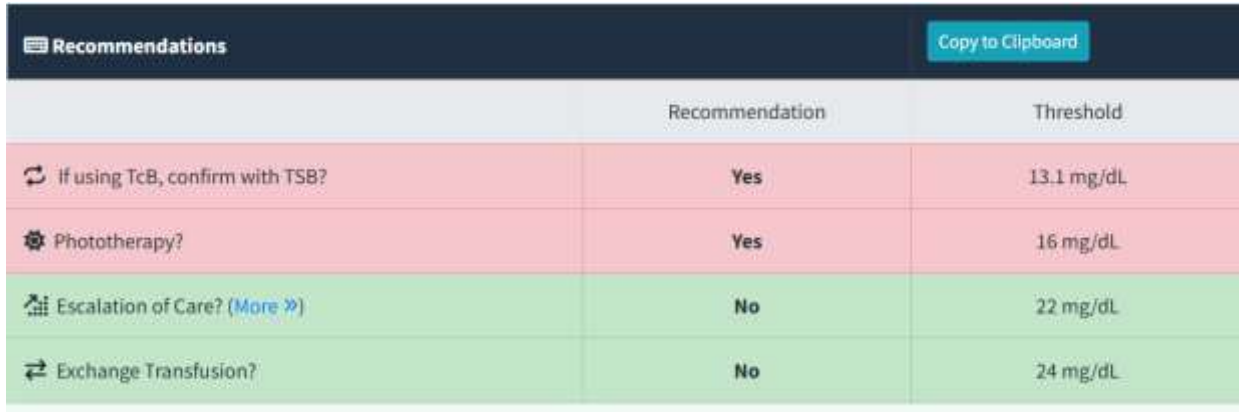
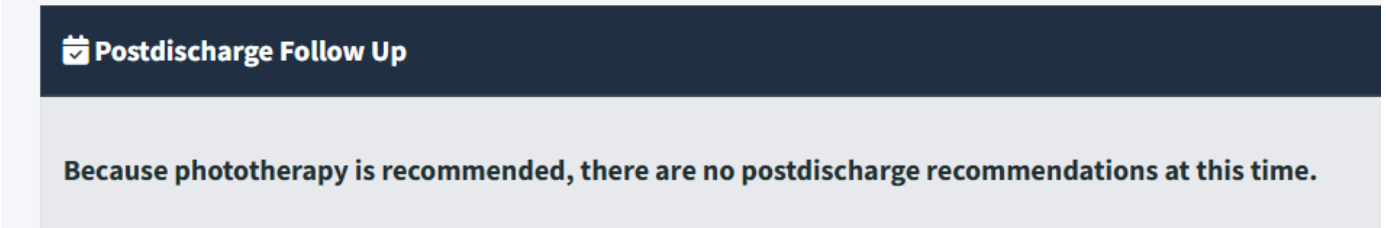




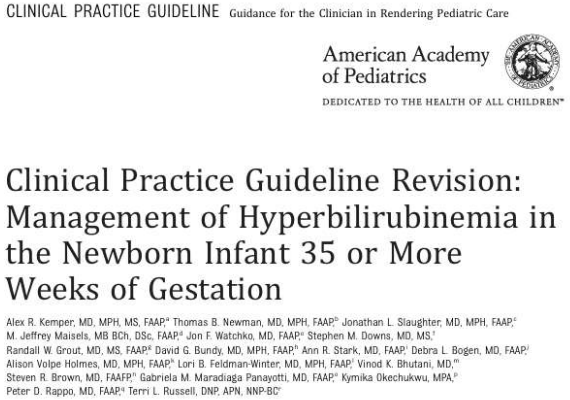


Un aiuto in più: il tasso di incremento

A rapid rate of increase

(> 0.3 mg/dL per hour in the first 24 hours or >0.2 mg/dL per hour thereafter) is exceptional and suggests hemolysis.

In this case, perform a DAT if not previously done


CLINICAL PRACTICE GUIDELINE Guidance for the Clinician in Rendering Pediatric Care

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

Clinical Practice Guideline Revision: Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation

Alex R. Kemper, MD, MPH, MS, FAAP,[a] Thomas B. Newman, MD, MPH, FAAP,[b] Jonathan L. Slaughter, MD, MPH, FAAP,[c] M. Jeffrey Maisels, MB BCh, DSc, FAAP,[d] Jon F. Watchko, MD, FAAP,[e] Stephen M. Downs, MD, MS,[f] Randall W. Grout, MD, MS, FAAP,[g] David G. Bundy, MD, MPH, FAAP,[h] Ann R. Stark, MD, FAAP,[i] Debra L. Bogen, MD, FAAP,[j] Alison Volpe Holmes, MD, MPH, FAAP,[k] Lori B. Feldman-Winter, MD, MPH, FAAP,[l] Vinod K. Bhutani, MD,[m] Steven R. Brown, MD, FAAFP,[n] Gabriela M. Maradiaga Panayotti, MD, FAAP,[o] Kymika Okechukwu, MPA,[o] Peter D. Rappo, MD, FAAP,[a] Terri L. Russell, DNP, APN, NNP-BC[p]

The AAP recommends implementation of maternity care practices that promote comprehensive, evidence-based, family-centered breastfeeding support

Zero separation

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- American Academy of Pediatrics Subcommittee on Hyperbilirubinemia. Management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation. Pediatrics. 2004 Jul;114(1):297-316. doi: 10.1542/peds.114.1.297. Erratum in: Pediatrics. 2004 Oct;114(4):1138. PMID: 15231951.

Caso clinico

Iperbilirubinemia neonatale

U.O Neonatologia Ospedale Versilia

2024

Aurora

DN 24/07/2024

TC elettivo per feto IUGR in presentazione podalica

36 settimane +2 giorni

PN 2335 g

AS 9/10

Madre primipara, sierologie non significative

Gruppo 0 Rh Positivo Coombs negativo

Decorso clinico 24/7- 03/08

Gruppo cordonale: B positivo Test di Coombs negativo

Ipoglicemia neonatale corretta con alimentazione

Ricovero in patologia neonatale

25/7 TSB 9,1 mg% Fototerapia

29/7 TSB 23,6 mg% Fototerapia (esclusa colestasi; esclusa infezione)

2/ 8 TSB 21,6 mg% Fototerapia (esclusa colestasi)

3/8 TSB 14,7 mg% Dimissione a domicilio, controllo a 48 ore

Riammissione

05/08 TSB 23,2 mg% (3°rebound); Hb 11,2 g/dL

Approfondimento diagnostico:

Aptoglobina indosabile; LDH aumentate > EMOLISI

Albuminemia nella norma

Ripetuto test di Coombs diretto: NEGATIVO

Difficoltà a reperire accesso venoso per idratazione e terapia

Trasferimento c/o centro 2° livello avanzato (ESCALATION OF CARE)

UTIN Pisa

05/08 fototerapia intensiva e idratazione ev

06/08 Hb 8,8 g/dl; eseguita trasfusione

Rilevazione di agglutinine anti-B ad alto titolo nel campione di sangue materno nonostante la confermata negatività del Test di Coombs

Immunoglobuline ev in due somministrazioni a distanza di 24 ore.

09/08 è stata sospesa la fototerapia senza necessità di nuovi cicli

Eco cerebrale : nella norma

Visita NPI: nella norma

15/08: dimissione a domicilio

RM encefalo post dimissione: nella norma

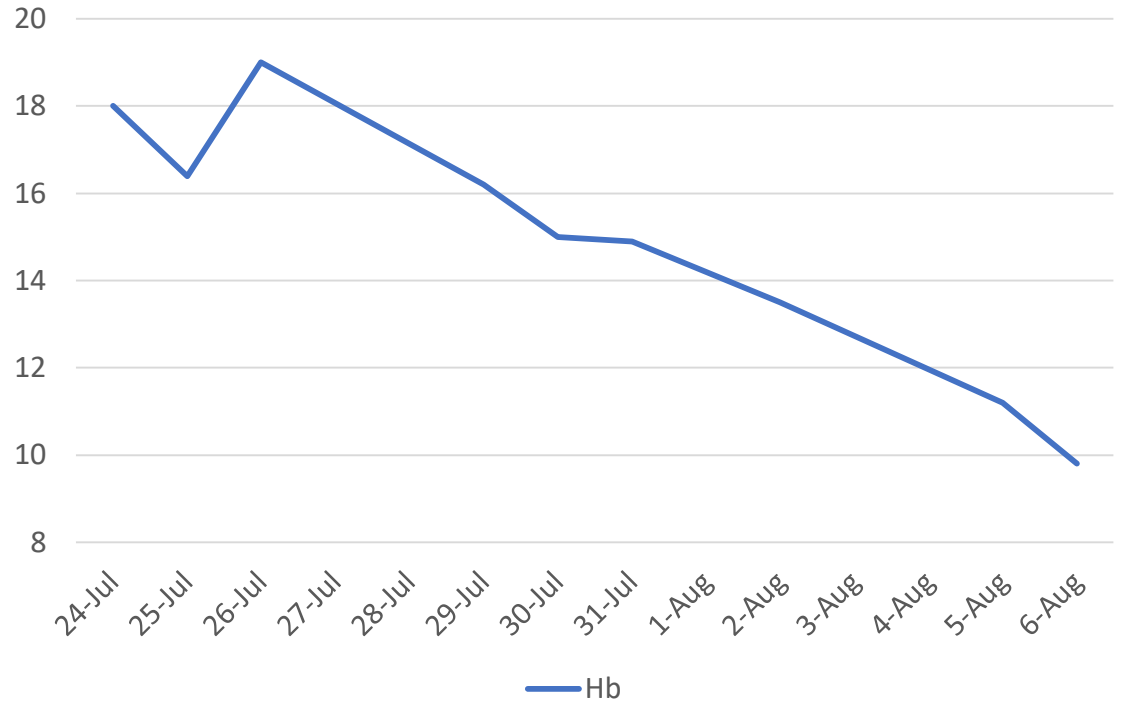
Aurora: campanelli di allarme

Late preterm

Iperbilirubinemia nelle prime 24 h

3 episodi di rebound che hanno necessitato di fototerapia

Progressivo calo dell'emoglobina



Test di Coombs diretto negativo

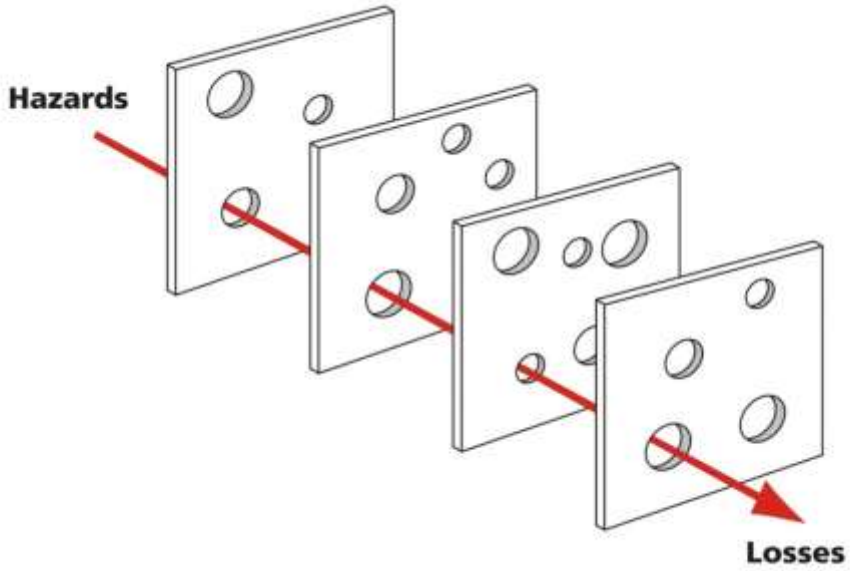
Calo dell’emoglobina progressivo

Utilizzo di curve non appropriate

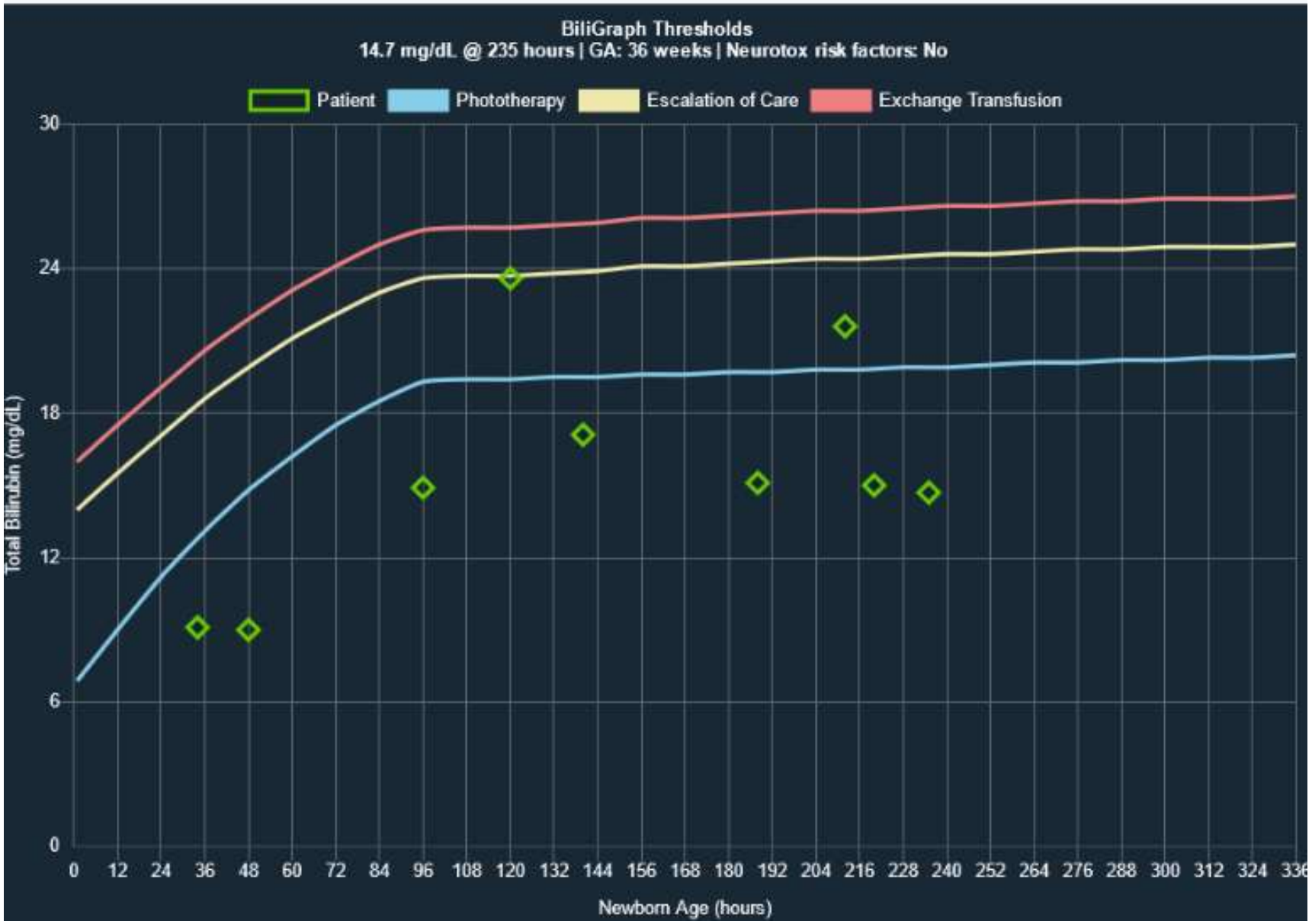
Ottime condizioni e incremento ponderale

Accertamenti parziali (colestasi-infezioni)

Follow up inappropriato



Curve utilizzate



Curve corrette

Incompatibilità ABO, interpretazione del test di Coombs

Interpretation of the DAT — In the DAT, agglutination of red blood cells (RBCs) from the neonate, when suspended with serum that contains antibodies to immunoglobulin G (IgG), indicates the presence of maternal antibody on the RBC surface.

- **Positive DAT** – A positive DAT demonstrates the presence of maternal antibody on the neonate's RBCs and is consistent with HDN. (See 'Diagnosis' below.)
- **Negative DAT** – A negative DAT does not exclude the diagnosis of HDN, particularly in the setting of ABO incompatibility. This is because the A and B antigens are less well developed in neonates than in older children and adults, and thus the DAT may not detect sensitized RBCs. In addition, the antigenic sites are fewer and farther apart on neonatal RBCs, making agglutination with the reagent more difficult

If the DAT is negative, an elution is performed on the infant's RBCs to free any bound maternal antibodies into the serum, then an indirect antiglobulin test (IAT) is performed with the eluted serum. In IAT, RBCs with a specific antigen, such as RhD, A, or B, are incubated with the infant's serum. Antibodies to the specific antigen will adhere to the RBCs. The RBCs are then washed and suspended in serum containing antihuman globulin. A positive IAT is indicated by agglutination of RBCs coated with maternal antibody, demonstrating the presence of free maternal antibodies in the neonatal serum [23]. However, a positive IAT only confirms that maternal antibodies have crossed into the neonate's circulation. Thus, it is a supportive finding but is not diagnostic of HDN.

Tossicità da bilirubina: Never Event

Fisiologia

Patologia

Sovrastima

Sottostima

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Grazie per l’attenzione

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Giuseppe Maiorino

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