Concorso pubblico, per titoli ed esami, per la copertura a tempo indeterminato di n. 2 posti di Dirigente Medico disciplina Ginecologia e Ostetricia.

Verbale n. 6

Il giorno 21 del mese di luglio dell'anno 2025 alle ore 11.15 presso i locali del Dipartimento Amministrativo dell'Azienda Ospedaliero-Universitaria Policlinico "G. Rodolico – San Marco" di Catania, siti in via Santa Sofia 78, si è riunita la Commissione esaminatrice del concorso pubblico in epigrafe, per l'espletamento della prova orale e attribuzione dei punteggi ai singoli candidati.

La Commissione esaminatrice è composta come al precedente verbale n. 1 del 15 luglio 2025.

Il Presidente, constatata la presenza di tutti i Componenti e del Segretario, accertata la legale costituzione della Commissione, dichiara aperta la seduta.

La Commissione pertanto:

a. predispone collegialmente, così come definito nel verbale n. 1 a n. 62 argomenti/quesiti (due in più rispetto ai candidati ammessi alla prova) di uguale complessità ed impegno, inerenti la disciplina a concorso, allegato n. 1 parte integrante del presente verbale (gruppo A);

b. concordemente definisce n. 62 quesiti (gruppo B) (due in più rispetto ai candidati ammessi alla prova) di uguale complessità ed impegno, volti ad accertare l'uso delle apparecchiature e delle applicazioni informatiche più diffuse, allegato n. 1 parte integrante del presente verbale;

c. sceglie di comune accordo due articoli scientifici in lingua inglese da far leggere e tradurre ai candidati. (all. n. 1 bis)

Quindi collegialmente stabilisce che ciascun candidato:

- *inizialmente* estrarrà a sorte le 2 domande, corrispondenti, una all'argomento oggetto d'esame inerente la disciplina a concorso, una il quesito oggetto d'esame relativamente alla conoscenza delle applicazioni informatiche, e una riguardante un periodo da tradurre della rivista scientifica allegato n. 1 bis (i quesiti sorteggiati saranno poi esclusi dalle possibilità di estrazione a sorte dei candidati successivi);
- *successivamente* il candidato relazionerà in merito al contenuto dallo stesso estratta a sorte.

La Commissione elabora, quindi, n. 126 bigliettini contenenti ciascuno un numero da 1 a 62 corrispondenti alle domande inerenti la disciplina a concorso (n. 1- 62), relativi alla conoscenza delle applicazioni informatiche più diffuse (n. 63-126), e alla conoscenza della lingua inglese (traduzione di un articolo scientifico (all. n. 1 bis) tra quelli a tal fine predisposti dalla Commissione (per come sopra riportati), che vengono piegati in quattro e riposti in tre contenitori trasparenti (uno per ogni gruppo di domande).
L'esito del sorteggio è riportato nell'allegato n. 2 parte integrante del presente verbale.

Alle ore 11.40 la Commissione ammette nei locali di esame i candidati, procedendo progressivamente all'appello degli stessi, così come identificati tramite l'esibizione di un valido documento di riconoscimento ed all'apposizione delle relative firme su apposito foglio presenze (All. n. 3 verbale n. 6).

Risultano essere presenti n. 60 Candidati.

La commissione chiede ai candidati se c'è qualcuno con esigenze particolari che vuole svolgere prima il colloquio, 4 candidati chiedono di espletare subito il colloquio, dopo di che si procederà in ordine alfabetico.

La prova orale svolta alla presenza dell'intera Commissione ed in seduta pubblica ha inizio alle ore 12.00.

Il Presidente informa i candidati sulle modalità di effettuazione della prova orale, quindi comunica che l'elenco dei candidati esaminati, con indicazione dei voti attribuiti, sarà pubblicato sul sito internet istituzionale aziendale, a fine colloqui e nella giornata odierna.

Ciascun candidato sorteggia i quesiti che costituiscono l'oggetto del colloquio. L'esito del sorteggio viene riportato nell'allegato (n. 2), parte integrante del presente verbale.

La Commissione, alle ore 13.00 sospende i lavori e li aggiorna alle ore 13.30.

Alle 13.30 riprendono i colloqui con il candidato Dott. Calandra.

La prova orale finisce alle ore 18.20 con l'ultima candidata, dott.ssa Zambrotta Elisa che al termine dell'esame estrae e legge i quesiti non estratti: 10, 24, 115 e 95.

Al fine di informare i concorrenti sull'esito della terza ed ultima prova concorsuale, la Commissione elabora apposita tabella con i voti conseguiti dai candidati nella prova orale, che viene pubblicata sul sito internet istituzionale aziendale nella pagina dedicata al concorso di cui in epigrafe (allegato n. 4).

La Commissione procede quindi alla formulazione delle graduatorie di merito dei candidati, allegate al presente verbale (allegato n. 5 e n. 6) per farne parte integrante, quale risulta dalla somma dei punteggi riportati da ciascuno di essi rispettivamente nella valutazione dei titoli, della prova scritta, della prova pratica e della prova orale.
Alle ore 18.45 la Commissione conclude i propri lavori dando mandato al Segretario di trasmettere la graduatoria e gli atti della procedura selettiva di che trattasi al Direttore Generale dell'Azienda, per i provvedimenti di competenza

Il presente verbale è letto, approvato e sottoscritto e le pagine che lo compongono sono siglate da tutti i membri.

F.to Presidente: Dott. Antonio Rapisarda
F.to Componente: Dott.ssa Maria Rita Falco Abramo
F.to Componente: Dott. Antonio Maiorana
F.to Segretario: Dott.ssa Piera C. M. Iudica
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1	PCOS
2	Diagnosi di endometriosi
3	Patogenesi endometriosi
4	Terapia medica endometriosi
5	Terapia chirurgica endometriosi
6	Diagnosi prolasso uterino
7	Trattamento del prolasso uterino
8	LUS
9	Lesioni preneoplastiche della portio
10	Pap test
11	Ruolo del papilloma virus nella patologia neoplastica della portio
12	Vaccinazioni anti HPV
13	Lesioni benigne della vulva
14	Neoplasie della vulva
15	Sintomatologia miomi uterini
16	Metrorragie in pre menopausa
17	Metrorragie in post menopausa
18	Cisti dermoide
19	Carcinoma dell'endometrio
20	Tri test
21	Indicazioni all'amniocentesi tardiva
22	Modalità induzione al travaglio di parto
23	Minacce d'aborto

24	Presentazione podalica
25	Presentazione di faccia
26	Situazione trasversa del feto a termine
27	Eclampsia
28	Score di Bishop
29	Macrosomia fetale
30	Condilomatosi vulvare
31	Anomalie del secondamento
32	Amenorree primitive
33	GEU (gravidanza extrauterina)
34	Emorragia del terzo trimestre di gravidanza
35	PID (malattia infiammatoria pelvica)
36	Il Bi Test
37	AFI in gravidanza
38	La biometria fetale
39	Indicazioni all'amniocentesi precoce
40	Monitoraggio biofisico in gravidanza
41	Monitoraggio cardiotocografico in travaglio di parto
42	Indicazione all'induzione al parto
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44	Parto operativo
45	Iperemesi gravidica
46	Ipertensione in gravidanza

47	Diabete in gravidanza
48	Placenta previa
49	Distacco di placenta
50	Parto pretermine
51	Gestione della gravidanza gemellare monocoriale
52	Gestione della gravidanza gemellare bicoriale
53	Morte endouterina fetale
54	Emorragia del post partum
55	Isteroscopia diagnostica
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57	Indicazioni all'isteroscopia
58	Laparoscopia diagnostica: indicazioni
59	Laparoscopia operativa
60	Controindicazioni alla laparoscopia
61	Toxoplasmosi in gravidanza
62	Rosolia in gravidanza
63	Se nell'ambito di una riunione si volessero presentare dei risultati con una presentazione al PC, quale software risulterebbe più adeguato utilizzare e perché?
64	Che cosa sono gli applicativi Word, Excel e Power Point, che utilizzo un utente può rispettivamente farne e quali elementi li caratterizzano? Descriverne caratteristiche, specificità e differenze.
65	Occorre creare un "data base" per incrociare numerosi dati provenienti da diverse fonti e persone per poi poter realizzare dei grafici, che software utilizzo?
66	Occorre inoltrare via e-mail copia di un documento del quale possiedo esclusivamente l'originale in formato cartaceo, che cosa faccio e perché?
67	Se si vuole mandare un messaggio via e-mail semplice/ordinaria che software utilizzeresti, cosa devi necessariamente conoscere e che tipi di allegati si possono accludere?
68	Se ho urgente necessità di collegarmi ad un sito internet specifico, per acquisire delle informazioni indispensabile per poter effettuare delle scelte, ma non conosco l'URL htts, come agisco?

69	Cos'è Windows Media Player?
70	Se durante l'utilizzo del PC appare sullo schermo un avviso di "Download", senza che si abbia volutamente scelto tale azione, che cosa sta succedendo?
71	Se un collega tramite posta elettronica mi inoltra dei dati su un "foglio di lavoro elettronico", di che software o bisogno per poterlo aprire ed eventualmente modificare o integrare?
72	In Windows, il file "Manuale.doc" è un documento che è possibile aprire con il programma?
73	Qual è la definizione di Tablet?
74	Qual è la definizione di Smartphone?
75	Qual è la definizione di Pendrive?
76	In Outlook che cosa succede quando si fa clic sul pulsante Invia della finestra Messaggio?
77	Cosa è la Pec?
78	Cosa è un motore di ricerca?
79	A cosa serve un back up?
80	I dispositivi di input.
81	I dispositivi di output.
82	Il filtro di posta indesiderata.
83	La barra dei preferiti.
84	la firma digitale.
85	La funzione copia.
86	La funzione incolla.
87	la funzione cronologia.
88	la firma digitale.
89	la funzione dello scanner.
90	la casella di posta elettronica.
91	le funzioni dell'hard disk.

92	l’inserimento di una tabella in Microsoft Word.
93	L’anteprima di stampa, funzioni e utilità.
94	cosa è un motore di ricerca?
95	Differenza tra rete internet e rete intranet.
96	la funzione taglia.
97	cosa è il power point?
98	estenzioni dei file.
99	la funzione filtro in Microsoft Exel.
100	la funzione modifica carattere su MS Word.
101	le modalità di connessione di un dispositivo alla rete.
102	la funzione dell’antivirus
103	Cosa è una connessione wireless?
104	Un modem è indispensabile per …
105	Che cosa è Windows?
106	Che cos'è Internet?
107	Che cos'è un "Portale"?
108	In Word è possibile attivare il controllo ortografico?
109	Per visualizzare l'anteprima di stampa è necessario?
110	Cosa si visualizza nella coda di stampa?
111	Cos'è il desktop?
112	Quando si riduce ad icona una finestra…
113	Cosa è Google Chrome?
114	Se nell’ambito di una riunione si volessero presentare dei risultati con una presentazione al PC, quale software risulterebbe più adeguato utilizzare e perché?.

115	Che cosa è “Outlook Express” e “Microsoft office outlook”, sono la medesima cosa e quali attività ti permettono di portare a compimento?
116	Occorre creare un “data base” per incrociare numerosi dati provenienti da diverse fonti e persone per poi poter realizzare dei grafici, che software utilizzo e perché?
117	Occorre inoltrare via e-mail copia di un documento del quale possiedo esclusivamente l’originale in formato cartaceo, che cosa faccio e perché?
118	Se si vuole mandare un messaggio via e-mail semplice/ordinaria che software utilizzeresti, cosa devi necessariamente conoscere e che tipi di allegati si possono accludere? Possiamo fare la medesima cosa con posta elettronica certificata?
119	Che cosa significa www, LAN e WAN e precisamente cosa è internet. Come si chiamano, quali software conosci e quale utilizzi per la navigazione su internet?
120	Se durante l’utilizzo del PC appare sullo schermo un avviso di “Download”, senza che si abbia volutamente scelto tale azione, che cosa sta succedendo? E se invece appare Upload?
121	Se un collega tramite posta elettronica mi inoltra dei dati su un “foglio di lavoro elettronico”, di che software ho bisogno per poterlo aprire ed eventualmente modificare o integrare? E se dovessi inviarlo di che applicativo ho necessità?
122	Che cos’è la posta elettronica certificata (PEC), come si ottiene e per cosa si differenzia dalla posta elettronica cosiddetta semplice o ordinaria?
123	Che cosa è l’e-mail?
124	La funzione salva con nome.
125	Cosa è lo Spamming?
126	Cosa è la tecnologia Bluetooth?

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Editorial: Education in obstetrics and gynecology

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KEYWORDS

medical education, obstetrics, gynecology, continuing medical education, training

Editorial on the Research Topic
Education in obstetrics and gynecology

Medical education in obstetrics and gynecology (OB-GYN) has undergone significant transformations to reach its current state, with the field adapting to advancements in technology, evolving patient needs, and a growing emphasis on multidisciplinary approaches to healthcare. This dynamic field, crucial to women's health, now requires a more comprehensive and integrative educational framework to prepare future clinicians for the complex challenges they will face in their practice. High-quality education and training of medical professionals are fundamental pillars in ensuring the health and wellbeing of global populations. In particular, OB-GYN requires continuous advancements in educational strategies to address the unique challenges presented by a globalized and interconnected world. This Research Topic seeks to explore the multifaceted aspects of medical education within OB-GYN, spanning from undergraduate studies to postgraduate education, continuing medical education (CME), and beyond.

The journey to becoming an OB-GYN specialist begins with a robust undergraduate medical education. Here, it is imperative to develop a curriculum that not only covers the essential medical knowledge but also fosters critical thinking, empathy, and self-reflective skills (1). Modern medical schools are increasingly adopting integrated curricula that blend basic sciences with clinical practice early on (2). This approach helps students contextualize their learning and understand the relevance of theoretical knowledge in real-world scenarios. Innovative teaching methods, such as problem-based learning (PBL) and team-based learning (TBL), have shown significant promise in enhancing student engagement and retention of knowledge (3). These methodologies encourage collaborative learning, critical analysis, and the application of knowledge to practical problems, preparing students for the dynamic and often unpredictable nature of clinical practice in OB-GYN (4).

In the context of obstetrics and gynecology education, competency-based ultrasound education has emerged as a pivotal component of training programs (Weimer et al.). This approach ensures that learners develop the essential skills and knowledge required for effective ultrasound use, regardless of the time it takes to achieve these competencies. Rather than progressing through a fixed curriculum, students advance based on their demonstrated proficiency in various aspects of ultrasound, from image acquisition and interpretation to the integration of findings into clinical decision-making (5). Simulation-based training plays a significant role, providing learners with opportunities to practice and refine their skills in a controlled environment until they reach a level of mastery. This method not only enhances technical abilities but also promotes critical thinking and clinical judgment, ensuring that graduates are fully prepared to utilize ultrasound as a diagnostic and

therapeutic tool in their practice. By focusing on competency rather than time spent in training, this educational model better equips future obstetricians and gynecologists to meet the demands of modern healthcare.

Postgraduate education, particularly residency training, is where the foundational knowledge acquired during undergraduate studies is honed into specialized clinical skills (Plöger et al.). Residency programs for OB-GYN must be rigorous, inclusive, and comprehensive, ensuring that trainees are well-equipped to handle the complexities of the field. Standardized accreditation and validation processes are crucial to maintaining the quality and consistency of these programs globally. Simulation-based training has become a cornerstone in residency programs, providing a safe and controlled environment for residents to practice and refine their skills. High-fidelity simulations, including the use of virtual reality (VR) and augmented reality (AR), offer immersive experiences that mimic real-life clinical scenarios. These technologies not only enhance technical skills but also improve decision-making, teamwork, and communication—essential components of effective clinical practice.

The rapid pace of medical advancements necessitates a commitment to lifelong learning for OB-GYN professionals. Continuing medical education (CME) ensures that practitioners remain up to date with the latest developments, techniques, and best practices in the field. CME programs must be flexible, accessible, and relevant, catering to the diverse needs of healthcare professionals across different stages of their careers. Digital platforms have revolutionized CME, offering online courses, webinars, and virtual conferences that enable professionals to learn at their own pace and convenience (6). Additionally, mobile applications and e-learning modules provide on-the-go access to educational resources, allowing clinicians to seamlessly integrate learning into their daily routines.

The digitalization of medical education has opened up new avenues for teaching and training. VR and AR are transforming the way medical students and professionals learn, providing immersive and interactive experiences that enhance understanding and retention (7). These technologies can simulate complex OB-GYN procedures, offering hands-on practice without the risks associated with real-life interventions. Simulation centers equipped with high-fidelity mannequins and task trainers allow for the practice of intricate surgical techniques, obstetric emergencies, and patient management scenarios. These controlled environments enable learners to make mistakes and learn from them, building confidence and competence.

Healthcare is inherently multidisciplinary, and the education of OB-GYN professionals must reflect this reality. Inter-professional training, where medical students, nursing students, and other healthcare trainees learn together, promotes a collaborative approach to patient care. This model fosters mutual respect, understanding, and communication among different healthcare professionals, ultimately improving patient outcomes. Transdisciplinary approaches, which incorporate non-medical education such as ethics, communication, and leadership training, further enrich the learning experience. These elements are crucial in developing well-rounded healthcare professionals who are not only skilled clinicians but also empathetic leaders and effective communicators.

Qualitative and quantitative research in medical education is essential for continuous improvement and innovation. Studies that evaluate the effectiveness of different teaching methods, curricular designs, and training tools provide valuable insights that inform educational practices. Research also helps identify gaps and areas for improvement, ensuring that medical education evolves to meet the changing needs of society.

The education of healthcare professionals in Obstetrics and Gynecology is a dynamic and evolving field that requires a multifaceted approach. From undergraduate education to postgraduate training and continuing medical education, each stage plays a critical role in developing competent, compassionate, and resilient practitioners. The integration of innovative teaching tools, inter-professional education, and rigorous research is essential to meet the challenges of a globalized world and ensure the wellbeing of global populations. As we look to the future, it is imperative that medical education remains inclusive, collaborative, and forward-thinking. By embracing these principles, we can train the next generation of OB-GYN professionals who are not only skilled clinicians but also advocates for health and wellbeing in their communities and beyond. This Research Topic aims to shed light on these important Research Topics, providing a platform for sharing knowledge, experiences, and best practices in the education of OB-GYN professionals.

The 17 contributions for this Research Topic concerning education in obstetrics and gynecology can be classified into different sections. For that purpose, the article by Frenk et al. in the Lancet, is still valuable (8). He categorized learning into three areas: specific skills needed to become a medical expert, general competencies required for professionalism, and transformative, future-focused learning to develop as a change agent. Eleven articles concern program evaluation, of which two describe checklists to assess either a skill or a generic competency, i.e., teamwork, and two articles describe program evaluation focused on generic competencies. The third class of articles are those concerning the future of education. They concern the changing demographics of our workforce and the need for culture changes, as artificial intelligence and digital tools are introduced in both our learning and care provision systems. Learning for the future in a fast-changing world also demands elements of transformative learning to foster change-agents in the health sector. The item of transformative learning is still in its infancy and needs far more academic attention. Hopefully, in a next Research Topic of this journal, the connection between health system transformation and education may attract more articles from this emerging field. Finally, an article from Ethiopia reminds us that sociological, economic, and cultural features of society are extremely relevant for addressing health issues. Learning about public health, with a broad view on society and its influence on health care, is essential for the quality and efficiency of future health services.

The landscape of medical education in obstetrics and gynecology is characterized by technological innovation, a shift toward competency-based learning, interdisciplinary collaboration, and a strong commitment to global health and equity. These

advancements ensure that future OB-GYN practitioners are well-prepared to meet the complex demands of their field, providing high-quality care to women across diverse settings. As the field continues to evolve, so too will the educational strategies, maintaining a focus on excellence and adaptability in the face of new challenges.

We hope that both obstetrician-gynecologists and teachers will enjoy this Research Topic and get engaged in optimal training for the benefit of global health.

Author contributions

FR: Writing – review & editing, Writing – original draft, Supervision, Resources, Methodology. FS: Writing – review & editing, Writing – original draft, Methodology, Investigation.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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Systematic Review

Magnesium Sulfate Before Preterm Birth for Neuroprotection

An Updated Cochrane Systematic Review

Emily S. Shepherd, PhD, Shona Goldsmith, PhD, Lex W. Doyle, MD, Philippa Middleton, PhD, Stéphane Marret, MD, PhD, Dwight J. Rouse, MD, Peter Pryde, MD, Hanne T. Wolf, MD, PhD, and Caroline A. Crowther, MD

OBJECTIVE: To systematically review the evidence for the effectiveness and safety of magnesium sulfate as a fetal neuroprotective agent when given to individuals at risk of preterm birth.

DATA SOURCES: We searched Cochrane Pregnancy and Childbirth's Trials Register, ClinicalTrials.gov, the World Health Organization International Clinical Trials Registry Platform (through March 17, 2023), and reference lists of relevant studies.

METHODS OF STUDY SELECTION: Randomized controlled trials (RCTs) assessing magnesium sulfate for fetal neuroprotection in pregnant participants at risk of imminent preterm birth were eligible. Two authors assessed RCTs for inclusion, extracted data, and evaluated risk of bias, trustworthiness, and evidence certainty (GRADE [Grading of Recommendations Assessment, Development and Evaluation]).

From the SAHMRI Women and Kids, South Australian Health and Medical Research Institute (SAHMRI), and Adelaide Medical School, University of Adelaide, Adelaide, the Cerebral Palsy Alliance Research Institute, Specialty of Child and Adolescent Health, Sydney Medical School, Faculty of Medicine and Health, University of Sydney, Sydney, and the Department of Obstetrics, Gynaecology and Newborn Health, University of Melbourne, Melbourne, Australia; INSERM Unit 1245, Team 4, Rouen School of Medicine, Normandy University, and the Department of Neonatal Pediatrics, Intensive Care, and Neuropediatrics, Rouen University Hospital, Rouen, France; Women & Infants Hospital of Rhode Island, Warren Alpert Medical School of Brown University, Providence, Rhode Island; the Department of Anesthesiology, University of Wisconsin School of Medicine and Public Health, Madison, Wisconsin; the Department of Gynaecology and Obstetrics, Hvidovre University Hospital, Hvidovre, Denmark; and the Liggins Institute, University of Auckland, Auckland, New Zealand.

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Each author has confirmed compliance with the journal's requirements for authorship.

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Financial Disclosure

Emily S. Shepherd: former Editor for Cochrane Pregnancy and Childbirth and current Sign-off Editor for Cochrane Central Editorial Service, but had no involvement in the editorial processing of this review. Shona Goldsmith: senior research fellow with Cerebral Palsy Alliance, The University of Sydney. Lex W. Doyle: investigator for an included randomized controlled trial (RCT) (Crowther 2003), and published opinions in medical journals relating to magnesium sulfate use in neuroprotection. Philippa Middleton: investigator for an included RCT (Crowther 2023); former Editor for Cochrane Pregnancy and Childbirth and current Sign-off Editor for Cochrane Central Editorial Service but had no involvement in the editorial processing of this review; and Independent Contractor for National Health and Medical Research Council Stillbirth Centre for Research Excellence. Stéphane Marret: investigator for included RCT (Marret 2006) and works as a health professional in neonatology and neuropaediatrics, Rouen University Hospital, Rouen, France. Dwight J. Rouse: investigator for an included RCT (Rouse 2008). Peter Pryde: investigator for an included RCT (Mittendorf 2002); published opinions in medical journals relating to magnesium sulfate to reduce cerebral palsy; is a retired clinician; and maintains an adjunct faculty position at the University of Wisconsin School of Medicine and Public Health strictly for academic purposes. Hanne W. Wolf: investigator for an included RCT (Wolf 2020), and works as a Gynaecologist and Obstetrician, University Hospital, Denmark. Caroline A. Crowther: investigator for included RCTs (Crowther 2003; Crowther 2023).

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TABULATION, INTEGRATION, AND RESULTS: We included six RCTs (5,917 pregnant participants and 6,759 fetuses at less than 34 weeks of gestation at randomization). They were conducted in high-income countries (two in the United States, two across Australia and New Zealand, and one each in Denmark and France) and commenced between 1995 and 2018. Primary outcomes: up to 2 years of corrected age, magnesium sulfate compared with placebo reduced the risk of cerebral palsy (risk ratio [RR] 0.71, 95% CI, 0.57–0.89; six RCTs, 6,107 children) and death or cerebral palsy (RR 0.87, 95% CI, 0.77–0.98; six RCTs, 6,481 children) (high-certainty evidence). Magnesium sulfate had little or no effect on death up to 2 years of corrected age (moderate-certainty evidence) or these outcomes at school age (low-certainty evidence). Although there was little or no effect on death or cardiac or respiratory arrest for pregnant individuals (low-certainty evidence), magnesium sulfate increased adverse effects severe enough to stop treatment (RR 3.21, 95% CI, 1.88–5.48; three RCTs, 4,736 participants; moderate-certainty evidence). Secondary outcome: magnesium sulfate reduced the risk of severe neonatal intraventricular hemorrhage (moderate-certainty evidence).

CONCLUSION: Magnesium sulfate for preterm fetal neuroprotection reduces cerebral palsy and death or cerebral palsy for children. Further research is required on longer-term benefits and harms for children, effect variation by participant and treatment characteristics, and the generalizability of findings to low- and middle-income countries.

SYSTEMATIC REVIEW REGISTRATION: The review protocol was based on a standard Cochrane Pregnancy and Childbirth template and our previous Cochrane Systematic Review (doi: 10.1002/14651858.CD004661.pub3; published before the introduction of PROSPERO).

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Cerebral palsy remains the most common physical disability in childhood. The birth prevalence of cerebral palsy in high-income countries is 1.6 per 1,000 live births.[1] Prevalence is markedly higher in low- and middle-income countries and for children born preterm.[2–4] There is no cure; prevention is crucial.

Magnesium sulfate showed promise for preterm fetal neuroprotection (including cerebral palsy prevention) in observational studies in the 1990s.[2–4] In response, several randomized controlled trials (RCTs) were conducted.[5–8] These RCTs were included in evidence syntheses,[9–11] including a 2009 Cochrane Systematic Review,[12] which confirmed the neuroprotective effects of magnesium sulfate. Magnesium sulfate compared with placebo was shown to reduce the risk of cerebral palsy (risk ratio [RR] 0.68, 95% CI, 0.54–0.87; five RCTs, 6,145 children) and death or cerebral palsy (RR 0.85, 95% CI, 0.74–0.98; four RCTs, 4,446 children) up to 2 years of corrected age.[12]

Over the past decade, adoption of magnesium sulfate for preterm cerebral palsy prevention has ensued across the globe. Across high-income countries, professional bodies, including in the United States,[13] have provided committee opinions and clinical practice guidelines.[14] In its 2015 guidance on interventions to improve preterm birth outcomes, the World Health Organization (WHO) delivered a strong recommendation for use.[15]

Despite proven effectiveness, studies, including an individual participant data meta-analysis based on data from RCTs included in the 2009 Cochrane Systematic Review,[16] have not established variation in magnesium sulfate's benefits according to participant and treatment characteristics. Recommendations for use therefore vary.[14] Local, national, and international translation and uptake are impeded by this variability. Further, in recent years, several new RCTs and school-age follow-up of original RCTs have been completed. Consequently, it is timely to re-evaluate the evidence on prenatal magnesium sulfate for preterm fetal neuroprotection. We aimed to systematically review the evidence for the effectiveness and safety of magnesium sulfate as a fetal neuroprotective agent when administered to individuals at risk of preterm birth in a Cochrane Systematic Review update.

SOURCES

We adhered to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines.[17] The review protocol was based on a standard Cochrane Pregnancy and Childbirth template and the previous Cochrane Systematic Review[12] (published before the introduction of PROSPERO).

For this Cochrane Systematic Review update,[18] on March 17, 2023, we searched Cochrane Pregnancy and Childbirth's Trials Register (containing reports from CENTRAL [Cochrane Central Register of Controlled Trials], MEDLINE, EMBASE and CINAHL, hand searched journals and conference proceedings), ClinicalTrials.gov and the WHO International Clinical Trials Registry Platform. Further details of the search strategies can be found in Appendix 1, available online at http://links.lww.com/AOG/D710. We also searched the reference lists of relevant studies and Google Scholar. No language restrictions were applied. Searches were not date restricted (not limited to after the 2009 Cochrane Systematic Review[12]).

STUDY SELECTION

To minimize potential biases, only RCTs and cluster-RCTs were eligible, in full-text or abstract form. Quasi-RCTs and crossover trials were not eligible. Randomized controlled trials assessing magnesium sulfate given for fetal neuroprotection compared with placebo or no treatment in pregnant participants at risk of imminent preterm birth (at less than 37 weeks of gestation) were eligible. Randomized controlled trials in which magnesium sulfate was used with the primary aim of tocolysis, prevention and treatment of eclampsia and preeclampsia, or as a prenatal dietary supplement were not eligible.

For children, primary outcomes were death (fetal, neonatal, or later), cerebral palsy, death or cerebral palsy, major neurodevelopmental disability, and death or major neurodevelopmental disability. For pregnant participants, primary outcomes were severe outcome potentially related to treatment (death, respiratory arrest, or cardiac arrest) and adverse effects severe enough to stop treatment. Comprehensive secondary outcomes for infants, children, adults, and pregnant individuals were prespecified–the detailed list can be found in Appendix 1 (http://links.lww.com/AOG/D710).

Two reviewers (E.S.S. and a second author not involved in a potentially eligible RCT) independently assessed all potential studies identified for inclusion. Disagreements were resolved through discussion. Randomized controlled trials meeting the inclusion criteria were further evaluated by two reviewers (E.S.S. and S.G., not involved in the eligible RCTs) against predefined criteria for scientific integrity to select studies deemed to be sufficiently trustworthy for analysis (see Appendix 1, http://links.lww.com/AOG/D710, for details of criteria applied).

For included RCTs, data were extracted using a standardized form, including information regarding design, participants, magnesium sulfate regimen, control, outcomes reported, results relevant to the review, and risk of bias. Data were extracted by two reviewers (E.S.S. and S.G.), with differences resolved through discussion. Quality was appraised by two reviewers (E.S.S. and S.G.) using established guidelines provided in the Cochrane Handbook for Systematic Reviews of Interventions.[19]

Data were analyzed using RevMan Web.[20] Effect sizes were estimated as RRs for dichotomous outcomes and mean differences for continuous outcomes, with 95% CIs. Where there were sufficient data, pooled estimates were calculated, first using fixed-effects meta-analysis (Mantel-Haenszel method). We performed random-effects meta-analysis to combine effect estimates when there was substantial statistical heterogeneity (I^2>30% and either T^2>0 or low P value [<0.10] in the χ^2 test).

For the primary outcomes, subgroup analyses were planned based on characteristics of participants (primary reason considered to be at high risk of preterm birth, number of fetuses in utero, gestational age at randomization) and treatment regimens (mode of administration, time treatment intended to be started before birth, loading dose regimen, maintenance dose regimen, repeat treatment permitted). Sensitivity analyses were planned, restricting primary outcome analyses to RCTs with low risk of bias. We planned to investigate reporting biases using funnel plots if 10 or more RCTs were included in meta-analyses.

We planned to assess certainty of the evidence for the primary outcomes and prespecified secondary outcomes (infants: severe intraventricular hemorrhage [grade 3 or 4] and chronic lung disease or bronchopulmonary dysplasia; pregnant individuals: mode of birth (cesarean delivery), postpartum hemorrhage, breastfeeding at hospital discharge, and views of treatment) using the GRADE (Grading of Recommendations Assessment, Development and Evaluation) approach.[21] Evidence was classified as high, moderate, low, or very low certainty considering the following domains: study limitations, consistency, directness, imprecision, and publication bias. Certainty of evidence was assessed by two reviewers (E.S.S. and S.G.); discrepancies were resolved through discussion.

RESULTS

For this updated Cochrane Systematic Review, database searching and other sources identified 215 new records, which we assessed for inclusion, along with 29 records relating to RCTs included in the 2009 Cochrane Systematic Review. After removal of duplicate and irrelevant records, we assessed 137 in full. We included six RCTs (116 records) and excluded six studies (seven records); four studies (four records) are ongoing, and eight studies (10 records) are "awaiting classification" pending further information. A study flow diagram is shown in Figure 1, and Appendix 2, available online at http://links.lww.com/AOG/D710, provides a full list of records by classification.

The six included RCTs (four of which were included in the 2009 Cochrane Systematic Review[5–8]) were all individually randomized.[5–8,22,23] They were conducted in high-income countries (two in the United States,[5,8] two across Australia and New Zealand,[6,23] and one each in Denmark[22] and France[7]) and commenced between 1995[5] and 2018.[22] Sample sizes ranged from

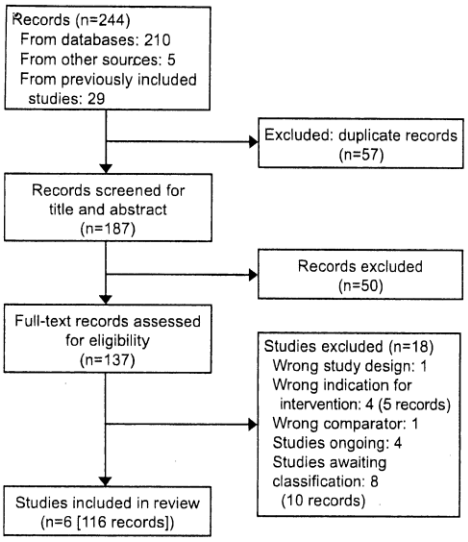

Fig. 1. Flow diagram of studies identified in the systematic review.

Shepherd. Magnesium Sulfate for Neuroprotection Review. Obstet Gynecol 2024.

57[5] to 2,241,[8] with the RCTs including a total of 5,917 pregnant participants and their 6,759 fetuses alive at randomization.[5–8,22,23] Although eligibility criteria varied, all RCTs included pregnant participants in preterm labor or with expected or planned imminent preterm birth at less than 34 weeks of gestation. Lower limits of gestational age varied (no limit,[6,7] 24 weeks,[5,8,22] or 30 weeks[23]), as did upper limits (less than 30,[6] 32,[8,22] 33,[7] or 34 weeks[5,23]). Four RCTs included singletons and twins,[5,8,22,23] and two also included higher-order multiple gestations.[6,7] All RCTs assessed intravenous magnesium sulfate for fetal neuroprotection compared with a placebo.[5–8,22,23] Three administered a 4-g loading dose only,[5,7,23] and three included a maintenance dose (a 4–6-g loading dose and 1–2-g/h maintenance dose).[6,8,22] Re-treatment was permitted in only two RCTs.[8,22] The six RCTs all reported on childhood follow-up outcomes at 18 months to 2 years of corrected age[5–8,22,23]; two also reported on school-age follow-up.[24,25] Further characteristics of the RCTs are provided in Appendix 3 (available online at http://links.lww.com/AOG/D710), including eligibility criteria, magnesium sulfate and control regimens, review outcomes reported, definitions of outcomes, and follow-up assessment methods used in each RCT.

Overall risk of bias for most domains across RCTs was judged to be low. Considering selection bias, five were at low risk[6–8,22,23] and one was at unclear risk.[5] All RCTs were at low risk of performance and detection bias.[5–8,22,23] Five RCTs were at low risk of attrition bias for the main RCT and initial 18-month–2-year corrected age follow-up,[6–8,22,23] and one was at unclear risk[5]; two RCTs were at unclear risk of attrition bias for school-age follow-up.[24,25] Four RCTs were at low risk of reporting bias,[6,8,22,23] and two were at unclear risk.[5,7] Appendix 3 (http://links.lww.com/AOG/D710) provides the detailed quality assessment of each RCT and a summary figure.

Primary outcomes for infants and children up to 2 years of corrected age: magnesium sulfate compared with placebo reduced cerebral palsy (RR 0.71, 95% CI, 0.57–0.89; six RCTs, 6,107 children; number needed to treat for additional beneficial outcome [NNTB] 60, 95% CI, 41–158) and death or cerebral palsy (RR 0.87, 95% CI, 0.77–0.98; six RCTs, 6,481 children; NNTB 56, 95% CI, 32–363) (both high-certainty evidence). Magnesium sulfate probably resulted in little to no difference in death (fetal, neonatal, or later) (RR 0.96, 95% CI, 0.82–1.13; six RCTs, 6,759 children), major neurodevelopmental disability (RR 1.09, 95% CI, 0.83–1.44; one RCT, 987 children), or death or major neurodevelopmental disability (RR 0.95, 95% CI, 0.85–1.07; three RCTs, 4,279 children) (all moderate-certainty evidence). See Table 1 for a summary of findings and Appendix 4, available online at http://links.lww.com/AOG/D710, for forest plots of meta-analyses.

Primary outcomes for infants and children at school age: magnesium sulfate compared with placebo may have resulted in little to no difference in death (fetal, neonatal, or later) (RR 0.82, 95% CI, 0.66–1.02; two RCTs, 1,758 children), cerebral palsy (RR 0.99, 95% CI, 0.69–1.41; two RCTs, 1,038 children), death or cerebral palsy (RR 0.90, 95% CI, 0.67–1.20; one RCT, 503 children), and death or major neurodevelopmental disability (RR 0.81, 95% CI, 0.59–1.12; one RCT, 503 children) (all low-certainty evidence). Magnesium sulfate also may have resulted in little to no difference in major neurodevelopmental disability (RR 0.92, 95% CI, 0.53–1.62; two RCTs, 940 children; very low-certainty evidence). See Table 2 for a summary of findings and Appendix 4 (http://links.lww.com/AOG/D710) for forest plots of meta-analyses.

Primary outcomes for pregnant individuals: magnesium sulfate may have resulted in little or no difference in severe outcomes potentially related to treatment (death, cardiac arrest, respiratory arrest) (RR 0.32, 95% CI, 0.01–7.92; four RCTs, 5,300 participants; low-certainty evidence). However, magnesium sulfate probably increased adverse effects

Table 1. Summary of Findings for Main Outcomes for Infants and Children Up to 2 Years of Corrected Age

Outcome*	Anticipated Absolute Effect (95% CI)†		RR (95% CI)	No. of Participants (RCTs)	Certainty of the Evidence (GRADE)‡
	Risk With Placebo	Risk With Magnesium Sulfate			
Primary					
Death (fetal, neonatal, or later—up to 2 y CA)	81/1,000	78/1,000 (66–92)	0.96 (0.82–1.13)	6,759 (6 RCTs[5–8,22,23])	⊕⊕⊕⊖ Moderate[§]
Cerebral palsy (up to 2 y CA)	58/1,000	41/1,000 (33–52)	0.71 (0.57–0.89)	6,107 (6 RCTs[5–8,22,23])	⊕⊕⊕⊕ High
Death or cerebral palsy (up to 2 y CA)	138/1,000	120/1,000 (106–135)	0.87 (0.77–0.98)	6,481 (6 RCTs[5–8,22,23])	⊕⊕⊕⊕ High
Major neurodevelopmental disability (up to 2 y CA)	162/1,000	177/1,000 (135–233)	1.09 (0.83–1.44)	987 (1 RCT[6])	⊕⊕⊕⊖ Moderate[§]
Death or major neurodevelopmental disability (up to 2 y CA)	223/1,000	212/1,000 (190–239)	0.95 (0.85–1.07)	4,279 (3 RCTs[6,8,23])	⊕⊕⊕⊖ Moderate[§,‖]
Secondary					
Severe intraventricular hemorrhage (grade 3 or 4) (newborn or infant)	45/1,000	34/1,000 (27–44)	0.76 (0.60–0.98)	5,885 (5 RCTs[5,6,8,22,23])	⊕⊕⊕⊖ Moderate[¶]
Chronic lung disease or bronchopulmonary dysplasia (newborn or infant)	183/1,000	168/1,000 (141–201)	0.92 (0.77–1.10)	6,689 (5 RCTs[6–8,22,23])	⊕⊕⊖⊖ Low[§,#]

RR, risk ratio; RCT, randomized controlled trial; GRADE, Grading of Recommendations Assessment, Development and Evaluation; CA, corrected age.

* Outcomes as defined by RCT authors.

† The risk in the intervention group (and its 95% CI) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

‡ GRADE Working Group grades of evidence. High certainty: we are very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.

§ Downgraded one level due to imprecision—the 95% CI includes both benefit and harm.

‖ Not downgraded for risk of bias; however, data from one RCT from secondary analysis (result remained similar when this RCT was excluded from meta-analysis).

¶ Downgraded one level due to risk of bias—when data from one RCT with potential methodologic concerns were excluded from the meta-analysis, the 95% CI included the null value.

Downgraded one level due to inconsistency as evidenced by statistical heterogeneity, which could be due to outcome definition variations.

severe enough to stop treatment for pregnant individuals compared with placebo (average RR 3.21, 95% CI, 1.88–5.48; three RCTs, 4,736 participants; moderate-certainty evidence). See Table 3 for a summary of findings and Appendix 4 (http://links.lww.com/AOG/D710) for forest plots of meta-analyses.

Considering secondary outcomes assessed using GRADE for infants and children, magnesium sulfate probably reduced severe intraventricular hemorrhage (grade 3 or 4) (RR 0.76, 95% CI, 0.60–0.98; five RCTs, 5,885 infants, NNTB 92, 95% CI, 55–1,102; moderate-certainty evidence) and may have resulted in little to no difference in chronic lung disease or bronchopulmonary dysplasia (RR 0.92, 95% CI, 0.77–1.10; five RCTs, 6,689 infants; low-certainty evidence) (Table 1). For pregnant individuals, magnesium sulfate probably resulted in little or no difference in cesarean delivery (five RCTs, 5,861 participants) and postpartum hemorrhage (two RCTs, 2,495 participants) (both moderate-certainty evidence). No data were reported for breastfeeding at discharge or pregnant individuals' views of treatment (Table 3 and Appendix 4 [http://links.lww.com/AOG/D710]).

No evidence of differences was observed for most other secondary outcomes not assessed using GRADE for infants and children. However, we did observe a number of possible benefits with magnesium sulfate compared with placebo: fewer infants required

Table 2. Summary of Findings for Main Outcomes for Infants and Children Up to School Age

Outcome*	Anticipated Absolute Effect (95% CI)†		RR (95% CI)	No. of Participants (RCTs)	Certainty of the Evidence (GRADE)‡
	Risk With Placebo	Risk With Magnesium Sulfate			
Primary					
Death (fetal, neonatal, or later—up to school age)	169/1,000	139/1,000 (112–172)	0.82 (0.66–1.02)	1,758 (2 RCTs[24,25])	⊕⊕⊖⊖ Low[§,‖]
Cerebral palsy (school age)	103/1,000	102/1,000 (71–145)	0.99 (0.69–1.41)	1,038 (2 RCTs[24,25])	⊕⊕⊖⊖ Low[§,‖]
Death or cerebral palsy (up to school age)	283/1,000	255/1,000 (190–340)	0.90 (0.67–1.20)	503 (1 RCT[24])	⊕⊕⊖⊖ Low[§,‖]
Major neurodevelopmental disability (school age)	116/1,000	107/1,000 (62–188)	0.92 (0.53–1.62)	940 (2 RCTs[24,25])	⊕⊖⊖⊖ Very low[§,‖,¶]
Death or major neurodevelopmental disability (up to school age)	259/1,000	210/1,000 (153–290)	0.81 (0.59–1.12)	503 (1 RCT[24])	⊕⊕⊖⊖ Low[§,‖]

RR, risk ratio; RCT, randomized controlled trial; GRADE, Grading of Recommendations Assessment, Development and Evaluation.

* Outcomes as defined by RCT authors.

† The risk in the intervention group (and its 95% CI) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

‡ GRADE Working Group grades of evidence. Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect. Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

§ Downgraded one level due to risk of bias—the included RCTs were judged to have some concerns due to missing outcome data at school-age follow-up.

‖ Downgraded one level due to imprecision—the 95% CI included both benefit and harm.

¶ Downgraded one level due to inconsistency as evidenced by statistical heterogeneity, which could be due to outcome definition variation.

intubation for resuscitation (two RCTs, 3,093 infants), and, up to 2 years of corrected age, fewer children had moderate or severe cerebral palsy (five RCTs, 5,502 children), died or had any neurodevelopmental disability (three RCTs, 3,194 children), had substantial gross motor dysfunction (one RCT, 1,042 children), or died or had substantial gross motor dysfunction (five RCTs, 5,097 children). No harms for infants or children were observed with magnesium sulfate compared with placebo, except for possibly more children up to 2 years of corrected age with behavioral scores (assessed by the Child Behavior Checklist) within the clinical problem range, overall and on the following scales: anxiety, withdrawal, sleeping problems, other (all in one RCT, up to 795 children). See Appendix 5, available online at http://links.lww.com/AOG/D710, for results for all secondary outcomes for infants and children.

For pregnant individuals, largely no evidence of differences in outcomes, including no benefits, were observed. We did, however, observe some possible harms in the magnesium sulfate compared with placebo group: more pregnant individuals experienced any side effects of treatment (four RCTs, 5,300 participants) and the following side effects: hypotension (three RCTs, 3,059 participants), tachycardia (one RCT, 1,062 participants), warmth over body or flushing (four RCTs, 5,300 participants), arm discomfort with infusion (three RCTs, 4,736 participants), mouth dryness (two RCTs, 2,495 participants), nausea or vomiting (four RCTs, 5,300 participants), sleepiness (one RCT, 1,062 participants), sweating (three RCTs, 4,736 participants), dizziness (two RCTs, 2,495 participants), and blurred vision (two RCTs, 2,495 participants). See Appendix 5 (http://links.lww.com/AOG/D710) for results for all secondary outcome for pregnant individuals.

Subgroup analyses for primary outcomes: interaction tests demonstrated no evidence of differences between subgroups with available data (eg, gestational age at randomization, loading dose regimen, maintenance dose regimen, repeat treatment permitted) for infant and child outcomes up to 2 years of corrected age (death, cerebral palsy, death or cerebral palsy, and death or major neurodevelopmental disability), at early school age (death, cerebral palsy, and major neurodevelopmental disability), or for pregnant individuals (severe outcome potentially related to treatment and adverse effects severe enough to stop treatment). See Appendix 5 (http://links.lww.com/AOG/D710) for results from subgroup analyses.

Table 3. Summary of Findings for Main Outcomes for Pregnant Individuals

Outcome*	Anticipated Absolute Effect (95% CI)†		RR (95% CI)	No. of Participants (RCTs)	Certainty of the Evidence (GRADE)‡
	Risk with Placebo	Risk with Magnesium Sulfate			
Primary					
Severe outcome potentially related to treatment (death, respiratory arrest, or cardiac arrest)	1/1,000	1/1,000 (0–8)	0.32 (0.01–7.92)	5,300 (4 RCTs[6–8,23])	⊕⊕⊖⊖ Low§
Adverse effects severe enough to stop treatment	19/1,000	61/1,000 (36–104)	3.21 (1.88–5.48)	4,736 (3 RCTs[6,8,23])	⊕⊕⊕⊖‖ Moderate
Secondary					
Mode of birth (cesarean delivery)	476/1,000	457/1,000 (433–486)	0.96 (0.91–1.02)	5,861 (5 RCTs[6–8,22,23])	⊕⊕⊕⊖¶ Moderate
Postpartum hemorrhage	216/1,000	203/1,000 (173–235)	0.94 (0.80–1.09)	2,495 (2 RCTs[6,23])	⊕⊕⊕⊖ Moderate#
Breastfeeding at hospital discharge	No RCTs reported data for this outcome				
Pregnant individuals' views of treatment	No RCTs reported data for this outcome				

RR, risk ratio; N, number of participants; RCT, randomized controlled trial; GRADE, Grading of Recommendations Assessment, Development and Evaluation.

* Outcomes as defined by RCT authors.

† The risk in the intervention group (and its 95% CI) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

‡ GRADE Working Group grades of evidence. Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.

§ Downgraded two levels due to imprecision given there was only one event and a wide 95% CI included both benefit and harm.

‖ Downgraded one level due to inconsistency as evidenced by statistical heterogeneity, which could be due to differences in protocols for stopping treatment.

¶ Downgraded one level due to inconsistency as evidence by statistical heterogeneity, which could be due to differences in birth intervention practices.

Downgraded one level due to imprecision—95% CI included both benefit and harm.

Sensitivity analyses for primary outcomes: where applicable, in sensitivity analyses based on RCT quality (removing one RCT at unclear risk of selection bias[5]), results for outcomes (up to 2 years of corrected age: death, cerebral palsy, death or cerebral palsy) remained similar to overall analyses. In post hoc sensitivity analyses pooling adjusted effect sizes, when reported by RCTs, results for outcomes (up to 2 years of corrected age: death, cerebral palsy, death or cerebral palsy, and death or major neurodevelopmental disability; at early school age: cerebral palsy) were similar to overall analyses. See Appendix 5 (http://links.lww.com/AOG/D710) for results from sensitivity analyses.

DISCUSSION

This updated Cochrane Systematic Review included six RCTs (enrolling 5,917 pregnant participants at less than 34 weeks of gestation and their 6,759 fetuses alive at randomization) that compared magnesium sulfate with placebo for neuroprotection of the fetus in pregnant individuals at risk of preterm birth.[5–8,22,23] Evidence indicates that magnesium sulfate, compared with placebo, reduces cerebral palsy and death or cerebral palsy for children up to 2 years of corrected age and probably reduces severe intraventricular hemorrhage for infants. Current evidence suggests that magnesium sulfate may result in little to no difference in outcomes at school age. Although evidence indicates that magnesium sulfate may result in little to no difference in severe outcomes (death, cardiac arrest, respiratory arrest) for pregnant individuals, it suggests that magnesium sulfate probably increases adverse effects severe enough to stop treatment.

Evidence to assess the effects of magnesium sulfate for preterm fetal neuroprotection is, however, currently incomplete. Although we were able to include data from all six RCTs for the review's primary outcomes of death, cerebral palsy, and death or cerebral palsy up to 2 years of corrected age, for many

outcomes, only one to five RCTs contributed data. For several prespecified secondary review outcomes, there were no data reported by the included RCTs. Only two of the six RCTs have reported data up into school age,[24,25] and none have reported on follow-up beyond the first decade of life.

This review's findings are further limited by variations in the characteristics of the pregnant participants randomized and treatment regimens used across the included RCTs. Although we attempted to explore variation through subgroup analyses, the ability to do this was limited (eg, inclusion criteria did not enable allocation to one or the other subgroup, or stratified results were not presented, or both).

All included RCTs were conducted in high-income countries and commenced between 1995 and 2018.[5–8,22,23] Thus, although there are nearly 6,000 pregnant participants and their children in these RCTs, the applicability to low- and middle-income countries and generalizability to present day clinical context or practice of their findings should be considered.

After screening of potentially eligible studies for trustworthiness, a total of eight were classified as "awaiting classification" (Appendix 2, http://links.lww.com/AOG/D710). These were conducted in various low- and middle-income countries. Their possible future inclusion (along with potential inclusion of "ongoing studies" (Appendix 2, http://links.lww.com/AOG/D710) in a further update to this review may extend the applicability and generalizability of its findings.

Overall risk of bias of the included RCTs was judged to be low. Sensitivity analyses, restricted to the five RCTs at low risk of selection bias,[6–8,22,23] supported findings from the main analyses. For primary and secondary review outcomes assessed using GRADE, evidence was determined to be high- to very low-certainty. Evidence was predominantly downgraded due to imprecision, study design limitations, and inconsistency.

We took steps to minimize bias throughout the review process. We conducted a detailed and systematic search, without language, date, or publication status restrictions. Two review authors (E.S.S. and S.G.) not involved in potentially eligible or included RCTs independently assessed RCTs for inclusion; performed data extraction, including risk of bias assessment; and assessed the certainty of the evidence, with disagreements discussed until consensus was reached. Despite independent assessments, these processes are inherently subjective and require a degree of interpretation. In all cases, we sought to be consistent and transparent, documenting our decisions and rationale. We recognize that, with many review outcomes, there is a risk of statistical type 1 error (a "false-positive" result). Results for which there are very few RCTs included, or with moderate or substantial heterogeneity, and "borderline statistical significance" should be treated with caution.

Our review provides the most up-to-date and comprehensive assessment of trustworthy evidence. The results and conclusions of this review are largely consistent with those of prior reviews.[9–12,26,27] Compared with the 2009 Cochrane Systematic Review, this review includes two new RCTs[22,23] and new school-age follow-up data from two previously included RCTs[24,25] and excludes one previously included RCT (magnesium sulfate was administered for preeclampsia not fetal neuroprotection).[28] Our review re-confirms that magnesium sulfate reduces cerebral palsy and death or cerebral palsy for children up to 2 years of corrected age. A new finding in this update is that magnesium sulfate probably reduces severe intraventricular hemorrhage for infants. This update also incorporates contemporary methodologies, including GRADE,[21] to rate the certainty of the body of evidence.

Our review is also broadly comparable with previous comprehensive reviews of adverse outcomes associated with magnesium sulfate (when administered for the prevention or treatment of eclampsia, for preventing preterm labor and birth [tocolysis], and for fetal neuroprotection).[29,30] Magnesium sulfate has not been shown to increase serious adverse effects for pregnant individuals, though an increase in comparatively "minor" adverse treatment effects and treatment cessation has been shown.[29] Magnesium sulfate has not been shown to increase neonatal adverse outcomes, including death.[30]

This review is the first to include data from Crowther et al.[23] This RCT was designed to assess the effect of magnesium sulfate at 30–34 weeks of gestation (beyond the gestational age currently recommended in some countries[14] based on the previous Cochrane Review).[12] Although a reduction in the RCT's composite primary outcome (death or cerebral palsy for children at 2 years of corrected age or the separate components) was not shown, the authors recognize the limited power to detect small between-group differences due to the lower event rates for death and cerebral palsy than predicted and the RCT's sample size.[23,31] Despite the absence of benefit observed in Crowther et al 2023,[23] the addition of their data to our review's meta-analysis did not negate the overall neuroprotective benefits observed with this treatment.

To date, only one other systematic review has reported on school-age outcomes of antenatal magnesium sulfate for fetal neuroprotection.[32] Its findings support ours—an absence of clear benefits or harms and the need for additional follow-up data to determine effects with greater certainty.[32]

The findings of our review's limited subgroup analyses are consistent with those from a previous individual participant data meta-analysis,[16] which similarly demonstrates reductions for children up to 2 years of corrected age in cerebral palsy and death or cerebral palsy—with benefit not clearly affected by characteristics including preterm gestational age and treatment regimen. With the availability of individual participant data, Crowther et al[16] were able to assess the influence of characteristics that we were not able to explore in our review (due to the limitations of aggregate data). The important opportunity and need to update this previous individual participant data meta-analysis to include the more recent RCTs and longer-term (school-age) follow-up data has been noted.[31]

The current international guideline from the WHO on interventions to improve preterm birth outcomes[15] used the 2009 Cochrane Systematic Review[12] to base their recommendation. Similarly, the clinical practice recommendations provided by professional bodies in many high-income countries (summarized in the systematic review by Jayaram et al[14]) are based on the previous Cochrane Review.[12] Although available clinical practice guidelines all support the use of this treatment for preterm cerebral palsy prevention, given that the systematic reviews have not supported a particular upper gestational age or dosing regimen, recommendations vary. The American College of Obstetricians and Gynecologists' 2010 Committee Opinion (re-affirmed in 2023) [13] suggests that physicians should develop specific guidelines regarding inclusion criteria and treatment regimens, in accordance with one of the larger RCTs.[6–8] As noted above, the opportunity to further investigate which pregnant individuals to treat (ie, considering primary reason they are at risk of preterm birth, number of fetuses in utero, and gestational age), when to treat (ie, considering how long before anticipated or planned birth), and how to treat (ie, considering loading and maintenance dose regimens) through an updated individual participant data meta-analysis should be explored.

Further research is needed on the longer-term benefits and harms of magnesium sulfate, including follow-up of children into adolescence and adulthood. Any future studies should use robust methodology and aim for consistency in outcome measurement and reporting (using standardized, ideally contemporary assessment methods—particularly for cerebral palsy[33]) to facilitate pooling of data. This will help to ensure that pregnant individuals whose children are likely to benefit from exposure are not denied treatment and that pregnant individuals whose children will likely not benefit from treatment are not exposed unnecessarily.

In conclusion, high-certainty evidence indicates that magnesium sulfate for preterm fetal neuroprotection reduces cerebral palsy and death or cerebral palsy for children up to 2 years of corrected age. Further research is required on longer-term benefits and harms for children, effect variation by participant and treatment characteristics, and the generalizability of findings to low- and middle-income countries.

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BUSCEMI RICCARDO	01/04/1991	omissis	BUSCEMI RICCARDO	BUSCEMI RICCARDO
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CAMPO GIORGIA	05/04/1996	omissis	CAMPO GIORGIA	CAMPO GIORGIA
CARDILLO GIULIANA	27/07/1995	omissis	CARDILLO GIULIANA	CARDILLO GIULIANA
CARUSO GIUSEPPE	03/06/1997	omissis	CARUSO GIUSEPPE	CARUSO GIUSEPPE
COCO CHIARA	06/06/1993	omissis	COCO CHIARA	COCO CHIARA
CORMACI LIVIA	23/10/1991	omissis	CORMACI LIVIA	CORMACI LIVIA
COSENTINO AGATA	11/09/1993	omissis	COSENTINO AGATA	COSENTINO AGATA
D'AMICO SERENA	25/04/1986	omissis	D'AMICO SERENA	D'AMICO SERENA
DI NARO ROBERTA	06/11/1991	omissis	DI NARO ROBERTA	DI NARO ROBERTA
DI PASQUA SALVATORE	19/03/1990	omissis	DI PASQUA SALVATORE	DI PASQUA SALVATORE
DI STEFANO ALESSANDRA	08/02/1989	omissis	DI STEFANO ALESSANDRA	DI STEFANO ALESSANDRA
DISTEFANO ROSARIO EMANUELE	11/03/1993	omissis	DISTEFANO ROSARIO EMANUELE	DISTEFANO ROSARIO EMANUELE
FAUZIA MARTA	03/06/1987	omissis	FAUZIA MARTA	FAUZIA MARTA
FERRARA LAURA	21/11/1984	omissis	FERRARA LAURA	FERRARA LAURA
FICHERA NADIA	21/11/1988	omissis	FICHERA NADIA	FICHERA NADIA
FIORITO DEBORA	12/05/1994	omissis	FIORITO DEBORA	FIORITO DEBORA
GALVAGNO CELESTINA	22/01/1986	omissis	GALVAGNO CELESTINA	GALVAGNO CELESTINA
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LOMEO GIOVANNA	19/12/1995	omissis	LOMEO GIOVANNA	LOMEO GIOVANNA
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PREVITI MIRIAM	02/02/1990	omissis	PREVITI MIRIAM	PREVITI MIRIAM
RAPISARDA ANTONELLA	10/03/1992	omissis	RAPISARDA ANTONELLA	RAPISARDA ANTONELLA
REINA SALVATORE	25/10/1994	omissis	REINA SALVATORE	REINA SALVATORE
RUFFO DESIREE	24/07/1995	omissis	RUFFO DESIREE	RUFFO DESIREE
SACCA ALESSIA	11/08/1993	omissis	SACCA ALESSIA	SACCA ALESSIA
SANTAGATI ALICE ANGELA FRANCESCA	23/08/1993	omissis	SANTAGATI ALICE ANGELA FRANCESCA	SANTAGATI ALICE ANGELA FRANCESCA
SCIASCIA LUCIA	18/02/1976	omissis	SCIASCIA LUCIA	SCIASCIA LUCIA
SIENI MICELI FRANCESCO	02/08/1993	omissis	SIENI MICELI FRANCESCO	SIENI MICELI FRANCESCO
SORCE TIZIANA	15/02/1994	omissis	SORCE TIZIANA	SORCE TIZIANA
TORRISI ELENA MARIA	06/12/1992	omissis	TORRISI ELENA MARIA	TORRISI ELENA MARIA
TOSCANO GIUSEPPE	21/04/1992	omissis	TOSCANO GIUSEPPE	TOSCANO GIUSEPPE
TRAPANI MARIARITA	27/01/1994	omissis	TRAPANI MARIARITA	TRAPANI MARIARITA
TRUPIA GIULIA	17/04/1995	omissis	TRUPIA GIULIA	TRUPIA GIULIA
VAZZANO SIMONE	07/12/1995	omissis	VAZZANO SIMONE	VAZZANO SIMONE
ZAMBITO ORIANA	14/10/1996	omissis	ZAMBITO ORIANA	ZAMBITO ORIANA
ZAMBROTTA ELISA	17/11/1990	omissis	ZAMBROTTA ELISA	ZAMBROTTA ELISA

F.to Presidente: Dott. Antonio Rapisarda

F.to Componente: Dott.ssa Maria Rita Falco Abramo

F.to Componente: Dott. Antonio Maiorana

F.to Segretario: Dott.ssa Piera C. M. Iudica

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CONCORSO PUBBLICO, PER TITOLI ED ESAMI, PER LA COPERTURA A TEMPO INDETERMINATO DI N. 2 POSTI NEL PROFILO PROFESSIONALE DI DIRIGENTE MEDICO DISCIPLINA GINECOLOGIA E OSTETRICIA.

PROVA ORALE del 21/07/2025 **SALA RIUNIONI ED 8/D**

CANDIDATI CHE HANNO SUPERATO LA PROVA		
CANDIDATO	**DATA NASCITA**	**PUNTEGGIO**
ANASTASI JESSICA	03/07/1991	17
ARCARESE GIORGIO	09/06/1995	20
ARCIDIACONO GIULIA ROBERTA	16/12/1991	16
BUSCEMI RICCARDO	01/04/1991	16
CALANDRA DAVIDE	26/06/1992	18
CAMPO GIORGIA	05/04/1996	18
CARDILLO GIULIANA	27/07/1995	18
CARUSO GIUSEPPE	03/06/1997	18
COCO CHIARA	06/06/1993	17
CORMACI LIVIA	23/10/1991	17
COSENTINO AGATA	11/09/1993	17
D'AMICO SERENA	25/04/1986	18
DI NARO ROBERTA	06/11/1991	15
DI PASQUA SALVATORE	19/03/1990	18
DI STEFANO ALESSANDRA	08/02/1989	19
DISTEFANO ROSARIO EMANUELE DISTEFANO	11/03/1993	18
FAUZIA MARTA	03/06/1987	16
FERRARA LAURA	21/11/1984	15
FICHERA NADIA	21/11/1988	18
FIORITO DEBORA	12/05/1994	20
GALVAGNO CELESTINA	22/01/1986	17
GRIMALDI RAFFAELA LUISA	04/11/1995	18
GULISANO CHIARA	12/04/1997	20
GULISANO MARIANNA	04/06/1992	19
INTERLANDI FABIANA	07/04/1992	16
LEONARDI ELISA	06/09/1991	18
LOMBARDO ALESSIA	25/02/1995	17
LOMEO GIOVANNA	19/12/1995	20
LUCIGNANO GABRIELLA	17/09/1994	17
MANCUSO ANGELO	06/04/1994	16
MARILLI ILARIA	26/10/1986	14

MAUCERI MARTINA	27/08/1989	16
MAUGERI GIULIANA CHIARA	11/08/1989	17
MAZZA GABRIELE	28/01/1993	16
MAZZIO SALVATRICE	19/09/1991	20
MENESINO SALVATRICE	24/06/1993	18
MILICI CARLA	14/05/1997	16
MILLE VENERA	14/11/1978	16
MONACO CATERINA	27/09/1992	20
MONTANA GIUSEPPE DARIO	27/10/1994	20
NASTRUZZO ROBERTA	17/04/1993	20
NERI ADELE	08/06/1997	19
PALERMO GAIA	16/02/1994	15
PIRRUCCELLO BARBARA	21/06/1971	17
PREVITI MIRIAM	02/02/1990	20
RAPISARDA ANTONELLA	10/03/1992	18
REINA SALVATORE	25/10/1994	17
RUFFO DESIREE	24/07/1995	16
SACCA ALESSIA	11/08/1993	18
SANTAGATI ALICE ANGELA FRANCESCA	23/08/1993	18
SCIASCIA LUCIA	18/02/1976	17
SIENI MICELI FRANCESCO	02/08/1993	20
SORCE TIZIANA	15/02/1994	16
TORRISI ELENA MARIA	06/12/1992	20
TOSCANO GIUSEPPE	21/04/1992	20
TRAPANI MARIARITA	27/01/1994	16
TRUPIA GIULIA	17/04/1995	18
VAZZANO SIMONE	07/12/1995	16
ZAMBITO ORIANA	14/10/1996	18
ZAMBROTTA ELISA	17/11/1990	16

CANDIDATI CHE NON HANNO SUPERATO LA PROVA		
CANDIDATO	**DATA NASCITA**	
NESSUN CANDIDATO PRESENTE		

CANDIDATI RITIRATI	
CANDIDATO	**DATA NASCITA**
NESSUN CANDIDATO RITIRATO	

CANDIDATI ASSENTI	
CANDIDATO	**DATA NASCITA**
NESSUN CANDIDATO ASSENTE	

CANDIDATI ESCLUSI

CANDIDATO	DATA NASCITA	MOTIVO ESCLUSIONE
NESSUN CANDIDATO ESCLUSO		

F.to Presidente: Dott. Antonio Rapisarda
F.to Componente: Dott.ssa Maria Rita Falco Abramo
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CONCORSO PUBBLICO, PER TITOLI ED ESAMI, PER LA COPERTURA A TEMPO INDETERMINATO DI N. 2 POSTI NEL PROFILO PROFESSIONALE DI DIRIGENTE MEDICO DISCIPLINA GINECOLOGIA E OSTETRICIA.

GRADUATORIA FINALE CANDIDATI SPECIALIZZATI						
Pos.	**Candidato**	**Punt. Titoli**	**Prova Scritta**	**Prova Pratica**	**Prova Orale**	**Punt. Tot**
1	MILLE VENERA	16.500	30.000	30.000	16.000	92,5
2	GULISANO MARIANNA	5.740	30.000	30.000	19.000	84,74
3	SCIASCIA LUCIA	14.800	22.000	30.000	17.000	83,8
4	DISTEFANO ROSARIO EMANUELE DISTEFANO	10.742	30.000	25.000	18.000	83,742
5	GALVAGNO CELESTINA	4.490	30.000	30.000	17.000	81,49
6	MONACO CATERINA	4.918	24.000	30.000	20.000	78,918
7	PREVITI MIRIAM	4.480	24.000	30.000	20.000	78,48
8	FIORITO DEBORA	6.517	26.000	25.000	20.000	77,517
9	DI PASQUA SALVATORE	10.029	24.000	25.000	18.000	77,029
10	DI STEFANO ALESSANDRA	8.600	24.000	25.000	19.000	76,6
11	FICHERA NADIA	9.400	25.000	24.000	18.000	76,4
12	TORRISI ELENA MARIA	5.359	23.000	28.000	20.000	76,359
13	D'AMICO SERENA	9.080	23.000	26.000	18.000	76,08
14	PIRRUCCELLO BARBARA	12.818	23.000	23.000	17.000	75,818
15	MARILLI ILARIA	16.700	23.000	22.000	14.000	75,7
16	ANASTASI JESSICA	4.250	27.000	27.000	17.000	75,25
17	FAUZIA MARTA	14.100	23.000	22.000	16.000	75,1
18	CALANDRA DAVIDE	6.825	24.000	26.000	18.000	74,825
19	CORMACI LIVIA	4.686	25.000	28.000	17.000	74,686
20	BUSCEMI RICCARDO	6.160	29.000	23.000	16.000	74,16
21	MAUGERI GIULIANA CHIARA	8.980	22.000	26.000	17.000	73,98
22	INTERLANDI FABIANA	8.968	24.000	25.000	16.000	73,968
23	ZAMBROTTA ELISA	9.580	22.000	26.000	16.000	73,58
24	MAZZA GABRIELE	5.152	24.000	28.000	16.000	73,152
25	ARCIDIACONO GIULIA ROBERTA	4.570	24.000	28.000	16.000	72,57
26	PALERMO GAIA	6.524	26.000	25.000	15.000	72,524
27	FERRARA LAURA	9.400	24.000	24.000	15.000	72,4
28	LEONARDI ELISA	5.311	22.000	25.000	18.000	70,311
29	MAUCERI MARTINA	6.100	24.000	23.000	16.000	69,1
30	TRAPANI MARIARITA	2.893	24.000	26.000	16.000	68,893

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GRADUATORIA FINALE CANDIDATI SPECIALIZZANDI						
Pos.	**Candidato**	**Punt. Titoli**	**Prova Scritta**	**Prova Pratica**	**Prova Orale**	**Punt. Tot**
1	LOMEO GIOVANNA	1.540	30.000	30.000	20.000	81,54
2	GULISANO CHIARA	0.700	30.000	28.000	20.000	78,7
3	NASTRUZZO ROBERTA	0.000	30.000	28.000	20.000	78
4	ARCARESE GIORGIO	0.440	27.000	30.000	20.000	77,44
5	TOSCANO GIUSEPPE	2.280	27.000	28.000	20.000	77,28
6	SANTAGATI ALICE ANGELA FRANCESCA	1.417	27.000	30.000	18.000	76,417
7	ZAMBITO ORIANA	1.950	26.000	30.000	18.000	75,95
8	SORCE TIZIANA	0.500	30.000	28.000	16.000	74,5
9	MAZZIO SALVATRICE	0.330	26.000	28.000	20.000	74,33
10	CARUSO GIUSEPPE	5.250	23.000	28.000	18.000	74,25
11	GRIMALDI RAFFAELA LUISA	2.193	25.000	29.000	18.000	74,193
12	MILICI CARLA	0.000	30.000	28.000	16.000	74
13	MENESINO SALVATRICE	0.690	25.000	30.000	18.000	73,69
14	SIENI MICELI FRANCESCO	0.600	25.000	28.000	20.000	73,6
15	NERI ADELE	1.520	24.000	29.000	19.000	73,52
16	RUFFO DESIREE	1.500	28.000	28.000	16.000	73,5
17	CARDILLO GIULIANA	0.500	24.000	30.000	18.000	72,5
18	COSENTINO AGATA	1.350	27.000	27.000	17.000	72,35
19	COCO CHIARA	0.240	24.000	30.000	17.000	71,24
20	CAMPO GIORGIA	2.060	28.000	23.000	18.000	71,06
21	TRUPIA GIULIA	0.000	25.000	28.000	18.000	71
22	REINA SALVATORE	0.740	25.000	28.000	17.000	70,74
23	MANCUSO ANGELO	0.790	25.000	28.000	16.000	69,79
24	DI NARO ROBERTA	0.550	26.000	28.000	15.000	69,55
25	RAPISARDA ANTONELLA	0.110	24.000	26.000	18.000	68,11
26	MONTANA GIUSEPPE DARIO	0.480	26.000	21.000	20.000	67,48
27	LOMBARDO ALESSIA	1.950	27.000	21.000	17.000	66,95
28	LUCIGNANO GABRIELLA	0.420	23.000	25.000	17.000	65,42
29	VAZZANO SIMONE	0.600	26.000	21.000	16.000	63,6
30	SACCA ALESSIA	0.910	23.000	21.000	18.000	62,91

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