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## Revisiting "The Maximin Strategy in Modern Obstetrics"

*Howard Brody and Carol Sakala*

### ABSTRACT

Published in 1981, "The Maximin Strategy in Modern Obstetrics" offered two claims—first, that obstetrical interventions ought to be assessed not singly, but rather as packages of interconnected measures that could cumulatively increase risks of harm; and second, that many of these interventions, considered either singly or as a package, lacked a sound evidence base. The first claim has been well supported by later literature, although the term "cascade effect" has proven a more felicitous descriptor for the phenomenon of interventions that trigger the use of other interventions to monitor, prevent, or treat possible side-effects. The second claim was initially supported in a very inadequate way, since the "Maximin" article appeared before an understanding of the methods of systematic reviews of medical evidence had been widely promulgated. Despite these defects, subsequent, rigorously conducted systematic reviews have tended to confirm the impression first offered in 1981, that practices that support physiologic childbearing and the innate, hormonally driven capacities of childbearing women and their fetuses/newborns are much more in keeping with the available evidence than practices involving common or routine high-technology interference with physiologic processes.

**Howard Brody, MD, PhD**, is Director of the Institute for the Medical Humanities and John P. McGovern Chair in Family Medicine at the University of Texas Medical Branch, Galveston, Texas, habrody@utmb.edu.

**Carol Sakala, PhD, MSPH**, is Director of Programs, Childbirth Connection, New York, New York, sakala@childbirthconnection.org. ©2013 by *The Journal of Clinical Ethics*. All rights reserved.

Harm may occur either directly, through high-technology interventions, or when such procedures distract attention and resources from safe, effective biological processes and lower-technology measures. Surveys indicate a lack of knowledge of this evidence among childbearing women, signaling a serious ethical deficiency in shared decision-making processes and perhaps the skills and knowledge of maternity care clinicians.

### INTRODUCTION

The spring of 1979 found one of us (HB) doing a two-month stint as a family medicine resident in the labor and delivery unit of a community hospital in Fredericksburg, Virginia. While the residency was located at the University of Virginia Medical Center in Charlottesville, the chair of the obstetrics department refused at that time to allow his own unit to be contaminated by the presence of non-obstetrically trained physicians, so it had been necessary for family medicine to negotiate a distant obstetric placement for their residents.

At the Fredericksburg community hospital, HB observed the frequency with which technological interventions were utilized—a special feature of the unit seemed to be epidural anesthesia for management of labor pain, which yielded him a good deal of experience in applying forceps for outlet delivery. He noted that when one unusual woman was admitted and announced her desire to use the Lamaze method, the nurses laughed at her. The vol-

ume of births—at least those for which the attending obstetricians would allow a family medicine resident to participate—proved, however, to be much lower than planned, and HB spent a good deal of time instead in the medical library. He decided to devote that time to researching the available evidence on the benefits and harms of common obstetric interventions.

Worried that his own inexperience would hamper his ability to interpret this literature, HB approached a fellow family medicine resident, James R. Thompson, who had managed to attend many more births during his rotation. Their collaboration resulted in an article, “The Maximin Strategy in Modern Obstetrics” (hereafter, “Maximin”), published in the *Journal of Family Practice* in 1981.<sup>1</sup>

Our goal in the present article is to revisit this early attempt to discover the evidence base for medical approaches to childbirth, and to place that article in the context of evidence that has become available in the interval. We then address the ethical concerns that follow from this analysis.

## TWO ARGUMENTS

“Maximin” offered two distinct arguments based on the literature review. The first argument was that we should not view obstetrical interventions singly, but should rather understand their role within an interconnected chain of interventions. Taken in isolation, a single intervention might appear beneficial or at least harmless. To assess the full impact on women and their newborns, one had to see the procedure as perhaps having been resorted to only as a consequence of some earlier intervention, and possibly, in turn, leading to a series of further interventions. Epidural analgesia, for example, might initially appear highly desirable as a relatively effective method for pain relief during labor. If, however, it regularly resulted in the increased use of the high-alert medication synthetic oxytocin or of instrumental delivery with vacuum extraction or forceps, its net impact could be detrimental. Ideally one would compare the entire set of commonly or routinely used interventions with a less-interventionist strategy, such as that of many midwives who prefer to support the innate capacities of a woman and her baby for initiating labor, laboring, giving birth, breastfeeding, and attachment, and to turn to interventions only when they might be expected to offer a clear benefit.

A literature review for “Maximin” turned up only one such comprehensive study.<sup>2</sup> Notably, its first author, Iain Chalmers, was a leader in estab-

lishing the methods and standard of systematic reviews to assess the weight of the best evidence and draw conclusions about effects of interventions.

The title of the article came from a technical term used in game theory to describe the strategy that the authors attributed to interventionist-minded physicians. “Maximin” denotes an approach that seeks to yield the best possible outcome if the worst possible contingencies are realized. A maximin strategy might be rational if the likelihood of the worst state of affairs arising is reasonably high. Such a strategy, on the other hand, might be undesirable if the actual probability of this occurring is quite remote. A maximin strategy is especially irrational if adopting it increases the probability of greater net harm or leads to the worst-case scenario. “Maximin” claimed that this latter eventuality was likely to be true of interventionist obstetrics. That is, interfering with normal physiologic labor to prevent a bad outcome in the event of things going wrong, however improbable that was in a low-risk pregnancy, actually made it more likely that various things would go wrong, and a bad outcome would result.

The second argument offered by “Maximin” was that there was very little scientific basis for many commonly employed obstetric interventions. “Maximin” was, at the time, unable to present positive evidence that an overly interventionist strategy was harmful in low-risk women. The evidence rather was suggestive, consisting of the absence of evidence of benefit and the theoretical plausibility of one intervention creating the need for further interventions with a net increase in the risk of harm. The best that could be stated at the time was that low-risk women would probably be just as safe with a more physiologic approach to labor and delivery unless specific indications justified a more interventionist strategy. Clearer answers, however, would soon emerge.

## ASSESSING THE MAXIMIN SYSTEMS ARGUMENTS

The term maximin turned out to be inauspicious. Few physicians or childbirth professionals are devotees of the game theory literature. The article was often mistakenly cited as “The *Maximum* Strategy in Modern Obstetrics.”

A much more apt term entered the medical literature five years later, when Mold and Stein described the “cascade effect.”<sup>3</sup> The cascade effect illustrates how clinicians can cause harm by doing things that appear to be innocuous or beneficial, by not thinking far enough ahead to the sequence of

further interventions and effects that might ensue. The idea of a cascade of interventions was intuitively clearer, and Mold and Stein demonstrated that the concept had utility well beyond maternity care practice. Without the idea of a cascade effect, for example, it would be more difficult to understand why many common (and seemingly harmless) screening tests, used in low-risk populations, produce deleterious consequences when false-positive results precipitate anxiety and invasive procedures.<sup>4</sup> Analyses and recommendations of the U.S. Preventive Services Task Force<sup>5</sup> and the establishment of the Choosing Wisely program to reduce tests and interventions that may be unnecessary in many clinical areas<sup>6</sup> are recent reflections of this understanding.

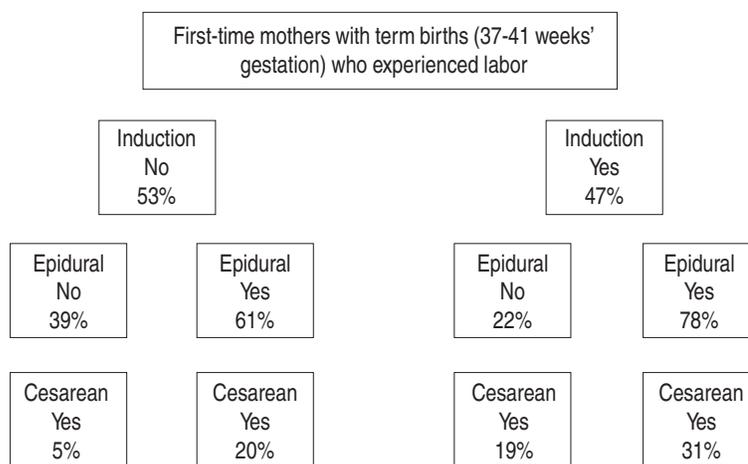
In general, the idea that interventionist meddling with physiologic childbirth in healthy women leads to a cascade of interventions that magnifies maternal and newborn risk has stood up well under more exacting research scrutiny. Most recently, Childbirth Connection's national *Listening to Mothers III* survey of 2,400 women aged 18 through 45 who gave birth to a single baby in U.S. hospitals from mid-2011 to mid-2012 provided a striking illustration of this phenomenon. Figure 1 charts the use of three consequential interventions—labor induction, epidural analgesia, and cesarean section—among the 750 survey participants who were first-time mothers and experienced labor at term. Of those who experienced neither induction nor epidural, just 5 percent had a cesarean. Those who had either induction or epidural had a 19 percent to 20 percent cesarean rate. Those who experienced both induction and epidural had a 31 percent cesarean rate, about six times the rate of those with neither. Overall rates of these interventions in this group of women who labored at term reflect the current technology-intensive approach to maternity care in U.S. hospitals: 47 percent had labor induction, 69 percent had epidural analgesia, and 21 percent had cesarean section.<sup>7</sup>

Conversely, increasing evidence indicates that physiologic birth processes

create a beneficial cascade. When they are protected, promoted, and supported, major hormone systems have been shown, for example, to help with stress and labor pain, provide fetal neuroprotection, help prevent postpartum hemorrhage, and enhance breastfeeding initiation.<sup>8</sup> Comparison of the effects on the fetus and newborn of vaginal versus cesarean birth demonstrates a number of positive physiologic effects of vaginal birth, and depriving the emerging fetus of those processes may lead to later problems, including numerous childhood chronic diseases. Carefully conducted systematic reviews have found that those born by cesarean are more likely than those born vaginally to develop childhood type 1 diabetes, asthma, allergy, and obesity. The plausible mechanism most commonly mentioned is an impact of mode of birth on immune function.<sup>9</sup> These long-term linkages to serious chronic diseases underscore the importance of judicious use of perinatal interventions.

### ASSESSING THE EVIDENTIARY BASE

In retrospect, the 1981 “Maximin” article was relatively primitive in its attempt to review the obstetric literature, in keeping with the general knowledge level of its time. In a day when all literature reviews were unsystematic “narrative” reviews, and the adequacy of a review article in a medical journal was often assessed simply by counting the number of references, an article that boasted 107 citations seemed impressive. By 2013 standards, one is struck by the absence of any meth-



Base: first-time mothers with term births who experienced labor ( $n = 750$ )

In this group, which included 85% of first-time mothers, the overall intervention rates were: labor induction 47%, epidural analgesia 69%, and cesarean section 21%. Source: E.R. Declercq et al., *Listening to Mothers III: Pregnancy and Birth* (New York: Childbirth Connection, May 2013).

**FIGURE 1.** Cascade of intervention in first-time mothers with term births who experienced labor

ods to limit bias, including by defining the review parameters at the outset, assuring an exhaustive and comprehensive search for relevant research findings, assessing the methodological quality of the individual studies, and pooling the results of relevant high-quality studies as appropriate. Compared with today's systematic reviews, "Maximin" thus fell far short.

To fill in gaps in the findings of "Maximin," the 2008 report, *Evidence-Based Maternity Care: What It Is and What It Can Achieve*—co-issued by the Milbank Memorial Fund, the Reforming States Group, and Childbirth Connection—provides a broad overview of much that is known through the large number of high-quality systematic reviews available more recently.<sup>10</sup> At the heart of this report are chapters identifying over used and under used maternity practices. Those practices were identified by comparing the results of recent, well-conducted systematic reviews assessing beneficial and harmful effects of practices relevant to the care of a large proportion of the maternal-newborn population with the care that this population was actually receiving. To describe contemporary practice, the report used results, as available, of Childbirth Connection's national *Listening to Mothers II* survey of women who gave birth in U.S. hospitals in 2005.<sup>11</sup>

*Evidence-Based Maternity Care* proposed the standard of "effective care with least harm" as most appropriate for the large vulnerable population of childbearing women and newborns. This is a variant, in the era of comparative effectiveness, of the principle "first, do no harm." Applying this standard, the report identified evidence-practice gaps involving over use of interventions that would be clearly beneficial in more limited use. These interventions include those shown in figure 1, and others:

- Labor induction
- Epidural analgesia
- Cesarean section
- Continuous electronic fetal monitoring
- Artificial rupture of membranes
- Episiotomy<sup>12</sup>

The many established downsides of these procedures, discussed in the report, call for their judicious rather than casual or routine use. Conversely, the report identified a large number of evidence-practice gaps signaling under use of practices that are generally effective, non-invasive, and beneficial, with few or even no known downsides. These practices include:

- Family physician maternity care, midwifery care

- Smoking cessation interventions for pregnant women
- External cephalic version for breech presentation fetuses
- Vaginal birth after cesarean (VBAC)
- Continuous labor support
- Measures for comfort, pain relief, and labor progress
- Non-supine positions for giving birth
- Delayed cord clamping in term and preterm babies
- Early skin-to-skin contact
- Breastfeeding and interventions to support its initiation and duration
- Practices to foster women's satisfaction with the childbirth experience
- Interventions for postpartum depression<sup>13</sup>

Two examples will illustrate the forgone benefits to women and newborns of these errors of omission. It is now well-established that having the continuous support of a companion during labor is associated with numerous benefits and has no known downsides. Such care can lead to a substantial decrease in the use of pain medication, assisted delivery, and cesarean section. Equally, it is associated with a woman's increased satisfaction with the childbirth experience and increased likelihood of experiencing the optimal spontaneous vaginal birth.<sup>14</sup>

In 1981, "Maximin" correctly identified the supine position during labor as a common pathway for how many other interventions, such as epidural analgesia, might cause harm. *Evidence-Based Maternity Care* reported the multifaceted value of the woman adopting a non-supine posture for labor and birth. The benefits include diminished pain, a reduced need for episiotomy, fewer fetal heartbeat abnormalities, and a shortened active pushing phase.<sup>15</sup>

Despite these benefits, the most recent national *Listening to Mothers* survey found that just 6 percent of women who gave birth in U.S. hospitals from mid-2011 through mid-2012 received continuous labor support through the care of a doula (a professional labor attendant), and 68 percent of women with a vaginal birth reported lying on their back while pushing their baby out and giving birth.<sup>16</sup>

While the *Evidence-Based Maternity Care* report primarily addressed the quality and outcomes of care, it also identified implications for the costs of childbirth care. It noted that charges in out-of-hospital birthing centers are approximately one-fourth those of uncomplicated vaginal births in hospitals, with no evidence of better outcomes in the latter setting.<sup>17</sup> Yet, currently, less than 1 percent of U.S.

women use freestanding birth centers.<sup>18</sup> The recently reported 6 percent cesarean rate in the National Birth Center Study II of 79 participating centers, 2007-2010, in comparison with the national rate of about one childbearing woman in three, suggests that major differences in practice style underlie the differences in cost.<sup>19</sup> The birth center rate is within an optimal cesarean rate range of 5 percent to 10 percent, whereas the national rate is well above 15 percent, the threshold when harm is a more likely result than benefit.<sup>20</sup>

Compared with other nations that spend less, the U.S. and its high-technology style of practice is, if anything, falling farther behind in desired outcomes.<sup>21</sup> Moreover, persistent and in some cases widening disparities exist for many maternal-newborn measures among racial and ethnicity groupings in the U.S.<sup>22</sup>

In addition to the potential for greatly reduced costs, *Evidence-Based Maternity Care* identified the potential for styles of practice and systems of care that are much more compatible with the evidence and demonstrate much more conservative use of interventions than usual care. A comparison, for example, of a large cohort of women who planned home births and used certified professional midwife careproviders with low-risk women who received hospital care during the same year (2000) reported differences in the use of electronic fetal monitoring (10 percent versus 84 percent), episiotomy (2 percent versus 33 percent), vacuum extraction (1 percent versus 5 percent), forceps (1 percent versus 2 percent), and cesarean (4 percent versus 19 percent).<sup>23</sup> The subsequent publication of a systematic review comparing home and hospital birth similarly found significant differences in interventions such as epidural (9 percent versus 23 percent), electronic fetal monitoring (14 percent versus 63 percent), episiotomy (7 percent versus 10 percent), assisted delivery (4 percent versus 10 percent), and cesarean (5 percent versus 9 percent), which were mirrored by significant differences in morbidity favoring home birth care: third or fourth degree perineal laceration (1 percent versus 3 percent), vaginal laceration (8 percent versus 22 percent), retained placenta (1 percent versus 2 percent), and infection (1 percent versus 3 percent).<sup>24</sup>

#### ETHICAL IMPLICATIONS AND NEEDED DIRECTION

Of special concern for ethics, *Evidence-Based Maternity Care* refers to national *Listening to Mothers* survey results finding that while women who

have recently given birth overwhelmingly wish to know all or most of the potential side-effects of consequential interventions, many had poor awareness of the harms of labor induction, epidural analgesia, and cesarean section, whether they experienced these interventions or not.<sup>25</sup> The most recent *Listening to Mothers III* survey confirmed these continuing knowledge deficits<sup>26</sup> and found that most women who had recently given birth felt that the recommendations of maternity careproviders would be up to date and consistent with the best evidence, that getting more tests and treatments indicates a higher quality of care than getting fewer tests and treatments, and that more-effective tests and treatments are generally more costly than less-effective ones. Despite the problems of over use and under use noted above, respondents also gave very high ratings to the quality of maternity care in the U.S.<sup>27</sup>

None of this, we are often told, can be blamed on the healthcare system. We live in a consumerist age. Especially since childbirth is a physiologic process rather than a disease, women's preferences should govern. We are often told that women are afraid of childbirth pain and demand anesthesia. Equally, they desire the convenience and predictability of induced labor or cesarean birth. Such rationalizations might carry weight if there were compelling evidence that women are well informed of their choices and of the true harms and benefits of common interventions, but the national *Listening to Mothers* survey data tell a very different story. Most women, it appears, are making these crucial life choices without full and balanced evidence-based information about the potential benefits and harms of the various care options for childbirth.

One obvious requirement for more ethical healthcare is consistent use of shared decision making. The use of decision aids—which present to patients the options for a specific condition; present a current, balanced, and evidence-based overview and benefits and harms of each; and help people with the condition consider their own values and preferences, leading to an individualized decision—has an extensive and impressive record across health and medicine<sup>28</sup> and a growing record within maternity care.<sup>29</sup> The extended period of pregnancy is opportune for engaging a highly motivated population to make wise decisions through the use of high-quality decision aids.

To illustrate, consider the example of the impact of such aids on men's decisions to undergo prostate-specific antigen (PSA) screening for prostate cancer—a screening intervention recently discouraged, based on solid evidence, by the U.S. Preven-

tive Services Task Force.<sup>30</sup> Studies of interactive decision aids report that when presented with the actual facts about harm and benefit, the men who, at baseline, request PSA screening may, more than 90 percent of the time, drop their request to a rate of around 50 percent.<sup>31</sup>

A shared decision-making program for maternity care incorporating rigorous decision aids and other complementary decision tools could be equally efficacious. Such an urgently needed program is currently being developed through a collaboration of the Informed Medical Decisions Foundation and Childbirth Connection.<sup>32</sup>

A challenge for shared decision making in the context of childbirth is the need to help women and their careproviders understand how the cascade effect could come into play and how they can avoid the unintended consequences of such an effect and achieve their desired outcomes. A cautionary example here is decision making for end-of-life care in hospitals. Detailed studies of hospital practices indicate that patients are ill-served when offered shared decision making around specific interventions, such as ventilator support, as other forces are at play. Hospital care at this time is generally driven by the cascade effect—once a person is admitted, a sequence of events starts to unroll that is very hard to put back into the bottle later on, regardless of the person's expressed preferences.<sup>33</sup> An initial step might be to include discussion of any co-interventions that are routinely used or are more likely to be used with the options under consideration.

Given the extent of maternity care practice variation across regions, hospitals, individual careproviders, and different types of careproviders,<sup>34</sup> the intertwined decisions about choice of careprovider and choice of birth setting are crucial decisions for childbearing women. Decision aids can provide important guidance, and developing and implementing decision aids to assist with these important decisions is a priority. Optimally, such tools should reach a woman early in her pregnancy, before she makes decisions about careproviders and birth settings. They also might be used later in pregnancy to reassess and evaluate whether initial choices still seem to be meeting the woman's needs, or after she has concluded that this is so. Admittedly, these crucial decisions are somewhat of an anomaly in shared decision making, in that, as described here, they are unlikely to be made in consultation with a careprovider. The significance of these choices justifies deviation from the established model.

While ethical attention might well focus on shared decision making, policy matters deserve

equal ethical scrutiny. Financial incentives in the current reimbursement system contribute to the over use of some practices and under use of others. For example, the large professional fee for attending a birth creates an incentive for careproviders to induce labor, and reimbursement is lacking or difficult to obtain for continuous labor support and time spent in shared decision making. This perverse reimbursement structure must be reconfigured. Innovative delivery and payment systems should be developed to reward optimal outcomes and create incentives for the use of high-performing settings such as freestanding birth centers, high-performing careproviders, and evidence-based practices.

As *Evidence-Based Maternity Care* clarifies, an insidious consequence of the cascade of intervention is that obstetricians, and often other types of maternity careproviders, see very few low-technology births, both in training and in practice. Consequently, they either lack the relevant knowledge and clinical skills entirely, or are likely to lose what they might have acquired. As a result, in the present environment, many women do not have access to such essential maternity care practices as external version to turn a breech presentation baby, vaginal breech birth, vaginal twin birth, vaginal birth after cesarean, and judicious use of assisted delivery. A revamping of basic and continuing education for all maternity care practitioners is needed to ensure a deep, enduring, and shared understanding of the underlying maternal and fetal/newborn physiology; of the skills and knowledge to protect, promote, and support physiologic childbearing; and of the rationale for conservative, judicious use of practices with serious unintended consequences.

Compendia of systematic reviews about the effects of care for pregnancy and childbirth were initially published more than two decades ago.<sup>35</sup> This "head start" on identifying, evaluating, and summarizing evidence to guide maternity care practice ultimately led to the paradigm-shifting establishment of the Cochrane Collaboration. Building on the pioneering work in maternity care, that international organization assesses the weight of the best evidence about the effects of care in all fields of health and medicine. Subsequently, thousands of systematic reviews for care during pregnancy and childbirth have been developed and updated within the Cochrane Collaboration, through programs of public agencies, and within the international journal literature. Although primary studies and syntheses on additional questions are still needed, this extraordinary body of reviews provides many signposts for practice that are not widely or uniformly taken up.

The failure of the maternity care system to reliably deliver well-established evidence-based care is a lingering conundrum. The newest national *Listening to Mothers* survey identified many concerns. For example, contrary to best evidence, many women received ultrasounds at the end of pregnancy to estimate the weight of their fetus and were encouraged to have labor induction or planned cesarean section because their baby might be getting quite large. While evidence and guidelines support vaginal birth after cesarean as a good choice for nearly all women with one or two previous cesareans, and the hazards of repeated cesareans are increasingly recognized, careproviders overwhelmingly steered such women to have repeat cesareans. Many women reported experiencing pressure from a careprovider to have the three major interventions covered in figure 1, including pressure to have labor induction among 25 percent who had labor induction, pressure to have cesarean section among 25 percent who had a cesarean, and pressure to have epidural analgesia among 19 percent who did not have epidural analgesia. Despite the high rates of intervention around the time of birth, 59 percent of respondents agreed that giving birth is a process that should not be interfered with unless medically necessary, while 16 percent disagreed, and 26 percent neither agreed nor disagreed. The proportion agreeing has steadily increased over the decade of *Listening to Mothers* surveys. Overwhelmingly, women wanted high-quality care and trusted the maternity care system to deliver the right care. However, many did not receive it and seemed to have little awareness of this.<sup>36</sup>

Multifaceted solutions are needed. Using shared decision making and other means of informing and engaging women, implementing innovative payment and delivery systems, and revamping the education of maternity careproviders have already been noted. Other crucial strategies include fostering a culture of continuous quality improvement and the expanded use of maternity care quality collaboratives, developing and implementing priority performance measures for quality improvement and public reporting, harnessing the power of electronic health records to foster high-quality maternity care, and developing the optimal maternity care work force mix and birth setting mix for the primarily healthy population of childbearing women and newborns.<sup>37</sup>

## CONCLUSION

Despite the methodologic limitations of “Maximin,” subsequent research suggests that both of its primary assertions are well supported. Interventions

that interfere with physiologic labor, applied outside of specific well-supported indications, set off a cascade of further interventions, with the total package of interventions having great potential for increased risk of harm to women and children. The increased likelihood of several chronic childhood diseases in those who were born by cesarean section, rather than vaginal birth, is alone an alarming finding that warrants urgent attention.

The “Maximin” article was also prescient in identifying the breadth of important gaps between common practice and best evidence. Even as extensive use of interventions has become the norm in the U.S., the overall evidence base for childbirth care strongly supports a less-interventionist strategy, which most childbearing women endorse. Meanwhile, low-technology interventions that support rather than impede physiologic labor, such as the use of a companion for continuous support during labor and non-supine positions for giving birth, reach just a small proportion of those who would benefit. Ethical healthcare requires that these gaps be systematically and expeditiously addressed through the most effective tools of implementation science.

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