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Editorial

Measuring IVF Success: Why the Field Still Lacks Unified Metrics?

According to the latest statistics released by the International Committee for the Monitoring of Assisted Reproductive Technologies (ICMART) in 2019, a total of 3,855,694 infertility treatment cycles were started worldwide, resulting in 783,073 live births. Considering unreported clinics in the countries studied, these cycles were estimated to increase to more than 3,855,694, corresponding to over 865,914 live births. Given that Asian and African countries lack national registries for mandatory reporting of their IVF cycles data, the number of total worldwide cycles is likely much higher than the estimates and statistics of ICMART (1). Accordingly, it is reported that by 2019, between 10 and 13 million babies had been born through IVF cycles, and from 2019 to 2026, another 6 to 7 million babies will be added to this number, bringing the total to more than 20 million. Every 35 *s*, a baby is born as a result of assisted reproductive technologies (ARTs), which implies that more than one million babies are born via IVF every year, taking into account the unreported cases. Assuming the reported number of cycles is accurate, dividing the number of babies born by the total number of IVF cycles yields a success rate of around 22%. Is this success rate representative of the figures that IVF centers advertise to encourage couples to undergo infertility treatment? In fact, the percentages provided in their websites or advertisements are often exaggerated. The highly competitive market of private IVF clinics relies heavily on selective reports of success rate to attract and motivate patients for beginning their treatment. The lack of standard reporting criteria allows clinics to use biased metrics, such as live births per embryo transfer, without accounting for failed and cancelled cycles. Clinic websites often act as advertising platforms that present optimistic results and selection criteria with limited transparency. This approach also facilitates demand for ineffective add-on interventions and offers couples a favorable outlook of treatment while lacking transparency about costs; the patient's actual likelihood of success is uncertain and clinics are not obliged to be held accountable if the cycle fails (2).

Presenting IVF outcomes in a standardized format has always been considered elusive, as reporting "success" outcome in ARTs is a multidimensional and complex endeavor involving clinical, financial, and patient-centered perspectives. Despite the enormous revolutions that IVF has brought to the treatment of infertile couples and reproductive medicine, the field still faces serious challenges in defining standard measures of success. Different clinics and registries use different denominators (per cycle, per embryo transfer, per patient) to report their performance, making it cumbersome to compare results, counsel patients, or evaluate technologies and policies across facilities, both nationally and globally. There is currently "a great deal of variation" in how clinics choose to report their success rates. One study reviewed 142 randomized controlled trials and stated that "due to the multi-stage nature of IVF, there is wide variation in the choice of numerator and denominator in these trials". Over 800 different combinations of numerators and denominators were identified to report the results. This lack of global consensus makes it challenging to compare data from different registries and often leads to a distorted view of clinic performance (3).

The unit of analysis critically controls how success rate is measured and interpreted. Reporting success rate based on cycles or transfers systematically underestimates the outcomes at patient-level by integration of repeated cycles, thereby over-representing poor-prognosis patients and distorting comparisons between fresh and frozen cycles. Further bias arises when embryos or oocytes are regarded as independent observations, violating statistical assumptions. In contrast, woman- or couple-based metrics, particularly intention-to-treat and cumulative live birth rate (CLBR) units relating all fresh and frozen transfers of a single cycle, provide more realistic and clinically meaningful estimates of success. The selection of an analytical unit also influences economic evaluation, as resource use and associated costs scale with procedural complexity and the number of embryos rather than with simple cycle counts (2).

Currently, add-on interventions offered to couples in IVF cycles exert minimal impact on both success rates and treatment costs despite limited evidence of their clinical benefits. Most of these interventions have not been evaluated by randomized clinical trials for improving live birth outcomes, and regulatory assessments frequently classify them as lacking sufficient and conclusive evidence. Reported higher success rates often are due to selective reporting rather than proven efficacy, and some of these add-on interventions may even compromise IVF cycles through additional embryo manipulation or attrition. They significantly increase costs and laboratory resource utilization that lead to patient attrition as the result of economic burden rather than

medical factors. Although add-on interventions are considered for personalization and optimization of IVF for each couple, they often increase apparent efficiency and financial burden; they shift the risk to patients, without significant progress in CLBRs (4).

The Birth with Emphasis on Singleton Success at Term (BESST) standard defines IVF success as the live birth rate of a singleton at term (≥37 weeks) per initiated cycle. Through restriction of the numerator to live birth of a singleton at term and using initiated cycles as the denominator, BESST integrates efficacy and safety into a single measure and clearly excludes multiple pregnancies as adverse outcomes of IVF rather than as successful cases. This patient-centered, value-based standard shifts the emphasis from achieving pregnancy to delivery of a healthy baby, provides more meaningful benchmarking, avoids risk-increasing procedures, and improves transparency in reporting results (5).

Contemporary reports of IVF success are extremely influenced by methodological choices and market forces rather than clinical efficacy. Cycle-based registries, diverse outcome definitions, and improper units of analysis thoroughly underestimate patient-level success without the possibility of comparing success rates with other clinics and at the global level. These primary limitations are exacerbated by selective reporting of success in private fertility markets, where optimistic metrics and add-on interventions are promoted despite limited evidence of their efficiency. Extensive utilization of IVF add-on interventions further inflates apparent efficiency, increases costs, and contributes to attrition of patients driven by financial rather than clinical factors. Taken together, these situations obscure the true cumulative potential of modern IVF while simultaneously transferring risk and uncertainty to patients. Patient-centered measures such as CLBR, intention-to-treat analyses, and value-based endpoints such as BESST provide more realistic, transparent, and secure assessments of treatment success. Therefore, standardizing outcome definitions, appropriate longitudinal analysis, and improving reporting transparency are essential to restore clinical meaning to IVF success rates, enable fair benchmarking, and support evidence-based patient counseling. Without such reforms, current reporting frameworks will continue to distort effectiveness, favor commercial incentives over clinical value, and undermine informed reproductive decision-making.

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