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Low-cost in-vitro fertilization method may help couples in developing countries (Update)

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A new low-cost method of in-vitro fertilization developed at the University of Colorado Boulder that performed successfully in recent human clinical trials in Belgium may help thousands of infertile couples in developing countries.

The study using the CU-Boulder technology showed that the low-cost of IVF for developing and "resource-poor" countries is feasible and effective, with baby delivery rates roughly the same as those achieved in conventional IVF programs. This proof-of-principle study, say the investigators, suggests that infertility care may now be universally accessible.

The research team showed the IVF methodology can be significantly simplified and result in successful outcomes at levels that compare favorably to those obtained in costlier, more sophisticated programs. The estimated cost of the simplified laboratory system, developed by CU-Boulder Research Professor Jonathan Van Blerkom, is estimated to be between 10 and 15 percent of current Western-style IVF programs. The team estimates that a cycle of IVF with the simplified procedure can be performed for around $250.

Results from the new study were presented July 8 at the annual meeting of the European Society of Human Reproduction and Embryology, or ESHRE, held in London.

Infertility in women living in developing countries can be caused by a

variety of factors ranging from blocked Fallopian tubes and endometriosis to ovulation disorders and pelvic adhesions. The personal stigmas often attached to infertile women in such countries can cause them to be disinherited, abused and ostracized. While roughly 5 million IVF babies have been born since 1978, the treatment of infertility by effective methods remains largely practiced only in developed countries.

A professor of molecular, cellular and developmental biology at CU-Boulder, Van Blerkom performed Colorado's first successful in vitro fertilization procedure in 1982 and is recognized internationally for his research on egg and sperm physiology. He has been working with ESHRE since the project began in 2008.

The study is part of the Walking Egg Project, http://www.thewalkingegg.com/thewalkingegg, an international project aiming to raise awareness surrounding childlessness in resource-poor countries and to make infertility care, including assisted reproductive technologies, available and accessible for a much larger proportion of the world population.

The low-cost culture system developed by Van Blerkom, which can fit in a shirt pocket, is designed to go anywhere, including off the grid, allowing it to be independent of the complex and costly infrastructure required by IFV programs in the developed world. "The system uses low-cost components, does not require complex microprocessor controlled incubators and is a closed system that generates its own unique atmospheric and culture conditions required for normal fertilization and embryogenesis using inexpensive, common chemicals," he said.

Van Blerkom's low-cost culture system is based on an incubator system consisting of two sealed glass tubes. A chemical reaction initiated by combining baking soda and citric acid in the first sealed glass tube

generates an atmosphere that includes a specific percentage of carbon dioxide. The atmosphere is then transferred into the second glass tube holding the culture medium.

The connection between the two glass tubes—needles and tubing—can easily be removed once the equilibrium between the two glass tubes is achieved. Oocytes and sperm are then injected by syringe into the tube containing the culture medium without disturbing the air environment inside the tube.

To date, 12 healthy babies have been born using the new method, said Van Blerkom.

The Belgian study started in 2012 with IVF patients under the age of 36 with at least eight oocytes, or egg cells, available for fertilization. The primary outcome measure was embryo quality at day three—the ideal day for grading the viability of embryos. The majority of top quality embryos as assessed by an independent expert were produced using Van Blerkom's simplified system rather than the more expensive system.

Van Blerkom and his colleagues envision the construction of low-cost modular buildings that can be shipped in standard containers and powered by the sun. The facilities would resemble walk-in closets where trained technicians can perform IV fertilization using Van Blerkom's innovative method. "These operators do not need courses in molecular or cellular biology, and they don't need to worry about electricity and incubators," he said. "They just need to know the simple steps to go through to achieve IV fertilization."

Applications of the new system may go beyond the treatment of human fertility, said Van Blerkom. "Because of their portability, these systems may well have applications in wildlife management, including reproductive help for endangered species," he said.