

Markov modeling of vasectomy reversal and ART for infertility: how do obstructive interval and female partner age influence cost effectiveness?

Michael H. Hsieh, M.D., Ph.D., Maxwell V. Meng, M.D., and Paul J. Turek, M.D.

University of California San Francisco, Department of Urology, San Francisco, California

Objective: To apply Markov models to assess the cost effectiveness of the relative impact of obstructive interval and female partner age on fertility using either assisted reproductive technology (ART) or vasectomy reversal, and elucidate the impact of these variables on fertility.

Design: Markov models based on review of published literature and available ART outcome data.

Setting: University-based clinical practice.

Patient(s): Simulation runs of 50,000 patients for each analysis.

Intervention(s): Varying vasectomy obstructive interval and maternal age.

Main Outcome Measure(s): Cost effectiveness, willingness to pay (WTP), and net health benefit.

Result(s): Base case analysis showed ART yields a higher pregnancy rate and higher cost than vasectomy reversal. Sensitivity analysis showed female age has a greater effect on cost effectiveness than obstructive interval. At a WTP < \$65,000, vasectomy reversal is more cost effective than ART. With increasing WTP, ART is more cost effective over wider windows of female age.

Conclusion(s): Markov modeling of fertility after vasectomy suggests female age has more impact than vasectomy obstructive interval on cost effectiveness. (*Fertil Steril*® 2007;88:840–6. ©2007 by American Society for Reproductive Medicine.)

Key Words: Markov process, decision analysis, cost effectiveness, assisted reproductive technology, vasectomy reversal

It is estimated that over 800,000 vasectomies are performed annually in the United States (1). In addition, 3% to 8% of men seek future fertility after the procedure (1). Vasectomy reversal and assisted reproductive technology (ART) are both used to treat male infertility resulting from vasectomy. In 2004, over 110,000 ART procedures were reported to the Centers for Disease Control and Prevention, some of which were performed for vasectomy-induced infertility (2). With an average cost of \$12,400 per in vitro fertilization (IVF) cycle (3), ART is clearly a costly option. Although vasectomy reversal can be less costly in many instances, many reproductive endocrinologists routinely recommend ART to couples with vasectomy-associated infertility.

Randomized, controlled clinical trials to determine the optimal treatment for vasectomy-associated infertility have not been undertaken, nor are they considered feasible. In addition, few cost-effectiveness studies exist to help physicians and patients make appropriate decisions regarding infertility treatment after vasectomy (4–6). In such instances, decision modeling can be very helpful in dissecting out

relevant and significant variables that impact a clinical condition.

Decision analytic models are methods of estimating and calculating outcomes by identifying the clinical question, disaggregating the problem into discrete units to include all reasonable choices and consequences, and assigning probabilities and costs to the various events and outcomes (7). Based on our prior work with decision analysis modeling of ART versus vasectomy reversal, we observed that vasectomy reversal is often more cost effective than ART, but the variable of vasectomy reversal patency, and indirectly vasectomy obstructive interval, is an important determinant of cost effectiveness (6). In addition, we assumed that female fecundity, and hence female age, was independent of treatment modality. Clinically, the decision to choose vasectomy reversal or ART is more complex in the setting of the “older” vasectomy (obstructive interval >14 years) or with advanced maternal age (>38 years old). Indeed, the relative impact of these clinical variables is very real to the many couples affected by them.

To our knowledge, the literature has not yet examined the combined effects of obstructive interval and female partner age with time on the success of fertility treatment options after vasectomy. Thus, we felt an analysis of these two clinical variables *over time*, through Markov modeling,

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Reprint requests: Paul J. Turek, M.D., 1600 Divisadero Street, Room A633,
San Francisco, CA 94143-1695 (FAX: 415-885-7443; E-mail: pturek@urology.ucsf.edu).