The high cost of having some babies...

Roughly 8.5 percent of U.S. married couples are infertile. Though that rate has not increased in recent years, the number of people who sought treatment between 1968 and 1982 nearly tripled, fueled in large measure by increasingly successful in vitro (test-tube) fertilization techniques.

But these treatments are expensive, as two studies document in the July 28 NEW ENGLAND JOURNAL OF MEDICINE.

The first studied the 1992 costs of a successful delivery of one or more babies following in vitro fertilization. Many couples undergo several cycles of egg harvesting, test-tube fertilization, and subsequent embryo implantation before a baby is born. The less fertile the couple, the more cycles they tend to require before giving birth. Overall, less than half of couples treated for infertility succeed in giving birth.

In a new analysis, Peter J. Neumann of the Project HOPE Center for Health Affairs in Bethesda, Md., and his colleagues find that the costs of having a baby climb from about $67,000 per delivery for couples undergoing one fertilization cycle to $114,000 per delivery after six cycles.

That's just the average cost. Certain forms of infertility can jack up the charges dramatically. For instance, when the mother is 40 or more years old and the father infertile, delivery costs climb from about $160,000 for one cycle of treatment to $800,000 for couples requiring six cycles.

Much of the high economic cost associated with in vitro fertilization traces to the higher proportion of multiple births that occur among treated couples, Neumann and his collaborators calculate. The reason? Multiple births are usually premature, with smaller and sicker babies who require more intensive — and expensive — care.

... gets higher by the numbers

A second study in the NEW ENGLAND JOURNAL OF MEDICINE shows why hospital costs multiply for each additional child. Among 13,206 pregnant women who delivered at Boston's Brigham and Women's Hospital between 1986 and 1991, single babies remained hospitalized 4.6 days on average; twins typically stayed 8.2 days. Births involving more babies involved even longer stays. Moreover, 15 percent of single babies needed intensive care, compared to roughly half the twins and three-quarters of triplets, quadruplets, and quintuplets, say Tamara L. Callahan of Massachusetts General Hospital and her coworkers. Multiple births also increased the mother's need for care.

In the end, after accounting for a mother's age, race, and type of insurance, Callahan's group found that hospital charges for a single baby totaled about $9,850. By contrast, twins incurred average charges of $37,950 ($18,975 per baby), and the birth of triplets cost $109,765 ($36,588 per baby).

One-third of the twins and three-quarters of the triplets in the study were born to couples treated for infertility. Indeed, Callahan's team estimates that if each multiple pregnancy had involved a single baby, "the [annual health care] savings would have been more than $3 million in this one hospital." And as they did not factor in the additional postdischarge costs typically associated with twins and triplets, these figures probably understate the total costs of multiple births.

With health care funds tight, these figures raise several ethical issues, the researchers say. For example, who should have access to expensive fertility treatments? Who should pay the bill? Moreover, because not all fertility treatments run the same risk of fostering multiple births, should physicians focus on those most likely to result in a single baby?

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The ends of the filaments that resist the outward pressure exerted by this synchrotron nebula point down into the nebula; they are colder, denser, and move more slowly, he explains. The ends carried aloft by the nebula's pressure are warmer, more tenuous, and move faster.

"People had speculated that this sort of pattern might be going on in the Crab nebula, but the surprise is that when you in fact look at the Crab — *everywhere* that you look — you see this same structure," he says. "It turns out that this interface between the synchrotron nebula, being powered by the pulsar, and the filaments, the stuff that was ejected by the supernova explosion ... is the dominant organizing process going on in the Crab nebula."

This geometric pattern isn't the only new evidence that the various parts of the Crab are inextricably linked, he adds. Astronomers have monitored for about 2 decades the rate at which the pulsar is gradually slowing down.

Data from Hubble, in combination with the ground-based observations, now suggest that as the pulsar loses rotational energy, it transfers a significant amount of that energy to the filaments. The pulsar is the source of the extra pressure exerted by the ballooning synchrotron nebula on the filaments. As a result, the filaments receive an extra kick, or acceleration, comparable to the energy lost by the pulsar, Hester says.

"If you want to understand the pulsar and the synchrotron nebula, or if you want to understand the filaments, you have to worry about their interaction," he concludes.

The Hubble findings may also shed light on new ground-based findings that a lineup of 11 knots extends more than halfway across the Crab. At the June meeting, Stephen S. Lawrence and Gordon M. MacAlpine of the University of Michigan in Ann Arbor reported that the newly discovered knots show extremely high emissions by argon ions.

Images of the knots were taken with a 2.4-meter telescope at the Michigan-Dartmouth-MIT Observatory atop Kitt Peak in Arizona. The astronomers obtained spectra of the knots, which revealed the unusually intense argon emission, using the 4.5-meter Multiple Mirror Telescope near Amado, Ariz.

The explanation for these argoknots is unknown. The enhanced argon emission could stem from argon gas that congregates in clumps. Alternatively, the radiation could be caused by some process that selectively stimulates ordinary concentrations of argon to emit high-intensity radiation.

A comparison of the ground-based data with the Hubble images suggests that the argon emission originates in those parts of the filaments that poke farthest into the synchrotron nebula. This dovetails with ground-based measurements of the velocity of the argoknots, which show that they move relatively slowly.

Hester speculates that the location of the argoknots indicates that they do not consist of unusually high concentrations of argon but rather are subject to some kind of special stimulation that triggers the observed radiation. Lawrence and MacAlpine note that the regions within each knot that lie closest to the pulsar have the strongest argon emission. Based on this finding, they suggest in the Sept. 10 ASTROPHYSICAL JOURNAL LETTERS that the pulsar triggers the enhanced emission.

The argoknot story, Hester adds, highlights the importance of using ground-based data in conjunction with the Hubble images. Armed with new information from telescopes on the ground and in space, scientists studying the Crab are taking a fresh, more intimate look at an old celestial phenomenon.

And in the processs, Hester says, astronomers are on the verge of putting together "a well-rounded picture of one of the most important objects in modern astrophysics." □