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An estimate of the cost of in vitro fertilization services in the United States in 1994.

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Abstract

Background: This paper addresses the cost of adding in vitro fertilization (IVF) treatment to a standard health care benefits package. IVF cost is defined as the marginal cost of a single cycle of treatment in an existing IVF program: the capital cost of adding IVF to an existing infertility service was not considered.

Methods: IVF utilization was estimated from existing data. IVF costs were determined from a 1993 survey of IVF clinics. The costs for benefits and premiums were projected to 1994 and the additional costs of 300% and 500% increases in utilization were estimated.

Results: The estimated total cost of IVF services in 1993 was \$186.16 million. A typical benefits package (the American Medical Association standard benefits package) was estimated to provide benefits in 1994 worth \$2694 at a premium cost of \$3031. After applying comparable assumptions the added benefit cost of IVF services in 1994 was \$2.36 at a premium of \$2.65. Benefits and premium costs for a 300% utilization increase were \$7.07 and \$7.95 respectively and for a 500% increase, \$11.78 and \$13.25.

Conclusions: The additional cost of adding IVF services appears to be affordable. Reasonable utilization levels would be predicted for a program which entails approximately 15% cost-sharing, but rational methods for controlling increases in utilization rates may be needed and should be based on clinical criteria.

INTRODUCTION

Background

As health care expenditures come under closer scrutiny, in vitro fertilization (IVF) services draw special attention for several reasons: the prevailing importance of families and children in our culture; the public debate generated by the associated ethical and effectiveness issues; and not least, the high cost of individual IVF treatments. The inability to have a child affects more than 4 million women and 3.95% of all women of reproductive age (2.3 million) receive medical advice or treatment for infertility in a given year.¹ Conventional treatments for infertility include ovulation induction, donor insemination, and surgery for tubal disease or endometriosis. Also, some couples conceive without treatment, but many are not successful in achieving a live birth and these patients gravitate towards intensive therapies, such as IVF.² Thus, IVF usually is a late-stage treatment for infertility. In collected data which include women over 40 years of age, and couples with severe male infertility, 15% of the cycles initiated are successful.³

Because of the complexity of IVF technology, the cost of IVF is high compared with conventional treatments.² In 1986 the median charge for a single cycle of IVF was \$4,688,² compared with a 1993 estimate of \$8,000 per cycle in a single clinic.⁴ Viewed in isolation from the context of infertility treatment, such figures have drawn attention to IVF expense and therefore it seems appropriate to subject this developing technology to special evaluation in relation to other health expenditures. This paper addresses the cost of adding IVF treatment to a standard benefits package. IVF cost is defined as the marginal cost of a single IVF treatment cycle. The capital cost of

adding IVF to an existing infertility service and the cost-effectiveness of IVF are not considered.

METHODS

National utilization of IVF services in 1993

The American Fertility Society (AFS) and the Society for Assisted Reproductive Technology (SART) maintain a database of the IVF experience in the United States. The AFS/SART IVF Registry includes the annual number of cycles for the majority of American IVF clinics and (after 1990) a few Canadian IVF clinics.^{3,5,6} A summary of the data from United States clinics for 1985 to 1992 was obtained from the administrator of the AFS/SART database. In the judgment of AFS and SART, the data collected from 1988 to 1992 represent 95% of the IVF cycles in the USA. Therefore the total annual cycle numbers from these years were projected to 1993 with the use of linear regression (Figure 1). The US cycle estimate for 1993 (28,703) was adjusted upward by 5% to approximate the actual total number of IVF cycles in 1993 (30,214).

Estimated 1993 costs of IVF services

In order to estimate costs from a wide range of US centres, in December of 1993 we conducted a survey of IVF clinics which contribute to the AFS/SART database. In the 71 clinics which responded, the mean charge for a single completed IVF cycle was \$7,861 (Table 1). In the absence of a detailed cost analysis, these charges for IVF services have been taken as the nearest available estimate of cost.²

The IVF clinics reported the charges for a complete cycle of IVF, and not all

couples complete a given cycle. Thus, the mean cost per cycle should be discounted by the proportion of couples experiencing each set of events during the cycle. The typical IVF cycle events include the initiation of ovulation stimulation, the retrieval of oocytes and the transfer of embryos. The AFS/SART database is not complete for 1993, but the 1992 Outcome Assessment results for IVF cycles performed in the United States were as follows:

Cycles initiated	26,839
Cycles retrieved	22,764
Cycles transferred	20,015
Clinical pregnancies	4,895
Live born deliveries	4,071

Thus, the discounted cost of retrieval and the associated events (gamete laboratory, hospitalization and anaesthesia) is $22,764/26,839$ or 0.848. The discounted cost of embryo transfer is $20,015/26,839$ or 0.746. The total cost of IVF service in the 71 clinics was adjusted by these discount factors as in Table 1. The adjusted cost per initiated IVF cycle in the 71 clinics is estimated to be:

$$\$439,252 / 71 = \$6,187.$$

The total cost of national IVF services in 1993 is the product of the total number of IVF cycles and the cost per initiated cycle:

$$30,214 \times \$6,187 = \$186,934,000.$$

IVF expenditures for the insured employed population.

IVF expenditures occur among healthy young people, and represent a proportion of the health care costs that are specific to this segment of the population.

We therefore made use of estimates based on assumptions that were computed for the American Medical Association (AMA) benefits package for currently employed persons.⁷ Certain adjustments made in the cost estimates for employees' health benefits packages are not appropriate with respect to IVF service costs. For example, no cost reducing factor should be applied for expenditures that would be covered by other insurance programs, such as those for retired persons, and for individuals eligible for Workmen's Compensation.⁷ To be consistent with the AMA benefits package, it is appropriate, however, to exclude costs estimated for the unemployed and self-employed persons, since these were not regarded as employed in the AMA benefits package estimates. For this purpose the total IVF expenditures in 1993 shown above (\$186.93M) were multiplied by a factor determined from the following ratio:

$$\frac{\text{women of child-bearing age in the family of a full-time employee}}{\text{women of child-bearing age (15-44 years)}}.$$

Taking into account women who were married, never-married and previously married, and the available employment data, 52.9M (90.1%) of the 58.7M women aged 15-44 years are working, living with a working spouse or living with working parents.^{8,9} Because the proportion of self-employed individuals was not reported for this sub-population, we adopted a worst-case approach: all working individuals were assumed to be full-time employees. This approach tends to inflate the costs of IVF services for full-time employees. The IVF expenditures for the insured employed population are then:

$$\$186.93\text{M} \times 0.901 = \$168.43\text{M}.$$

The additional cost of IVF services per employee is the cost of IVF for

insured employees (\$168.43M) divided by the estimated number of active employees who might have held certificates of coverage by an employer sponsored plan during 1993. The number of certificate holders estimated in costing the AMA benefits package was 68.85 million.⁷ This leads to the following average cost of IVF services per employee:

$$\$168.43 / 68.85 = \$2.45.$$

The effect of cost-sharing

The average cost of IVF services per employee was further modified to reflect the cost-sharing assumed for the AMA benefits package (annual deductible of \$350 or \$750 per family, coinsurance of 20% with a maximum of \$1,500 in any year).⁷ Deductible and coinsurance effects on the costs of IVF services were estimated by taking the highest values that had been estimated for similar services in the AMA standard plan. For the deductible effect this yields a factor of 0.965, and for the coinsurance effect the factor is 0.91. The combined impact of these factors is 0.878: the resulting average cost per insured employee is:

$$\$2.45 \times 0.878 = \$2.15.$$

Increases in utilization

If benefit plans were to cover a high proportion of the cost of IVF services, increased utilization of IVF services could be expected. As a guide to the impact of cost-sharing, we used data on utilization and cost-sharing from two countries in which IVF costs were covered in whole or in part by national insurance programs.

Utilization of IVF services in other countries. We searched relevant

publications to determine the annual cycles of IVF treatment in other countries in which part or all of the costs are supported by national health insurance or national health services. Australia and the United Kingdom publish only reports on the number of pregnancies and their outcome: the number of services in terms of cycles per year is not included.^{10,11} The Fecondation In Vitro National (FIVNAT), which is co-ordinated by the French Institute for Health and Research (INSERM) published IVF service data for France which includes the number of cycles from 1986 through 1990.¹² The French authors state that the published data represent 80% of the total IVF services in France. The annual number of cycles reported was multiplied by 100/80 and these results were projected to 1993 with the use of linear regression. The estimated total number of cycles initiated in France during 1993 was 33,142. In the Canadian province of Ontario, the Ontario Health Insurance Plan (OHIP) covered the 1993 costs of IVF procedures, and patients paid for the required drugs. The number of cycles in 1993 was derived from a January 1994 telephone survey of all Ontario clinics. The actual number of cycles initiated was documented by 7 clinics, and in 4 clinics the number was estimated from the number of embryo transfers using a factor of 100 cycles initiated for every 75 transfers, (as in Table 1). The total number of IVF cycles initiated in Ontario during 1993 was 3,186.

Cost sharing. The AFS staff estimate that 30% to 40% of American IVF services currently are partially or completely covered by insurance: insurance is estimated to pay 50% of costs for those covered. Cost-sharing in the United States is therefore estimated to be approximately 85%. Cost sharing in Ontario has been documented in a cost effectiveness study.¹³ The total direct and indirect costs for IVF in 1990 were \$C5466 per cycle initiated, of which patient costs for drugs were \$C1575 (28.8%). In the

clinic where this study took place. 55% of patients have supplementary employer health insurance which covers the drug costs of IVF services, usually with small deductible portions. Cost-sharing in Ontario is therefore estimated to be approximately 15%. The French national health service pays for all costs including drug costs. Cost-sharing in France is therefore estimated to be approximately 0%.

Annual cycles of treatment per million population. In order to compare IVF utilization rates, annual cycles of treatment per million population were estimated by converting total cycles per year to cycles per million population. Population estimates for the year 1992 for the United States, Ontario and France were drawn from various sources.¹⁴⁻¹⁶ If the Ontario utilization applied in the United States, the annual number of cycles might be 84,168 (267.2M times 315 per million). If there were no cost-sharing, as in France, the number of cycles annually might be as high as 154,976 (267.2M times 580 per million). (Table 2) We have estimated costs for utilization increases equivalent to 300% and 500%.

Other considerations

The AMA Standard Benefit Plan includes service costs for the preventive programs, including the prevention of infertility. Preventive costs were not estimated for IVF services, as costs for the prevention of infertility would be included among infertility service costs.

The reduced cost of benefits that would occur as a result of the elimination of bad debts was not considered in the estimation of the additional cost of IVF benefits, as IVF services are usually pre-paid and bad debts are not

significant.

The costs to administer the employer health plans for the AMA standard plan were estimated to be 12.5% and this factor determines the difference between the cost of the benefits and the cost of premiums.⁷

RESULTS

The estimated 1993 cost of the total benefits in the AMA Standard Benefit Plan with all bad debts recycled would have been \$2,456 per full-time employee, and the cost of premiums would have been \$2,763.⁷ The average expenditure by employers per full-time employee to offer the additional costs of IVF coverage estimated for 1993 would have been \$2.15 (Section 5). These estimates were converted to 1994 costs. The 1994 costs are the 1993 costs multiplied by an inflation factor based on projected national health care expenditures.¹⁴ The 1993 and 1995 non-governmental projected expenditures on personal care were \$434.0 and \$518.1 billion respectively. Data for 1994 were not provided; the straight-line projection for 1994 is \$476.1 billion, an increase of 9.7% over 1993. IVF costs are given for three scenarios: a straight line projection of the current service load, a 300% increase in utilization and a 500% increase in utilization.(Table 3)

Geographic variations by state in the 1994 average benefits provided by the AMA plan and the additional costs associated with IVF services are shown in Table 4.

Discussion

Estimates of the cost of future medical services necessarily are based on assumptions concerning cost estimates, cost-sharing and utilization. Uncertainties about the level of expenditure that can be expected to occur are particularly important in the case of a continuously developing technology such as IVF, as the potential impact of such uncertainties can be consequential. Although the estimated costs of IVF services are less than half of one percent of the total health benefit package cost, IVF is just one of several types of treatment for a single health disorder among many which compete for health care funds. From a broader health care systems viewpoint, the cost of IVF services is high, relative to the burden of disease addressed by IVF treatment. Thus it is essential to consider whether savings may be expected from the reduced utilization of alternative treatments for infertility, and to consider factors governing IVF utilization if funding were available for IVF procedures.

Reduced utilization of alternative treatments.

Providing reasonable access to IVF treatment is likely to yield savings in the cost of other treatments such as tubal surgery, which is more invasive and entails additional risk. Several reports suggest that IVF is superior to surgical treatment in women with tubal disease.¹⁷⁻¹⁹ In a Dutch study, although IVF success rates were only 10% per initiated cycle, the cost-effectiveness of IVF treatment was equivalent to tubal surgery and in some sub-groups of patients IVF was superior.¹⁹ In a Norwegian study, the availability of IVF treatment reduced tubal operations by 50% and the calculated cost per live birth was \$17,000 for tubal surgery compared with \$12,000 after IVF treatment.¹⁸ Because no US studies have compared IVF costs and surgery costs per successful outcome in this way. The following less

formal comparison is used to address this issue. In the most recent IVF data cited above, 4,071 of the 26,839 cycles initiated (15.1%) resulted in live births. The 1993 cost per successful cycle would be approximately \$6,187/.151, or \$40,789. The cost-outcome ratio for tubal surgery was \$31,841 per pregnancy in 1983.²⁰ In 1993 dollars that would be \$72,763 per pregnancy, or approximately \$85,000 per live birth, applying the inflationary factor for expenditures on personal health care services.¹⁴ Policy decisions generally consider more than cost alone, but on the basis of cost-effectiveness there seems to be little evidence for favouring tubal surgery as an alternative to IVF treatment.

The extent of savings in alternative treatments other than tubal surgery is indicated by the results of a study in which couples randomly were allocated to wait at least six months, or have early IVF treatment. The waiting couples consumed infertility treatment services totalling 28% of the cost of the IVF services received by couples in the alternate arm of the study.¹³

Factors governing increased utilization and its cost.

If IVF is accepted as a necessary and appropriate service to be included in a comprehensive benefits package, the potential for a sizeable increase in the utilization rate is a matter for serious concern. Utilization in Ontario and France was three to five times greater than in the United States and there is no published evidence of ethnic, religious or socio-economic factors that might explain these differences. Thus, variations in the number of annual cycles of treatment appear to arise from differences in the proportion of the IVF cost that is shared by infertile couples. The relationship between cost-sharing and utilization was a key focus of the Rand experiment, in which

health care consumption declined most steeply when cost sharing rose from zero to 25% of the total cost.⁴¹ The utilization of IVF services relative to cost-sharing shows a similar trend (Figure 2). The utilization rate (as expressed in IVF cycles per million population) is much higher in France where cost sharing was less than 5%. Cost sharing at the 15% level, as in Ontario, leads to reasonable utilization. Such a policy might, however, exceed currently recommended cost sharing standards including the annual \$1500 maximum assumed for the AMA plan.⁴² Although the implementation of special cost-sharing requirements in this way may not be the optimal strategy for the control of IVF utilization, it is very likely to be effective.

Factors in addition to cost-sharing also may constrain utilization rate increases and the cost of such increases. Utilization rates could be regulated by limiting access through pre-authorization requirements and by covering a maximum number of cycles. Possible mechanisms to regulate the cost of increased IVF utilization include cost reductions through volume efficiencies and protocol modifications.

Controlling access by means of pre-authorization requirements would be more widely acceptable if bureaucratic decisions were supplanted by clinical criteria.²² In the case of infertility treatment, a single clinical criterion may suffice: conventional treatment avenues are indicated in most cases before IVF procedures should be considered.²³ Controlling access by putting a ceiling on the number of covered cycles may seem preferable, as most American couples having IVF undergo only one cycle.^{3,23} Nevertheless, additional cycles are beneficial, even if less so than the initial cycle.²⁴ In this respect, it is notable that the average couple in two cost-effectiveness studies had only 2.5 cycles of IVF, although four or more were

allowed.^{19,25}

The cost of increased utilization could be controlled by volume efficiency if the increase in IVF services were to be accommodated in a limited number of clinics. Individual clinics offering a higher annual volume of service have lower costs per cycle initiated and lower costs per pregnancy.¹⁹ Market factors may help to shape the desirable outcome: the cost per success was three times higher at the worst clinic compared with the best clinic.¹⁹ Alterations in IVF protocols also may achieve savings in the overall cost of IVF services.^{4,26} In a single IVF centre, one new protocol established satellite centres for ovulation induction procedures, thus reducing patient out-of-pocket expenditures.²⁶ Another protocol reduced by almost one-half the dosage and cost of drugs used for ovulation induction and the frequency of biochemical and ultrasound monitoring.⁴ Although overall pregnancy rates were lower in the low dose protocol, the difference was not significant. Continued study of low cost protocols appears to be warranted.

If coverage of IVF services were universally available, a likely predicted annual premium cost per employee would be approximately \$8.00 in a benefit plan costing \$3,031 in total, assuming 15% cost-sharing. Increasing the proportion of costs that must be borne by couples would constrain IVF utilization increases, but the greater cost may lead to reduced access for those who are less able to pay. It would be preferable to control access by means of clinical criteria, provided that such pre-authorization and cycle limit regulations could be implemented on a fair and reasonable basis for all couples with infertility.

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Table 1. Cost per IVF cycle: mean and adjusted charges, 71 IVF clinics in the United States
1993.

Charge Item	N*	Mean Charge	Total	Factor	Adjusted Total
Consultation	66	230	15.200	1.000	15.200
Medication	65	2,013	130.832	1.000	130.832
Ultrasound	60	716	42.978	1.000	42.978
Retrieval	61	1,521	92.781	0.848	78.678
Laboratory	61	1,452	88.547	0.848	75.088
Embryo Transfer	61	423	25.803	0.746	19,249
Hospital Charges	42	1,317	55.310	0.848	46,903
Anaesthesia	47	483	22,701	0.848	19,250
RN Coordinator	3	625	1.875	1.000	1,875
Hormone Lab	11	836	9.198	1.000	9.198
Total	71	\$7861	\$558,152		\$439,252

* N: number of clinics reporting individual charge items.

Table 2. Annual cycles of treatment per million (M) population.

Region	1993 Cycles	Population	Cycles/M	As % of USA
USA	30,214	267.2M	113	-
Ontario	3,186	9.6M	332	294
France	33,142	56.4M	588	520

Table 3. Average Benefits and Premium Costs per Full-Time Employee. 1994

	AMA Standard	Straight-line projection of US IVF volume	Increased IVF Utilization	
	Benefits Plan		300%	500%
Benefits	\$2,694	\$2.36	\$7.07	\$11.78
Premiums	3,031	2.65	7.95	13.25

Table 4. Average AMA plan benefit and additional IVF cost per employee by state.

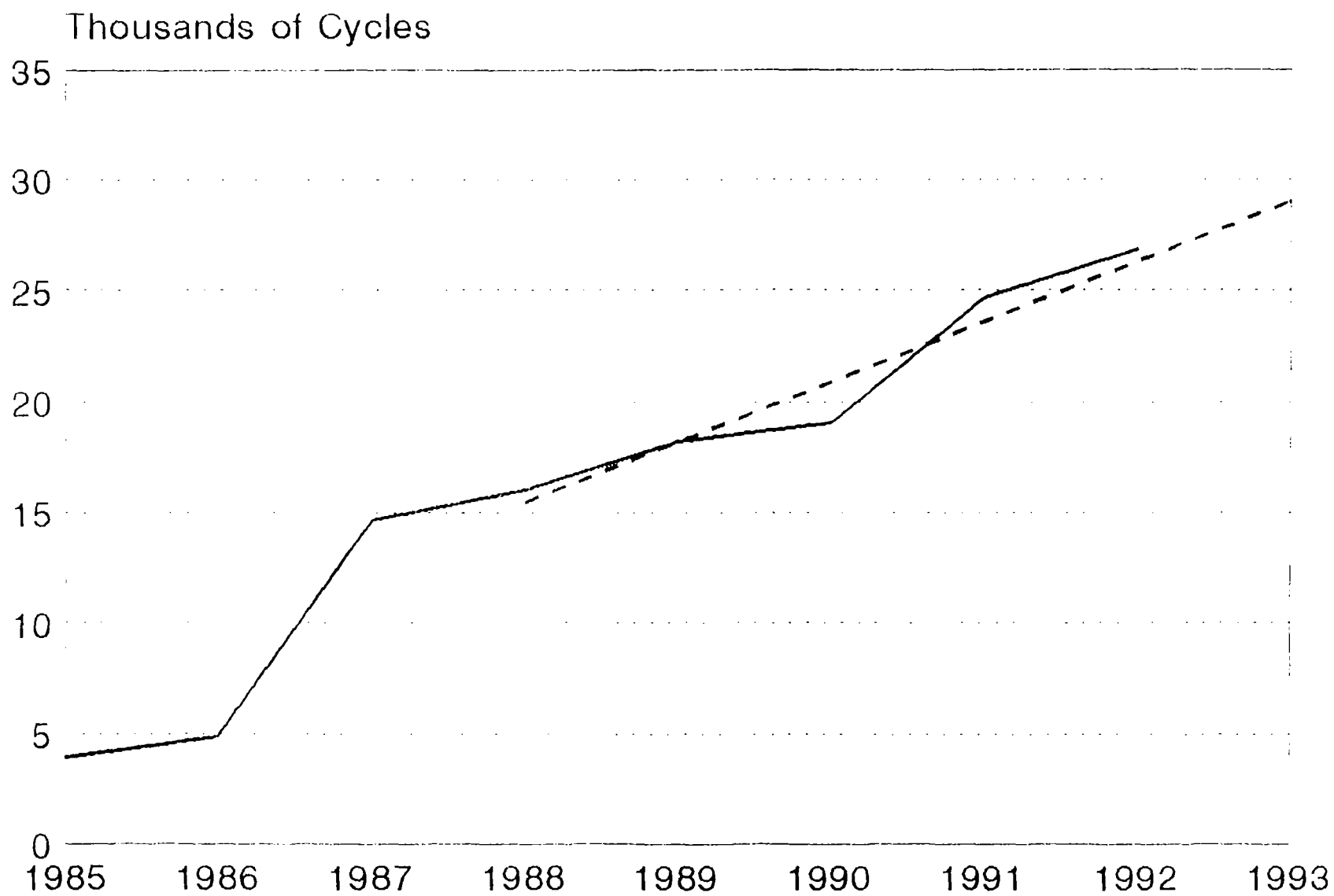
	AMA Plan Average Benefit	Utilization Rates		
		100%	300%	500%
Alabama	\$2100	\$2.01	\$ 6.04	\$10.07
Alaska	3177	3.05	9.14	15.24
Arizona	2496	2.39	7.18	11.97
Arkansas	2057	1.97	5.92	9.87
California	3267	3.13	9.40	15.67
Colorado	2523	2.42	7.26	12.10
Connecticut	2423	2.32	6.97	11.62
Delaware	2395	2.30	6.89	11.49
D.C.	3849	3.69	11.08	18.46
Florida	2910	2.79	8.38	13.96
Georgia	2020	1.94	5.81	9.69
Hawaii	2334	2.24	6.72	11.20
Idaho	1786	1.71	5.14	8.57
Illinois	2530	2.43	7.28	12.14
Indiana	2101	2.02	6.05	10.08
Iowa	1871	1.79	5.38	8.97
Kansas	2275	2.18	6.55	10.91
Kentucky	1764	1.69	5.08	8.46
Louisiana	1915	1.84	5.51	9.19
Maine	2099	2.01	6.04	10.07
Maryland	2839	2.72	8.17	13.62
Massachusetts	2878	2.76	8.28	13.81
Michigan	2985	2.86	8.59	14.32
Minnesota	2009	1.93	5.78	9.64
Mississippi	1854	1.78	5.34	8.89
Missouri	2165	2.08	6.23	10.39
Montana	1981	1.90	5.70	9.50
Nebraska	1841	1.77	5.30	8.83
Nevada	3297	3.16	9.49	15.82
New Hampshire	2086	2.00	6.00	10.01
New Jersey	2624	2.52	7.55	12.59
New Mexico	2277	2.18	6.55	10.92
New York	2777	2.66	7.99	13.32
North Carolina	1795	1.72	5.17	8.61
North Dakota	2266	2.17	6.52	10.87
Ohio	2359	2.26	6.79	11.32
Oklahoma	2079	1.99	5.98	9.97
Oregon	2175	2.09	6.26	10.43
Pennsylvania	2668	2.56	7.68	12.80
Rhode Island	2632	2.53	7.58	12.63
South Carolina	1813	1.74	5.22	8.70
South Dakota	1839	1.76	5.29	8.82
Tennessee	1956	1.88	5.63	9.38
Texas	2481	2.38	7.14	11.90
Utah	1856	1.78	5.34	8.90
Vermont	2051	1.97	5.90	9.84
Virginia	2066	1.98	5.95	9.91
Washington	2084	2.00	6.00	10.00
West Virginia	1867	1.79	5.37	8.96
Wisconsin	2123	2.04	6.11	10.18
Wyoming	2010	1.93	5.78	9.64

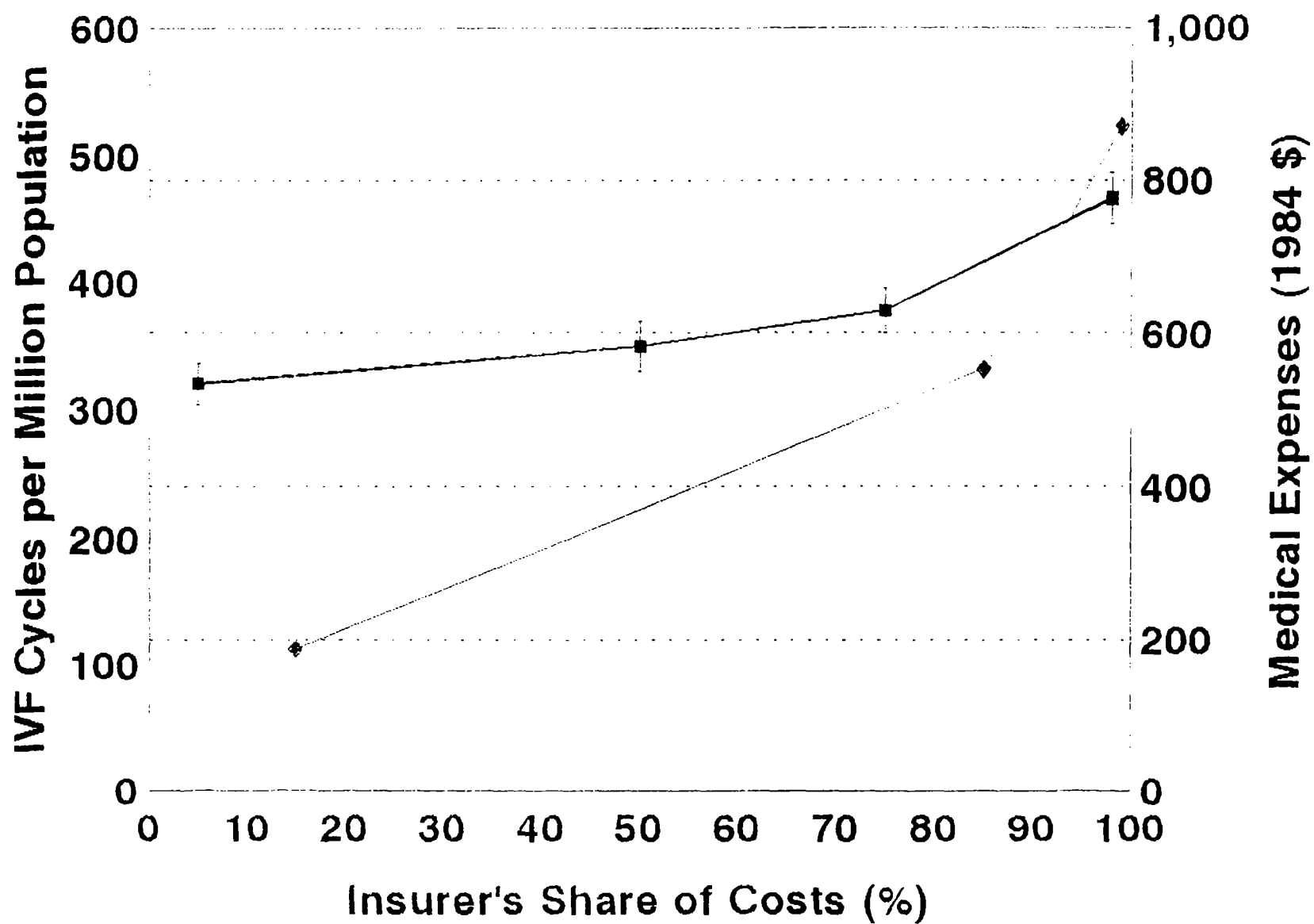
FIGURE LEGENDS

Figure 1. Annual cycles of IVF. Data from United States IVF clinics registered with AFS/SART, 1984-1992 ———; straight line projection: ----.

Figure 2. Relationship between cost-sharing and health services utilization. Closed squares with error bars: annual medical expenses reported from the Rand experiment (adapted from Table 4 in Manning et al ²²; closed diamonds: IVF cycles.

equ 1.





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- b(8) Release would disclose information concerning the regulation of financial institutions [(b)(8) of the FOIA]
- b(9) Release would disclose geological or geophysical information concerning wells [(b)(9) of the FOIA]



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[001]

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TO: JENNIFER KLEIN

FROM: LISA ANGERAME *La*

SUBJECT: IVF MEETING

DATE: MAY 4, 1994

Thanks for agreeing to meet with us at 10 a.m. May 18 in Room 211 of the Old Executive Office Building. Individuals attending the meeting will be the authors of the paper on the cost of adding in vitro fertilization to a standard health benefits package. They are:

Dr. Robert Visscher

Dr. Maria Bustillo --

Lynne Lawrence --

Dr. John Collins may also be at the meeting; I'll pass on his birth date to you as soon as I track him down. Finally, I'll be at the meeting too -- Lisa Angerame,

If you need more information, feel free to call me at 202-863-2494. Thanks again, and I look forward to meeting you in person.

Celebrating 50 Years of Progress

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