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SEMINARS IN PERINATOLOGY

First Trimester Screening: Economic Implications

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The implementation of new strategies for the detection of Down syndrome will have economic implications. These economic considerations must be considered before implementation, since resources are limited and health care costs in the Unites States are soaring. Economic analyses of prenatal diagnosis have unique challenges that must be considered. Most analyses include only direct medical costs, ignoring indirect and intangible costs.
Semin Perinatol 29:263-266 © 2005 Elsevier Inc. All rights reserved.

KEYWORDS Down syndrome, economic analysis

Why is Considering Cost Important?

Health care costs are rising rapidly in the United States. For example, in 2000, health care costs totaled $1.3 trillion, while in 2002, they totaled $1.6 trillion. From another perspective, health care costs are growing 5.7% faster than the Gross Domestic Product. The upward spiral of health care costs is leading to a crisis.

The addition of new screening tests for Down syndrome will have economic consequences, and it is critical to remember that resources are limited. Any additional money spent on Down syndrome screening will be unavailable for other programs. Often as physicians, we tend to "protect our turf" and advocate blindly for additional technologies/services for those groups for whom we care. While this may seem intuitive, we believe that such a narrow focus is inappropriate, and we need to consider Down syndrome screening in a broader societal context.

Overview of Economic Analysis

Economic analyses are usually founded on a decision analytic model, on which costs are overlaid.[1] There are several critical components to an economic analysis.

Perspective

Perspective is determined by the point of view of the analysis. An analysis can take the perspective of insurers, hospital, patients, or society. In most cases, a societal perspective is most appropriate.

Types of Costs Included

There are several types of costs: direct, indirect, and intangible.[1] Direct medical costs are those that are directly related to an illness. For example, the cost of cardiac surgery for a child with Down syndrome would be considered a direct medical cost. Indirect costs are economic losses/gains incurred by an illness. Most commonly, these include losses in societal productivity brought on by illness. Intangible costs include the cost of pain and suffering and grief. In most economic analyses, only direct medical costs are included (for ease of measurement), though it is widely accepted that indirect and intangible costs often overwhelm direct medical costs.

Patient Preferences

Some analyses may include patient preferences (aka utilities) in calculations of cost-effectiveness. These analyses are more precisely termed cost-utility analyses. Measuring patient preferences can be difficult methodologically, and there is debate as to whose preferences should be measured. As such, these analyses are seldom performed.

Methodological Issues Unique to Economic Analyses for Down Syndrome Screening

There are several unique issues related to economic analysis and Down syndrome screening. First, if patient preferences

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doi:10.1053/j.semperi.2005.05.005

are to be included, whose preferences should be measured—those of people with Down syndrome, parents, or health care providers? Data from a study focused on clinical outcomes in low birth weight infants suggest that parent and health care providers underestimate these preferences in comparison to the infants themselves.[2] Second, most analyses place no economic value on a pregnancy loss after amniocentesis/CVS. This is inappropriate from an economic perspective, as these losses incur a lifetime societal cost of lost productivity. Some might argue that a pregnancy loss will ultimately be "replaced" by another child. This assumption has not been validated. Lastly, comparison of first trimester versus second trimester strategies can be complicated because of the natural loss of Down syndrome pregnancies between the first and second trimesters. Thus, an analysis focused on detection of Down syndrome that does not account for spontaneous losses would overvalue first trimester strategies.

Economic Analyses of First Trimester Screening for Down Syndrome

We focus on two recent economic analyses evaluating the cost-effectiveness of different prenatal screening strategies for Down syndrome in the United States. Others have been published,[3-5] but these represent the most recent and inclusive analyses.

Biggio and coworkers compared the cost-effectiveness of five prenatal screening options for Down syndrome:[6]

- Triple screen
- Quad screen
- Integrated (NT/PAPP-A/Free-beta + Quad)
- Sequential (NT/PAPP-A/Free-beta, then Quad screen)
- 1st trimester only (NT/PAPP-A/Free-beta)

There were also strategies that included the genetic sonogram in conjunction with triple/quad screen (these strategies are not presented).

The analysis was limited to women under 35 years old and was not from a societal perspective. Key probability and cost estimates are listed in Table 1. Importantly, spontaneous losses of Down syndrome pregnancies were accounted for in this analysis.

Clinical outcomes are shown in Table 2. All strategies were less costly and more effective (detection) than no screening; thus, screening for Down syndrome is economically justified. Sequential was the least costly strategy and integrated the most costly. The most effective strategy, in terms of Down syndrome detection, is sequential screening, followed by integrated and first trimester. Sequential screening was associated with the highest number of procedure related losses, while integrated had the lowest number. Down syndrome births averted per procedure related loss is another way to express the trade-off between efficacy and safety of DS screening. A loss ratio >1 indicated that more DS births will be averted per loss, while a loss ratio <1.0 suggests that there will be more procedure-related losses than DS cases averted.

Table 1 Key Probabilities and Costs (Biggio et al.[6])

DS prevalence at 10 weeks- 1/595
DS loss rate: 10–14 wks- 25%; 15+ wks- 23%
Euploid loss rate: 10–14 wks- 1%; 15+ wks- 1%
Acceptance of diagnostic test- 70%
Post-amnio loss- 0.9%
Post-CVS loss- 1.6%
Triple screen- 60% sens; 95% spec
Quad screen- 70% sens; 95% spec
First trimester- 80% sens; 95% spec
Integrated- 85% sens; 99% spec
Sequential- 95% sens; 90% spec
Triple/Quad- $59–76
First trimester- $130
Integrated- $206
Amnio- $191
CVS- $235
Counseling- $60
Karyotype- $384
Curettage- $375
Mid-trim term- $2000
Lifetime DS cost- $677K

From the Biggio analysis, the most favorable loss ratio was integrated (loss ratio = 9.3), followed by quad screen (loss ratio = 1.5) and triple screen (loss ratio = 1.3). Sequential screening had the least favorable loss ratio (loss ratio = 0.87).

Incremental analysis is a way to assess the cost for increased clinical benefit when comparing two strategies. This is employed when a more effective strategy is also more expensive, which is often the case. Below are incremental analyses from the Biggio and coworkers analysis.

Quad screen→ Integrated

A total of 93 additional DS livebirths will be averted if we move from quad screen to integrated, at a cost of $526,000 per additional DS averted, and 249 euploid losses would be prevented.

1st trimester→ Integrated

A total of 30 additional DS livebirths will be averted if we move from first trimester to integrated, at a cost of $1,200,000 per additional DS averted, and 497 euploid losses would be prevented.

It is difficult to judge which strategy is most favorable, because there is clearly a trade-off between efficacy, safety, and cost. Our interpretation of the Biggio study would include the following points. First, Down syndrome screening is economically justified compared with no screening. Second, sequential screening is untenable, due to the extremely high number of procedure-related losses compared with other strategies.

Third, quad screen, first trimester, and integrated appear to be reasonable choices for Down syndrome screening.

A second analysis was performed by Odibo and colleagues.[7] This analysis included eight screening strategies: