ment, standardized methodology such as that proposed in Drummond et al. (2) has to be used with great care.

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REFERENCES

1. Beck, J. R., Kassirer, J. P., & Pauker, S. G. A convenient approximation of life expectancy; The "DEALE." *American Journal of Medicine,* 1982, 73, 863–97.
2. Drummond, M. F., Stoddart, G. L., & Torrance, G. W. *Methods for the economic evaluation of health care programmes.* Oxford, U.K.: Oxford University Press, 1987.
3. Johannesson, M., & Jönsson, B. Cost-effectiveness analysis of hypertension treatment—Methodological issues. *CMT Report,* Linköping, Sweden: Linköping University Center for Medical Technology Assessment, 1990, 5.
4. Keeler, E., & Cretin, S. Discounting of life savings and other non-monetary effects. *Management Science,* 1983, 29, 300–06.
5. Martens, L., & Van Doorslaer, E. Dealing with discounting: An application to the cost-effectiveness of intracoronary thrombolysis with streptokinase. *International Journal of Technology Assessment in Health Care,* 1990, 6, 139–45.
6. Rosen, S. The value of changes in life expectancy. *Journal of Risk and Uncertainty,* 1988, 1, 285–304.
7. Vermeer, F., Simoons, M. L., de Swaan, C., et al. Cost–benefit analysis of early thrombolytic treatment with intracoronary streptokinase. *British Heart Journal,* 1988, 59, 527–34.
8. Weinstein, M. C., & Stason, W. B. Foundations of cost-effectiveness analysis for health and medical practices. *New England Journal of Medicine,* 1977, 296, 716–21.

ON THE DISCOUNTING OF GAINS IN LIFE EXPECTANCY

Reply to Johannesson and Levin

To the Editors:

It is rather surprising that Magnus Johannesson and Lars-Ake Levin (J&L) (4), in their criticism of our article, end with virtually the same message as ours, namely that the use of standardized, consistent, and explicit methodology would be of great value in the improvement of the comparability of the results of cost-effectiveness analysis. However, we fear that their note may not be a step forward in this respect.

In our article (6) we adopted the following reasoning: If the administration of thrombolytic therapy reduces the mortality risk of treated patients (even if this reduction occurs only in the first year), then this implies that a higher proportion of patients will survive the first year and experience additional life years (or months, or days) during

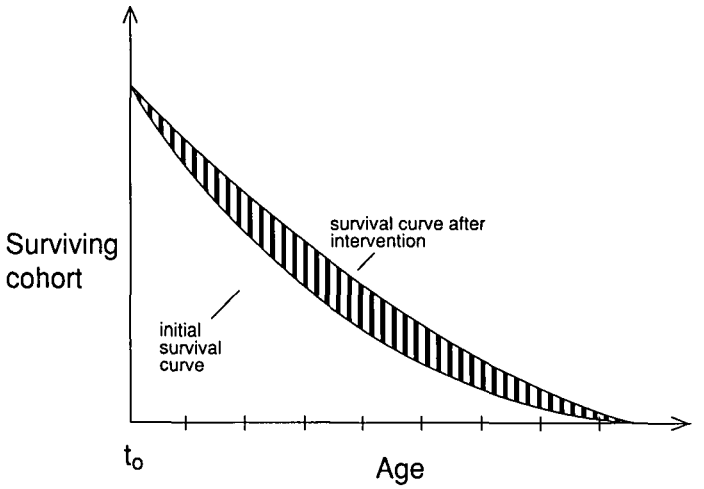

Figure 1. Survival curves with and without intervention.

the following years. These future gains have to be discounted to their present value according to the time preference rate for health. Because we do not know whether this rate is different from the time preference rate for money (1), and because we want to compare the gains with the sacrifices made to obtain them, it seems safe to use the same discount rate for both costs and benefits.

J&L argue that our article is misleading because our method of discounting is only one out of the four different methods of discounting gains in life expectancy that can be found in the literature, and in their eyes not the right one. Fortunately, we seem to be in good company because Milton Weinstein and William Stason (9) and Sherwin Rosen (8) argue for basically this method. In fact, J&L themselves refer to Rosen, who states that "the value of eliminating (or reducing) a risk to life at a specific age is the expected present value of the additional consumer surplus it gives rise to" (8,286). We have adopted exactly this viewpoint but have simplified the analysis by equating the gain in life expectancy with the utility derived from it.

J&L seem to have two criticisms of our approach. First they argue that in this case there is no need to discount because "the whole gain in life expectancy from intracoronary thrombolysis arises due to the decrease in risk during the first year." This is true, but the benefit derived from this risk reduction is clearly the improvement in life expectancy that will yield a number of additional life years in the future. The issue is illustrated in Figure 1. A gain in life expectancy due to an intervention at point t_0 can be represented as an upward shift of an expected survival curve, which in our case was approximated by a declining exponential function. The area between the initial and the shifted curve represents the survival gains that are to be discounted to the same point in time, e.g., the time of the intervention t_0. In our view, this is the only valid procedure to discount future life years. The three other methods described by Johannesson (3) appear to be simply incorrect.

The other argument that J&L raise against our way of discounting is that it would value life years gained differently for old versus young individuals and for men versus women because of differences in remaining life expectancy, which would be in contradiction to the "normative principle behind cost-effectiveness analysis . . . that one

life year should be valued equally for everyone" (4,651). We do not believe that there is any contradiction here. Our approach is perfectly egalitarian in the sense that the *present* value of any life year gained is treated equally. If this would be interpreted as discriminating against groups with longer life expectancies, and if it is felt that some weighting of this feeling is to be reflected in the decision making, one could adjust the valuation of future benefits but leave the discount rate untouched. This externality argument is comparable to that of Victor Fuchs and Richard Zeckhauser (2) in the context of intergenerational transfers: "If it turns out that we collectively value the future more than we express in private actions . . . we should adjust our valuations of future benefits upward, not our discount rate downward. Self-respecting economists should not adjust discount rates for externalities stretching to the future or use different rates because it is health that is being valued" (2,265).

We still believe that our method of discounting is the most appropriate one, but we do realize that there are other problems with assessing the present value of these life years. In principle, the consumer surplus is defined as the sum of utility to the relevant individuals of those life years. It is perfectly possible and even very likely that different individuals value future life years differently because their time preferences differ. Indeed, some authors (5;7) have even suggested methods to incorporate time preference rates of individuals for health in the utility assessments of health states. Unfortunately, these methods are still experimental and their applicability in clinical trials on real patients (rather than students of decision analysis) remains to be demonstrated. Moreover, because our article was concerned with a secondary analysis of published results we could not even consider using these methods.

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REFERENCES

1. Abel Olsen, J. Is the time preference rate for health different? Paper presented to the Second World Conference on Health Economics, University of Zurich, Switzerland, September 1990, 103–04.
2. Fuchs, V. R., & Zeckhauser, R. Valuing health—A "priceless" commodity. *American Economic Review,* 1987, 77, 263–68.
3. Johannesson, M. A note on the discounting of gained life-years in cost-effectiveness analysis. *International Journal of Technology Assessment in Health Care,* in press.
4. Johannesson, M., & Levin, L. A. Comment on "Dealing with discounting" [Letter to the Editors]. *International Journal of Technology Assessment in Health Care,* 1991, 7, 651–53.
5. Lipscomb, J. Time preference for health in cost-effectiveness analysis. *Medical Care,* 27, 1989, S233–53.

6. Martens, L., & Van Doorslaer, E. Dealing with discounting: An application to the cost-effectiveness of intracoronary thrombolysis with streptokinase. *International Journal of Technology Assessment in Health Care,* 1990, 6, 139–45.
7. Mehrez, A., & Gafni, A. Quality-adjusted life years, utility theory and healthy-years equivalents. *Medical Decision Making,* 1989, 9, 142–49.
8. Rosen, S. The value of changes in life expectancy. *Journal of Risk and Uncertainty,* 1988, 1, 285–304.
9. Weinstein, M. C., & Stason, W. B. Foundation of cost-effectiveness analysis for health and medical practices. *New England Journal of Medicine,* 1977, 296, 716–21.