Understanding Productivity Benefits and Related Future Research Needs in Cost-Effectiveness Analysis

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KEY POINTS

Productivity is an important effect of a health intervention.

Second Panel on Cost-Effectiveness Analysis provides guidance on how to measure and value productivity effects.

Many payers within the United States may be interested in knowing about these effects.

Healthcare can have a profound impact not only on the health-related well-being of an individual but also on one's functional status, which impacts the ability to contribute to society positively. One such important manifestation of changed functional status is its effect on productivity or the production of goods in a society, which are valued by others. When economic evaluation of healthcare interventions are conducted from a societal perspective, these benefits or costs should be accounted for through productivity estimates. The First Panel on Cost-Effectiveness in Health and Medicine [1] had recognized the importance of these benefits and recommended that they

beyond quality-adjusted life years (QALYs) would lead to "double counting".[2,3]

Empirical evidence since the First Panel, however, shows that QALYs typically do not reliably capture measures of productivity. [4-7] In most cases, productivity effects are simply not considered by the respondents to preference elicitation questions,[8] and sometimes they are explicitly asked to ignore them.[9] Researchers had long recognized this limitation of QALYs and had started incorporating explicit productivity estimates in CEA done from a societal perspective. Incorporating these estimates often has been found to have profound effects on the

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should be part of the calculus in establishing the societal benefits of an intervention. However, the panel concluded that these benefits are captured through stated preferences of the health state valuation such as quality-of-life weights. Hence, any explicit measurement of these benefits

incremental cost-effectiveness ratios (Figure 1). Based on this long line of evidence, the Second Panel on Cost-Effectiveness in Health and Medicine [10] concluded that QALYs are meant to reflect only a measure of health, and the productivity effects should be explicitly

Figure 1: ICERS with and without productivity costs. Reproduced from Krol et al. [8].
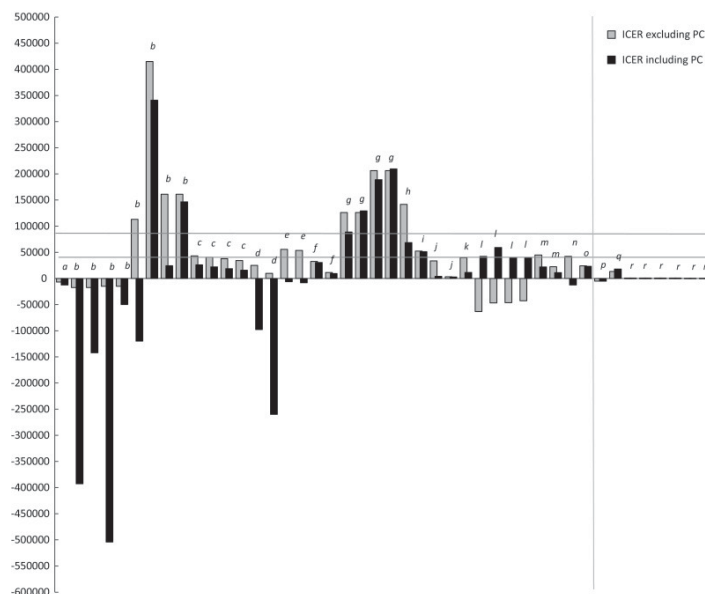
measured and accounted for in the numerator of an incremental cost-effectiveness ratio from a societal perspective.

Productivity benefits are also becoming an important part of promoting value calculations in healthcare.[12,13] In fact, the notion of "patient-focus" put forth by many private healthcare plans in the United States highlights the need for considering productivity benefits.[14]

WHAT SHOULD BE MEASURED
Productivity is viewed typically as a measure of efficiency and, therefore, must net consumption from total production of individuals. Total production may come from labor production, informal labor market production, and household production. Each of these production types could be affected by health and healthcare intervention. Additional income coming from governmental welfare, such as disability payments, is not considered to have any production value as this is merely a transfer of income from one person in the society to another. Similarly, investment income represents the flow of money from fixed assets and is unlikely to be affected by health or survival, and therefore should not be considered as production. Consumption, on the other hand, can occur from any of the income sources, including welfare payments and investment income, and also would likely vary by health status. Therefore, for any given period in the future (suppressing notation for discounting), the total productivity measure is given as

$$S(H)\cdot[(L(H) + IL(H) + HP(H) - C(H)]$$

Where

H = Health; (H) = indicates dependence on health
S = survival to that specific period
L = Labor production
IL = Informal labor production
HP = Household production
C = Total consumption, and

Changes in health $\triangle H$, presumably brought about by an intervention, generate two separate effects, one through a change in productivity and the other through a change in survival, $\triangle S$.

$$S(H)\cdot[\triangle L(\triangle H) + \triangle IL(\triangle H) + \triangle HP(\triangle H) - \triangle C(\triangle H)] + \\ \triangle S(\triangle H)\cdot[(L(H) + IL(H) + HP(H) - C(H)]$$

The first term shows the changes in productivity due to changes in health, conditional on survival, and includes changes to labor production $\triangle L(\triangle H)$, informal labor production $\triangle IL(\triangle H)$, and household production $\triangle HP(\triangle H)$. It is important to note that overall productivity changes typically nets out changes in consumption due to health, $\triangle C(\triangle H)$, from the changes to production. However, in cost-effectiveness analysis, one can **ignore** the changes to consumption due to changes in health and hence $\triangle C(\triangle H)$ is highlighted in red. This is because if one considers changes to consumption, one must also consider changes to the utility or well-being brought about by the changes in consumption (Nyman 2004).[15] However, since CEA focuses on maximizing health through QALYs, there is no scope for measuring changes to overall well-being due to the changes in consumption. Fortunately, economics comes to the rescue. It has been shown, through the famous Envelop theorem in economics, that the value of the utility change due to consumption change is equivalent to the magnitude of the consumption change at the margin.[16] Therefore, ignoring both those factors would not change the optimality condition for

investment in health. Consequently, in CEA, one can ignore these changes to consumption brought about by changes to health.

The second term, often dubbed as "future costs," reflects the net resource use in the society due to living longer. Here, the net resource use is the difference between the absolute levels of production from the three sources and total consumption.

Thus, the total productivity effect of an intervention in CEA is illustrated in Figure 2. Interventions that do not produce any survival gains would only focus on the first part of the productivity effect.

Figure 2: Components of incremental productivity effects.
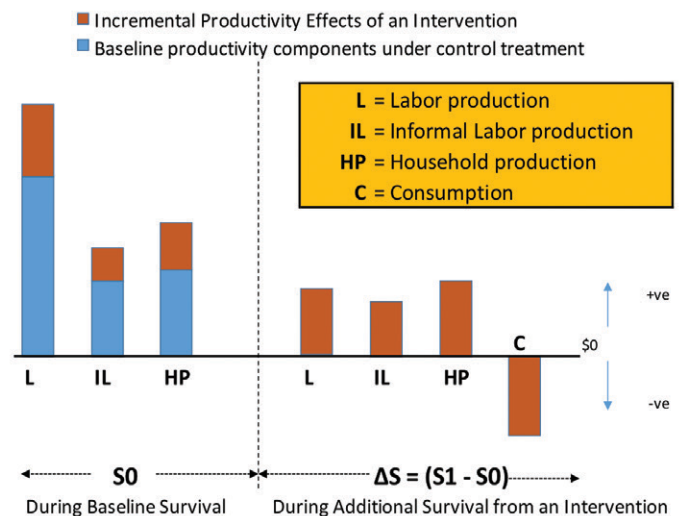
HOW TO MEASURE AND VALUE COMPONENTS OF PRODUCTIVITY EFFECTS
The Second Panel recommends valuation of production effects from a societal perspective using a human capital approach. The rationale for using this approach over alternatives such as the friction cost methods is detailed in the Second Panel Report.[4,10]

LABOR MARKET PRODUCTION
Labor market production refers to earned income in a formal job. Health certainly influences the ability to participate and perform in the labor market. In prospective evaluation studies, standard questionnaires exist to capture labor market participation and earned income. In many cases, a period-specific average number of hours of participation in the labor market can be imputed based on the product of the following 2 parameters: (1) the health-status–specific likelihood of a person's participating in the labor market during that period, and (2) the health-status–specific number of hours worked if participating in the labor market. Because an individual would be employed in the market only if the marginal product of labor is at least as large as the wages plus fringe benefits offered, the marginal value of a unit of time in the formal labor market is given by the (pre-tax) wages plus fringe benefits. In 2014, the average fringe rate in the United States was 46% (Bureau of Labor Statistics [BLS] 2015). Age-specific and average wages in the United States can be found in the BLS website. >

INFORMAL MARKET PRODUCTION

Informal market production involves participation in productive activities without being paid formally. For informal market production, one should only consider activities outside the household to differentiate from household production. Such production includes volunteering time for various activities (eg, babysitting), counseling, and mentoring younger people.[17,18] For example, an emeritus professor who is no longer on the payroll of a university may still spend a large number of productive hours mentoring students. To the extent that health status can enable one to participate in these activities, which in essence is thought of as replacing one's leisure time, these hours should be valued as productive time. More research is needed in measuring the impact of an intervention on informal market production. Many validated questions from the American Time Use Survey (ATUS, https://www.bls.gov/tus/) may be used to measure this form of productive time prospectively. Time spent in informal markets should be valued the same way as time spent in formal labor markets.

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HOUSEHOLD PRODUCTION

Household production represents the sum of time spent doing services around the household and time spent caring and helping household children and adults.[19] It has the same rationale for inclusion as informal market activities; only that household production consider unpaid productive activities within the household. Grosse et al [19] provide estimates for the labor market and household production in the United States by age and gender. Figure 3 presents both labor market and household production for the US population over age groups. The fact that household production, on average, is higher than labor market production at all ages and that the former reduces more slowly over age than the later indicates the importance of accounting for household production and the impact of health on it.

Like informal market production estimates, more research is needed in measuring the impact of an intervention on informal market production. In many cases, informal market and household production can be considered jointly in such prospective evaluations.

CONSUMPTION

As explained in the previous section, accounting for average non-healthcare consumption levels to net them out from total production levels becomes important during the added-years of life with an intervention. These can be estimated from the Consumer Expenditure Surveys in the United States.

Figure 3: Labor market and household production over age in the United States
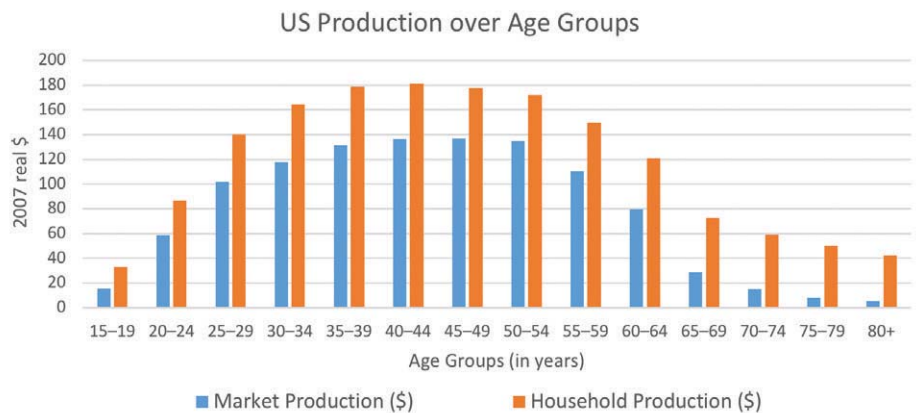
Source: Grosse et al. 2009.[19]

CAREGIVER TIME

An important effect of an intervention that alleviates health is on caregiving activities. Time contributed by formal (paid) and informal (unpaid) caregivers in caring for patients should be valued in the same way as productivity costs.[4] Hourly rates for both should be based on the marginal pre-tax wage rate plus fringe benefits observed in the formal caregivers' market.

DISTRIBUTIONAL ISSUES RELATED TO THE INCLUSION OF PRODUCTIVITY EFFECTS IN CEA

Several distributional issues are generated with the inclusion of productivity estimates in CEA. Traditional cost-benefit analysis typically would use targeted productivity estimates, based on age, sex, health status, and other characteristics of patients, to reflect the true resource use in the society. However, such an approach would, for example, imply that interventions meant to alleviate health conditions that are more prevalent among low-income populations would fare worse than other interventions. In contrast, a single national estimate of an hourly wage or average annual salary and annual consumption estimates may be used to value all productive time across all studies. These distributional issues are real and should be directly confronted by any decision maker presented with cost-effectiveness results that only account for 1 input into the overall decision-making process. However, these concerns do not preclude inclusion of productivity estimates in CEA. There are equally important and valid distributional issues even when productivity estimates are not included. Ignoring the productivity costs would bias evaluation in favor of those interventions that have only life expectancy gains, but generate no functional benefits. Failing to value productivity benefits of health interventions could be stark for low- and middle-income countries, where growth in labor productivity play an important role in economic development.[21]

For example, the value of a new drug for people with schizophrenia that improves cognition, which in turn leads to better functional outcomes, including labor market participation, would be seriously underestimated if these productivity benefits were not considered. Quality of life weights have long been subject to ethical issues. In fact, any consistent model for budget allocation would have "unethical" implications.[20] As

the Second Panel points out, the key is to develop a consistent process within an institution to account for effects of interventions on these resources and follow transparent, deliberative processes to address distributional issues.

CONCLUSION

Productivity is an important effect of a health intervention. Consistent measurement of the productivity effects in CEA can help convey the value of many healthcare interventions beyond their effects on health and healthcare resources. Although the inclusion of these effects in CEA would render a societal perspective to such analysis, many payers within the United States, especially those offering employer-sponsored plans, may be interested in knowing about these effects. ●

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Additional information

The preceding article was based on an issues panel presentation presented at the ISPOR 22nd Annual International Meeting. To view this presentation, go to http://www.ispor.org.