Missed Opportunities?! Gaps in Capturing the Full Value of Vaccination Across Health Economic Studies of COVID-19 Vaccination

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SUPPLEMENTAL MATERIALS

Table S1. Novel Value of Vaccination Framework Relevant to Health Technology Assessments and Cost-Effectiveness Analyses

Dimension	Concept
I	**Health gains to vaccinated individuals**
	• Reduction in morbidity and mortality • Avoidance of long-term sequelae • Reduction in long-term/ongoing disability • Improved life expectancy • Reduction in secondary infections that complicate vaccine-preventable diseases: vaccines can prevent diseases beyond the specific infection they are designed to target; prevention of the development or worsening of comorbidities (eg, influenza increasing the risk of myocardial infarction or stroke) • Prevention of primary nosocomial infections (eg, averting a hospital stay by preventing a vaccine-preventable disease can prevent an infection of the patient in the hospital)
I	**Savings in direct medical costs**
	• Reduction in: - Direct cost of healthcare - Number of general practitioner visits, specialist consultations, treatments, hospitalizations - Transportation costs for medical care
I	**Societal health gains beyond vaccinated individuals (I)[a]**
	• Health gains that are not related to vaccinated individuals but to the wider society, including: - Reduction in transmission of disease - Herd immunity - Outbreak control/preparedness
II	**Indirect health and economic gains related to caregivers and family/households**
	• Reduction in lost days of work due to caring for a sick person • Reduction in family spillover effects related to costs (productivity losses) and health outcomes (ie, prevention of health effects and loss in quality of life in family members, care time costs) • Productivity gains occurring over a longer time horizon/from a lifetime perspective due to changes in household behavior (eg, female labor participation, household investment, child dependency ratio, decrease in number of children born per mother, intergenerational effects [eg, due to protection against cervical cancer granted by vaccination against human papillomavirus, more mothers will survive to care for their children])
II	**Health-related productivity gains for vaccinated individuals**
	• Reduction in lost days of work due to being ill or death of sick patient (absenteeism) • Reduction in presenteeism • Avoidance of infectious diseases and their comorbidities that keep children out of school for substantial periods of time, preventing cognitive development (impact on lifetime productivity) • Avoidance of missed school days due to illness that may result in lower school attainment (impact on lifetime productivity)
II	**Societal health gains beyond vaccinated individuals (II)***
	• Health gains that are not related to vaccinated individuals but to the wider society, including disease eradication
III	**Vaccine-attributable financial risk protection**
	• Protection against the financial risk of illness such as out-of-pocket medical care costs • Insurance value: consumers cannot buy insurance policies that protect them against getting sick; they can buy only those policies that protect them against spending money on medical care (financial risk protection) • Improved financial security of households because of reduced risk of catastrophic expenditure
III	**Societal health gains beyond vaccinated individuals (III)***
	• Health gains that are not related to vaccinated individuals but to the wider society, including: - Reductions in nosocomial infections (secondary) - Reduction in antibiotic use - Decreasing antimicrobial resistance - Health utility gains from the altruistic aspect of herd immunity
III	**Health systems strengthening, resilience, and security**
	• Health system efficiency gains: fewer infectious disease cases mean medical supplies and professionals' time can be reallocated more efficiently (eg, to other patients or to research and development efforts), easing the strain on hospital budgets and benefiting other patient groups with unmet needs • Implementation of immunization programs provides an incentive for governments to improve their health system in order to efficiently deliver interventions • Reduction in health system disruption caused by unpredictable outbreaks or epidemics
III	**Peace of mind for the individual and family**
	• Utility in anticipation: the health utility yielded by preventive measures such as vaccination follows immediately after vaccination until the time when the outcome was expected and the utility depends on the anxiety associated with (i) the perceived risk of infection and (ii) the perceived effectiveness of the vaccination in reducing that risk • Risk reduction gains: within households, vaccination may yield benefits in terms of risk reduction and improved peace of mind, as families face decreased anxiety over the prospect of catastrophic health and financial consequences from vaccine-preventable diseases • Intrinsic value of good health: healthier people enjoy greater utility (specific to this concept: non-leisure, non-monetary) and happiness • Fear of contagion: vaccine and vaccination programs could significantly reduce the anxiety associated with the risk of contracting the disease or hospitalization and death among all individuals, not just those who are exposed or sick (this also includes the value of hope from a societal perspective and captures the "peace of mind" aspect of herd immunity)
III	**Fulfillment of societal preferences**
	• A society may prefer preventing particularly severe manifestations/infections; thus, people are willing to pay disproportionate amounts to prevent severe disease (societal preferences)
III	**Reduction in carbon footprint due to prevention of infection and disease**
	• Reduced total carbon production (eg, also considering carbon emissions due to hospital stays, treatments related to infection and disease) in a vaccination scenario vs no vaccination scenario as an important aspect of societal durability and sustainability of the environment
III	**Prevention of loss of leisure time**
	• Gain in leisure time
III	**Political stability**
	• High disease prevalence can erode trust in governing institutions. The potential cost to political stability may be small compared with other costs of a case of pediatric infectious disease; however, they are nevertheless part of a complete accounting of all vaccination benefits
III	**Institutional disruptions**
	• Organizations facing an outbreak may be forced to contend with substantial and costly disruptions. This type of disruption costs the institutions, resources (and potentially negative press attention), costs students time in the classroom, and may cost parents time, money, and energy to care for children who are not at school
III	**Enablement value**
	• Impact on the cost-effectiveness of other non-vaccine interventions: it has been argued that vaccines should not be evaluated in isolation because they enhance the effectiveness of other non-vaccine interventions (eg, a vaccine for patients with human immunodeficiency virus may enable cancer treatment with chemotherapy, which is otherwise a non-recommended option in people with an already weak immune system)
III	**Scientific spillovers**
	• The impact of a new technology on future generations of patients (eg, a drug with a new mechanism of action might not itself be valuable, but the knowledge that the mechanism works may lead to other more valuable drugs in the future) • The first drug unlocks the value of the later innovations
III	**Real option value**
	• Patients face uncertainty about when and how future advances in medicine will occur. Thus, extending life provides patients with an option to enjoy these uncertain future benefits • This "real option value" is generated when a health technology that extends life creates opportunities for the patient to benefit from other future advances in medicine
III	**Macroeconomic gains**
	• Changes in the national economy or individual sectors of the economy • Impact on gross domestic product or production by economic sector beyond productivity gains attributable to individuals or households (eg, profit gains of companies or gains in tax revenues) • Reduction in tourism loss • Poor health is associated with lower foreign direct investment inflows • Improved financial sustainability as a result of effects such as synergies with other healthcare programs (eg, delivery platforms), stimulation of private demand, and mechanisms to enhance group purchasing power
III	**Social equity and ethics**
	• More equal distribution of health outcomes • Avoidance of household medical impoverishment due to treatment costs, which can widen health and financial equity gaps within and between communities • Vaccine benefits often accrue disproportionately to poorer communities, and some racial and ethnic minorities; therefore, vaccines have additional value as a method of promoting health equity across sub-populations • The empowerment of women • Ethical values

[a]Societal health gains beyond vaccinated individuals belongs to Dimensions I, II, and III.

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