Title: Economic Rationale for an Early Peanut and Egg Introduction Intervention

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Background: The groundbreaking Learning Early About Peanut Allergy (LEAP) trial changed the landscape for the prevention of peanut allergy worldwide. After decades of unclear and changing guidance for pediatric clinicians around the prevention of food allergy, clinical guidelines were published by the National Institute of Allergy and Infectious Disease and endorsed by 25 organizations including the American Academy of Pediatrics. Later the three major North American allergy organizations expanded upon the NIAID guidelines to include the early introduction of egg; however, barriers have been shown to exist. Recent data finds that most caregivers are not introducing peanut or egg before age 1 and socioeconomic disparities exist. An intervention to support pediatric clinicians and caregivers achieve the benefit of early introduction of peanut and egg is warranted.

Purpose: To estimate economic benefit and number of years needed to achieve cost neutrality from a direct cost Medicaid payer perspective of Early Peanut and Egg Introduction (EPEI) intervention.

Methods: Direct medical costs, including the costs to the health care system for the diagnosis, treatment, and prevention of childhood food allergy, were determined. The likelihood of resource use was based on data stemming from a nationally representative survey of children with food allergy. Caregivers of food allergic children were asked about the number of times their child had outpatient visits, emergency department (ED) visits, and inpatient hospitalizations related to a food allergy in the past year. Costs attributed to each event were estimated from several sources. Costs for outpatient visits were taken from Medicare cost data. The mean cost associated with an ED visit was based on published calculations using the Healthcare Cost and Utilization Project Nationwide Emergency Department Sample for visits due to food allergy and food-induced anaphylaxis. The mean cost for an inpatient admission was also taken from national estimates based on the Healthcare Cost and Utilization Project Nationwide Inpatient Sample.

The direct medical costs per child were estimated by multiplying the mean number of each type of encounter by the mean cost per encounter and then converted in 2024 real dollars using the Bureau of Labor Statistics consumer price index. To account for a Medicaid payer perspective, the Kaiser Family Foundations' Medicaid fee index state average of 0.72 was applied to the annual direct medical costs per child. The potential economic benefits of early food introduction are based on clinical studies that demonstrate approximately 80% of peanut and egg allergies are eliminated through early introduction. The number of years needed to achieve cost neutrality in state Medicaid

program was determined using a nationally verified peer reviewed midpoint estimate of peanut and egg allergy across childhood of 3.1% and a 95 percent confidence interval of 2.7% and 3.6%, respectively.

Results: Average annual direct medical cost for children with food allergies is $1037.21 in 2024 dollars. This corresponds to an annual direct Medicaid expenditure per child of $746.79. Up to 80% of peanut and egg allergies are preventable through EPEI intervention at a cost of $80 per child. The expected value of the direct Medicaid expenditure is a combination of effectiveness of EPEI (0.80) and the annual direct Medicaid expenditure per child ($746.79) for an annual recurring savings of 597.43.

Peanut and egg allergies across childhood have an incident rate of 3.1% and a 95% confidence interval estimate with a lower bound prevalence of 2.7% and higher bound prevalence of 3.6%. Assuming a 3.1% allergy incidence then 1 in 32 EPEIs will produce an economic saving per year by preventing a case of peanut or egg allergy. The total cost of distributing 32 interventions is $2560 with a recurring annual economic savings of $597.43. The number of years needed to reach cost neutrality is $(2560/597.43) or 4.3 years. Using the 95% confidence interval of 2.7% and 3.6% prevalence estimate requires as many as 37 interventions to be distributed at a cost of $2960 and as few as 27 interventions at cost of $2160, respectively. The 95% confidence interval for the number of years to reach cost neutrality is $(2960/597.43) or 4.9 years and $(2160/597.43) or 3.6 years. The midpoint estimates for the number of years to achieve cost neutrality is 4.3 years with and associated 95% confidence interval estimate of 3.6 years and up to 4.9 years.

Conclusions: On average cost neutrality of EPEI can be achieved in as little as 3.6 years. Cost neutrality in the best case scenario is achieved in 3.6 years and in the worst case scenario 4.9 years, both under the 5 year time horizon ceiling requirement for cost neutrality. The economic rationale supports investment in EPEI in order to prevent an often life-long condition presenting in childhood.

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