Late Breaking/Rapid Science

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# (LB02-27-26) CART-KIDS: Convenience, Not Just Cost, Drives Ultra Processed Food Exposure in U.S. Household Food Purchases- Montecarlo Knapsack Study of Simulated Grocery Carts

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**Objectives:** The sourcing of simulated grocery carts with live data, including nutrient composition, has only recently become computationally feasible using Large-Language Models, which can solve the constrained cart-generation problem using the knapsack optimization.

We quantified the extent of UPF exposure in realistic, simulated U.S. family grocery carts providing individual recommended amounts of energy and protein; determined relative sensitivity to household food costs versus convenience (ready-to-eat (RTE) level/meal preparation time); and estimated relative exposure to UPF in adult and children's diets in the U.S.

**Methods:** This Monte-Carlo randomized computational study used constrained-cart-generation with

current pricing from U.S. grocery retailers. More than 1,000 randomly generated grocery carts that met individual energy & protein recommendations (for a family of four) were created across four grocery budgets ($250–$1,000+/week) and four cost–convenience RTE) quadrants, covering 50 U.S. states, multiple seasons, & four dietary patterns (standard, vegetarian, kosher, diabetic). UPF scores were calculated using the FPro algorithm (0=low, 1=high UPF intake) and cross-validated against the GroceryDB ($R^2 = 0.997$). Grok4 was used to solve the knapsack optimization.

**Results:** At the $250/week USDA-minimum budget, FPro scores were 0.682 ± 0.023 (80% RTE) versus 0.323 ± 0.017 (20% RTE), representing a >2-fold difference. A $250 low- RTE grocery cart yielded ~2.5 times lower UPF exposure (0.619 ± 0.023 vs 0.323 ± 0.017) than a $1,000+ high RTE cart. Within these simulations, children experienced disproportionately higher UPF exposure than adults, likely due to child-targeted products, even among lower UPF households. These results held across state, seasonal, and dietary variations.

**Conclusions:** Convenience was a stronger driver of UPF exposure than budget. While budget impacts UPF exposure (10% Fpro score difference at identical RTE levels), convenience & home cooking are stronger modulators of UPF purchasing and potential additive exposure among simulated U.S. households, based on available retail foods in 2025. Children experienced disproportionately higher UPF exposure than adults, likely due to food products targeted to children, even among lower UPF-consuming households.

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