

The Role of Public Health School Nutrition in Ending the HIV Epidemic, (EtHE): A Commentary

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Introduction

Health promotion, beginning early in the lifecycle, has lifespan implications. Youth is a critical period in the lifecycle. It marks the consolidation of lifestyle habits that predate "...nutrition-related diseases... (NRDs), [1] such as "...obesity, diabetes, cardiovascular disease..., cancer, osteoporosis, and dental disease." [2] In the U.S., the pervasiveness of NRDs prompted "the American Cancer Society, the American Diabetes Association, and the American Heart Association... [to advocate a joint position]. ...Quality health education programs delivered in the nation's schools can improve... well-being and health.... [The justification was] promoting and establishing healthy behaviors... [at an early age] are more effective, and often easier than... in adult populations" [3].

The nation's educational institutions have a captive audience for "...school-based nutrition education." [4] Among U.S. youth 7 – 17 years old, 96.8% attended school in 2017, for almost six months of the year, on average, six hours per day [5]. And "...coordinated school health programs, [CSHP]," [6] grounded in ecological and social-cognitive approaches to healthy eating, have changed both school and home environments [7]. Nutrition science marks territory for reducing non-communicable chronic diseases, but will it work with infectious diseases like HIV?

HIV epidemiology includes school-aged youth. Among new HIV diagnoses in the U.S., in 2017, one in five (21%) were persons 13 to 24 years old[8]. The Jacksonville metropolitan statistical area had 348 new HIV diagnoses in 2017 [9]. If the national proportion is generalizable, there should be 73 infected youth in local HIV cases. All is not lost, for science is delivering solutions to stymie the epidemic. "...PrEP, pre-exposure prophylaxis, [is a prevention tool for ending HIV] ... as a... public health phenomenon. ... Emtricitabine and tenofovir disoproxil fumarate... [is] a single pill daily [regimen and] are [approximately] 95% effective for preventing HIV acquisition" [10]. Everyone wants PrEP to be successful, except for the virus. They employ immune evasion mechanisms such as class I Major Histocompatibility Complex molecules to evade detection [11]. This commentary describes a role for Nutrition as an adjunct for PrEP. If the maxim, *two heads are better than one*, has currency, then nutrition and pharmacology, together, may do more for HIV prevention than apart.

Discussion

The efficacy of PrEP for HIV prevention may rest on a robust immune system (RIS). RIS may mean "...the presence of high levels of anti-HIV-1-specific CTLm, (memory cytotoxic T lymphocytes) ...[in vivo for] control of virus replication [at] initial... HIV-1 infection..." [12] If the assumption of RIS has merit, what are the chances that persons in food-insecure households will have robust immunity to support the metabolism of PrEP? Food shortages among the disadvantaged contribute to "health and nutrition problems during childhood..." [13] Might that be the case in the U.S., or Duval County, Jacksonville, Florida? In 2018, Jacksonville poverty rate was 16%; [14] however, Census Tract 3, on the Eastside of Duval County, had 40.5% of families below 100% of poverty and 41.6% of families under 100% of poverty with children less than 18 years [15]. "HIV prevalence rates in urban poverty areas [are] inversely related to annual household income—the lower the income, the greater the HIV prevalence rate" [16]. What does this mean for low-income families? Pena and Bacallao (2002), [17] shared this response.

Poor people are not only more exposed to health-impairing factors but are less

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resistant... to comparable levels of those factors [than non-poor peers]. ...Poverty's... broad-spectrum... manifestations... [includes] increased propensity to... diseases, both infectious and non-communicable...

The ties between poverty, food insecurity, place, and HIV for school attending youth with social determinants of health (SDH), risk factors make them eligible for Protein-Energy Malnutrition (PEM)—an umbrella term for “...undernutrition and deficiency of multiple nutrients and energy” [18].

PEM adversely affects immunological factors. These include suppressor cytotoxic CD8 cells, [19] ...cytokines..., and interferon-gamma. A decrease in these factors reduces the ability of T lymphocytes to follow the instructions of cytokines—chemical signaling molecules [20]. Here is Kedzierska and Crowe's (2001) [21] discussion of immunology.

Interferons, (IFN- α , - β and - γ), have... antiviral, antiproliferative, and immunomodulatory effects and... [can inhibit] viral replication in a non-specific manner. [And] ... cytokines exert both stimulatory and inhibitory effects on HIV-1 infection and replication....

PEM can impair the immune system response [22] through “...IFN- α/β [which] is crucial for protective immunity to viruses...”[23] An imperative exists to leverage multiple strategies to optimize EtHE efforts.

Local planners should ramp up efforts to support immune-competence in uninfected, school-aged youth. School nutrition services focusing on estimation of protein nutritional status[24] can yield indices for designing interventions that promote immunity. We know that PEM “...decreases resistance to infection and... [compromise] anatomical barriers... [like] mucus [membranes]...” [25] The connection exists because PEM co-occurs with low immunoglobulin A, (IgA), production, which works to deny toxins, viruses, and bacteria access to mucosal surfaces[26]. Strengthening the immune system to defend the host against antigens requires a joint focus on SDH and PrEP's metabolism. Medications are necessary for disease interdiction, and they are even more useful with nutritional support.

Conclusions

Public health research should have a more formative role in HIV prevention planning. Formative, as used here, implies serving as a guide to help planners “...identify potential... influence[r]s... [of] implementation efforts.” [27] “PrEP is a new HIV prevention approach, where HIV-negative individuals use anti-HIV medications to reduce their risk of becoming infected if... exposed to the virus.” [28] Nutrition is a legacy approach for boosting “... total antioxidant capacity... [for neutralizing] oxidative stress... [and decreasing] reactive oxygen species... [to limit] apoptosis... [and] ...decrease of CD4+ T cell[s]...” [29] Addressing nutritional deficiencies... [30] may serve as adjunctive therapy for PrEP's rollout and long-term efficacy in disadvantaged populations[31] More than a decade ago, Williams and colleagues[32] provided a health promotion rationale that remains apropos today.

Much of the policy focus [on] reducing health disparities has... [concentrated on] improving access, coverage, quality, and the intensity of healthcare. However, health is more a function of lifestyles linked to living and working conditions than of

healthcare. Accordingly, [practical] efforts to improve health and reduce gaps in health need to pay [more considerable] attention to addressing the social determinants of health within and outside of the healthcare system.

EtHE, is a policy proposal. It “...will require a heightened emphasis on... interventions... that will reach all people, irrespective of social class, or racial and ethnic background” [33].

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