Supporting Images

Provided by Cory Tichauer, ND

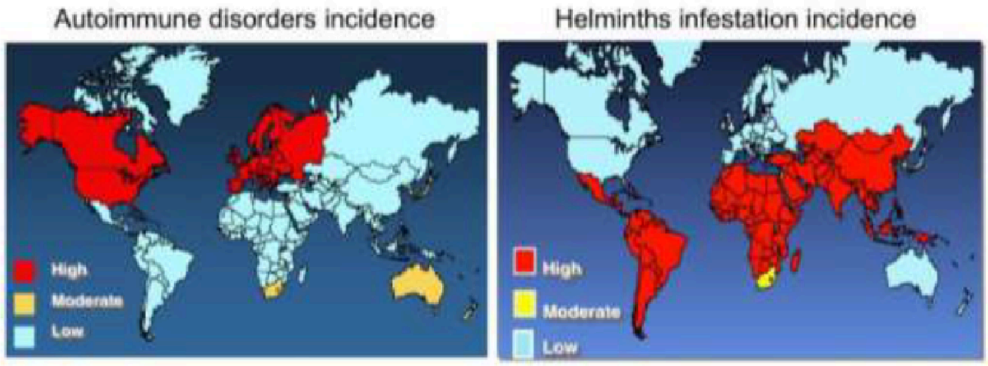

Fig. 2: Distribution of autoimmune disorders and helminths.
Map on the left side shows the incidence of autoimmune disorders. Map on the right side shows the incidences for infestation of humans with helminths. Color codes ranging from light blue (low incidence) to red (high incidence). Picture adapted from (Resource, 2012).

Source:
https://www.researchgate.net/figure/Distribution-of-autoimmune-disorders-and-helminths-Map-on-the-left-side-shows-the_fig2_340966638

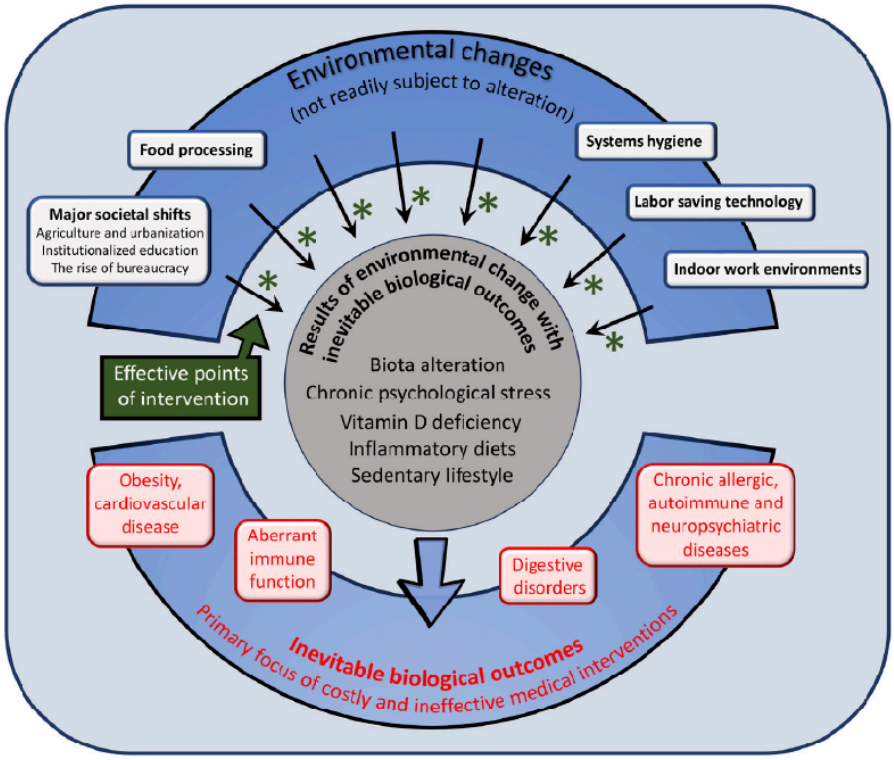

Figure 1. Breaking the chains of environmental mismatch. Environmental mismatch describes a condition in which an environmental change leads to unhealthy biological consequences. The ability of humans to intervene in the biological consequences of environmental change offers us the opportunity to break the chains of environmental mismatch. Such approaches are rooted in sound biological science and are highly effective, generally reflecting a proactive approach to human health. Unfortunately, medical practice and current biomedical research often overlook opportunities to break the chains of mismatch, focusing instead on reactive, reductionistic, costly and ineffective approaches to human health.

Source: https://pubmed.ncbi.nlm.nih.gov/38947109/

Table 1. Alteration of Various Components of the Human Biota by Urban, Industrial Environments, and the Health Consequences of those Alterations

Component of the biota	Effect of industrialization	Results for human health
Pathogens: infectious disease-causing organisms	**Increased exposure** as a result of high population density	Pro-inflammatory: acts as triggers for chronic inflammatory disease.
Beneficial microbiota	**Altered community composition** as a result of processed foods, loss of contact with the soil, chronic inflammation, and other factors	Associated with inflammatory disease, although direct causal relationships between particular species and disease states are not evident in most cases.
Helminths and most protists	**Almost complete loss of exposure** as a result of systems hygiene	Pro-inflammatory: Profound loss of immune regulation in many individuals, leading to propensity for allergy, autoimmune disease, and neuropsychiatric conditions.

These three divisions of the biota were first described by Rook and colleagues [13].

Source: https://pubmed.ncbi.nlm.nih.gov/38947109/

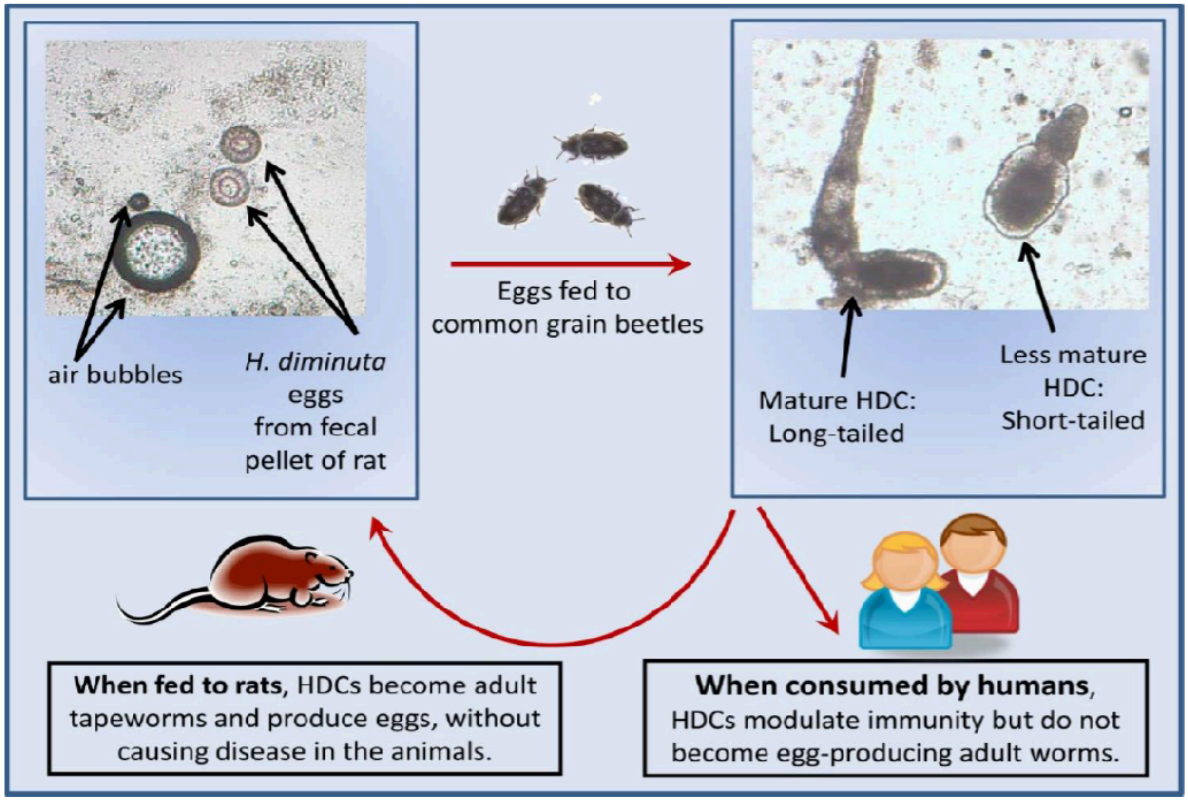

Figure 1. The life stages of *Hymenolepis diminuta* include an egg stage (top left, not to be confused with air bubbles under a cover slide) and a larval stage (top right, called a cysticercoid). The Hymenolepis diminuta cysticercoids (HDCs) can effectively colonize a rodent (bottom left) to produce egg-producing adults or can be used by humans to help maintain a normalized immune system. Even though exposure of humans to HDCs has a profound effect on immunity, the HDCs do not generally mature into egg-producing adults.

Source: unknown

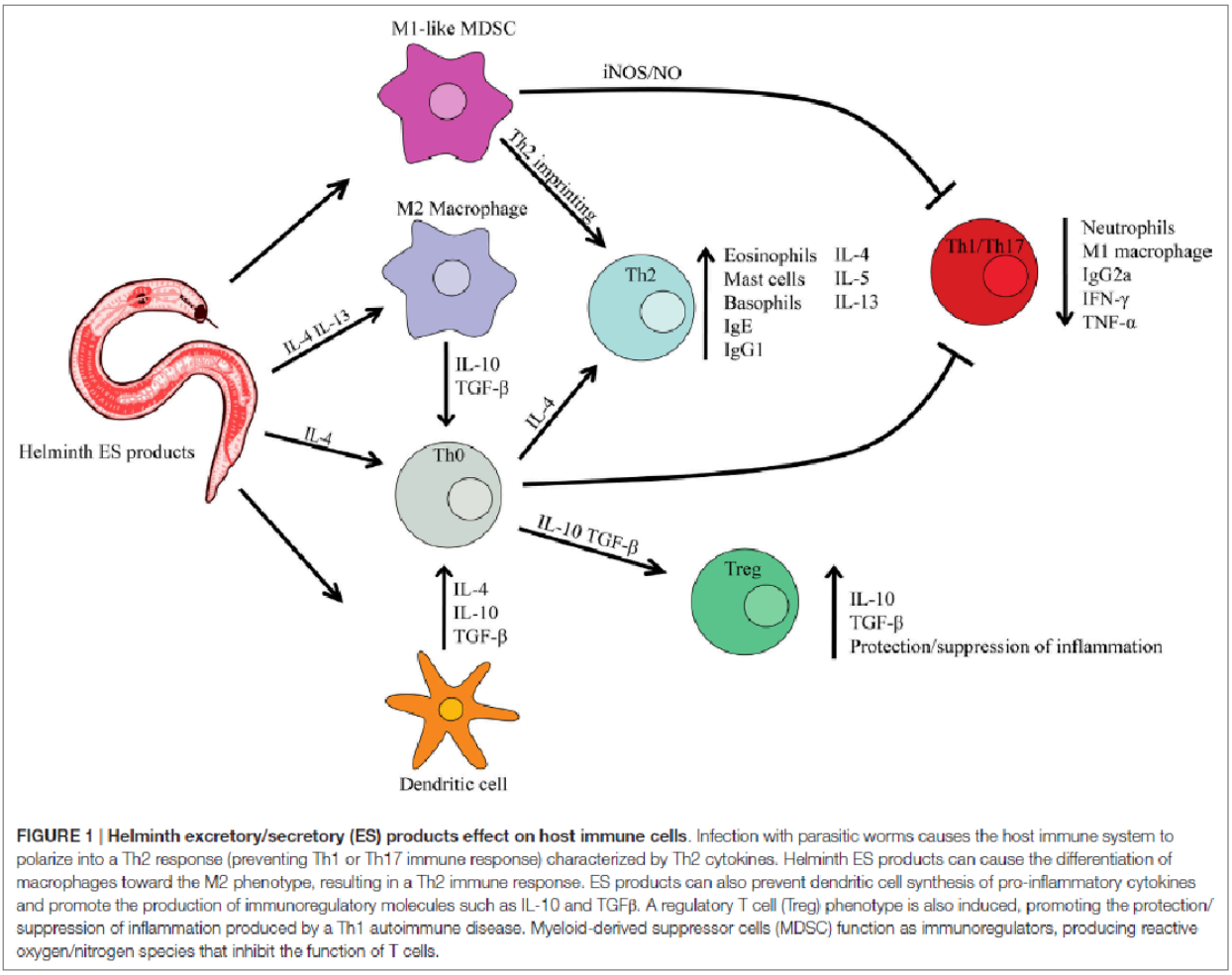

FIGURE 1 | Helminth excretory/secretory (ES) products effect on host immune cells. Infection with parasitic worms causes the host immune system to polarize into a Th2 response (preventing Th1 or Th17 immune response) characterized by Th2 cytokines. Helminth ES products can cause the differentiation of macrophages toward the M2 phenotype, resulting in a Th2 immune response. ES products can also prevent dendritic cell synthesis of pro-inflammatory cytokines and promote the production of immunoregulatory molecules such as IL-10 and TGFβ. A regulatory T cell (Treg) phenotype is also induced, promoting the protection/ suppression of inflammation produced by a Th1 autoimmune disease. Myeloid-derived suppressor cells (MDSC) function as immunoregulators, producing reactive oxygen/nitrogen species that inhibit the function of T cells.

Source:
https://www.researchgate.net/figure/Helminth-excretory-secretory-ES-products-effect-on-host-immune-cells-Infection-with_fig1_316458909

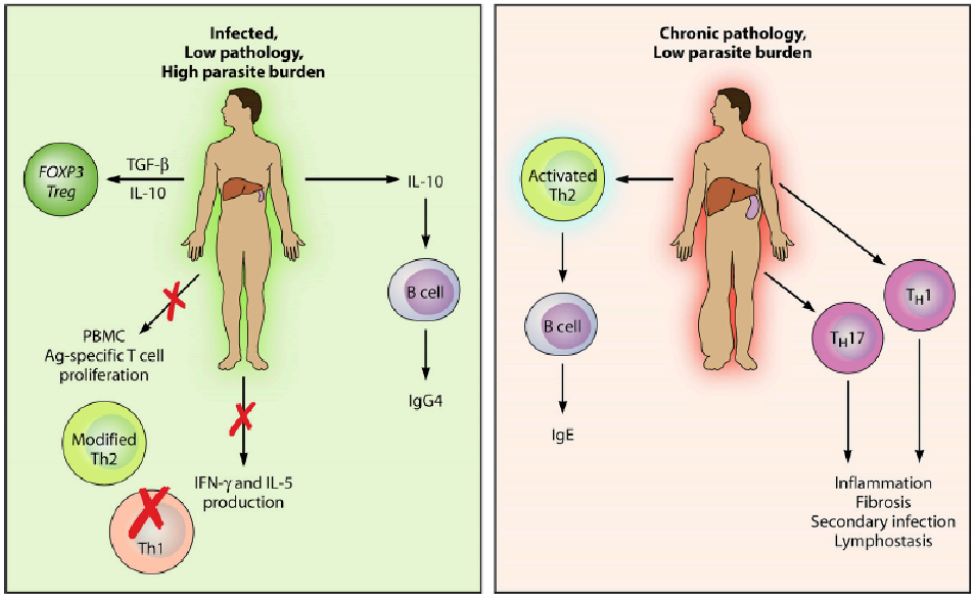

FIG 1 Spectrum of pathology in chronic tissue helminth infections. In areas where schistosome and filarial diseases are endemic, a spectrum of pathology is seen, with some individuals developing chronic debilitating pathologies and others showing a tolerant phenotype. The tolerant phenotype is characterized by the production of transforming growth factor β and IL-10 and the expansion of Forkhead box $P3^+$ Tregs. These cytokines lead to IgG4 production by B cells, suppressed parasite-specific T cell proliferation in PBMCs (peripheral blood mononuclear cells), reduced levels of Th2 cytokines, and ablated Th1 cytokines. Thus, the parasite survives productively in the host (schistosome eggs are deposited in the feces, or microfilariae circulate in the blood), with minimal collateral damage. In individuals with chronic pathology, the parasite may be killed or kept at low levels, at the cost of damaging immunopathology. High levels of Th1 and Th2 cytokines are seen, with the emergence of a Th17 response. B cells produce high levels of IgE against parasite antigens (Ag). Th1 and Th17 responses lead to inflammation and fibrosis around deposited schistosome eggs and lymph stasis, leading to secondary infections in lymphatic filariasis.

Source:
https://www.researchgate.net/figure/Spectrum-of-pathology-in-chronic-tissue-helminth-infections-In-areas-where-schistosome_fig1_232008455

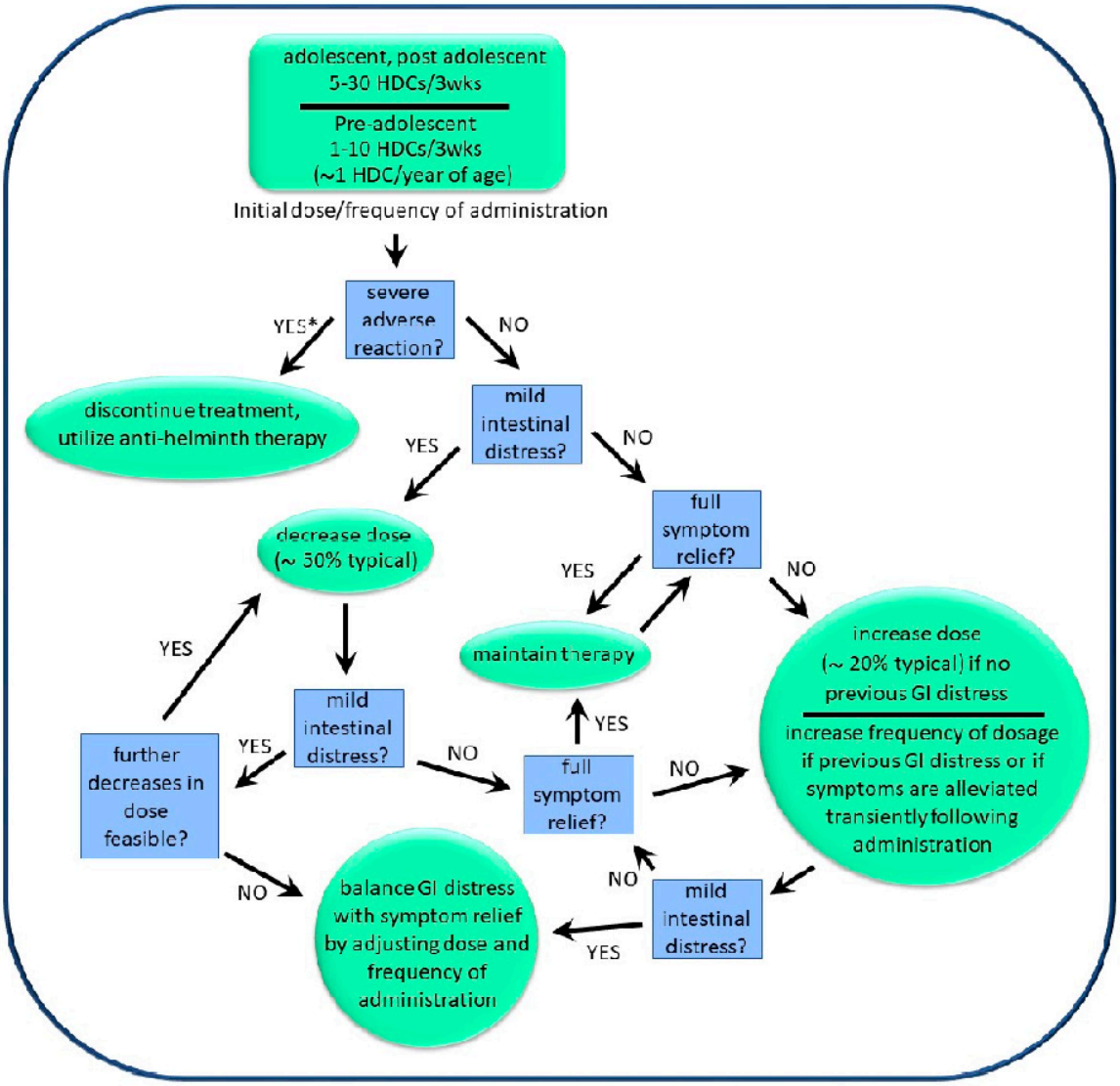

Figure 7. Decision tree for determination of optimal personal dosage and frequency of dosage of HDCs.
* Substantial adverse reactions are rare and have thus far been limited to the pediatric population.

Source: https://www.mdpi.com/2077-0383/6/10/98

Table 1. General effects of HDC exposure based on socio-medical studies.

Anticipated Effects of HDCs	Considerations/Caveats
Effective amelioration of autoimmune disease is often observed.	Based on observations made using helminths other than HDCs, it is expected that helminthic therapy works more frequently when the autoimmune disease is episodic, or waxes and wanes.
Allergic responses may be substantially retarded or even eliminated.	Reduction of allergic responses may be most effective in the absence of regular exposure to antigen.
Relief of neuropsychiatric conditions, including migraine headaches, anxiety disorders, chronic fatigue, and depression can be observed, even in cases where the condition has persisted for decades.	Therapy apparently does not eliminate dependency on pharmaceuticals that may have developed over time.
The effective dose and the maximum dose tolerated without adverse side effects are highly variable from individual to individual.	For a given individual, it is not yet possible to predict with certainty if therapy will be effective and what dose will be effective.
Both the minimum effective dose and the maximum dose tolerated without adverse side effects usually increases over time.	Periodic increases in exposure are generally needed and tolerated.
Individuals with mast cell dysfunction and with fibrotic disease (particularly fibromyalgia) may not respond well.	This is speculative and based primarily on the experience of self-treaters with helminths other than HDCs.
The most common adverse side effect is GI distress.	GI distress can generally be avoided by lowering the dose and increasing the frequency of administration if more therapeutic effect is desired.
In some pediatric patients, a common side effect is temporary hyperactivity, particularly when the organisms are first introduced or the dose is increased.	This side effect can be ignored, treated with ibuprofen, or avoided by lowered dose and increased frequency of administration.
In some pediatric patients, substantial adverse reactions may occur that include worsened behavior and severe GI distress. This reaction may be more than 20-fold less common than very positive reactions.	These reactions are apparently associated with colonization (adult HDs present in the GI tract), and require that the therapy be stopped and the HDs be removed by anti-helminth drugs. Fortunately, those drugs are effective.
Irritable bowel syndrome (IBS) and other digestive disorders, including IBD, can sometimes be relieved.	The degree of relief is apparently highly variable, depending on the individual.
Improved communication skills, learning ability and behaviors may be observed in some patients with autism.	This observation apparently applies to co-morbid inflammatory issues seen in some patients with autism. Effective treatment of impaired ability to understand social situations has not been observed.
Alleviation of a wide range of inflammation-associated conditions may be observed as a beneficial and unexpected side effect of attempting to treat an apparently unrelated condition. (e.g., hemorrhoids and cardiac arrhythmias have resolved in individuals attempting to treat allergies).	It is expected that alleviation of multiple inflammation-inducing factors (e.g., vitamin D deficiency, chronic psychological stress, inflammatory diets, cigarette smoking, etc.) will be synergistic with the beneficial effects of HDC exposure.

Source: Unknown