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Letter

Dermatologist prescriptions for biologics contribute to thousands of tons of plastic waste

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To the Editor

Biologics are primarily packaged in thermoplastic autoinjectors that are not recyclable but instead can be incinerated or autoclaved and shredded, if not improperly disposed of otherwise. These disposal methods pose a significant threat through the creation of carcinogenic air pollutants and by damaging the earth's ecosystems, respectively.[1] Additionally, plastic bubble wrap, cold packs, and coolers are also used in delivery to ensure a stable temperature enroute to the patient. The environmental burden of plastic waste from biologics use has not been well studied, and this research letter aims to estimate the prescribing of waste in the industry. In this cross-sectional study, we used the National Ambulatory Care Survey to extract data for medications prescribed by dermatologists in 2019.[2] We obtained supplementary data from Medical Sciences Liaisons for the respective drug's manufacturer. We examined 6 biologics prescribed by dermatologists for psoriasis or atopic dermatitis: etanercept, adalimumab, ustekinumab, secukinumab, dupilumab, and guselkumab.[3] We obtained practice autoinjectors for etanercept, tralokinumab, risankizumab, ixekizumab, and dupilumab, and used the mean of their masses to estimate the mass for autoinjectors we could not obtain. The dosing schedule provided by each manufacturer was used to determine how many autoinjectors would be needed for one year of use for patients starting each drug. We multiplied the weighted frequency of drug mentions by the estimated number of autoinjectors used then multiplied these values by the mass of the autoinjectors, respectively.

We found that the total estimated plastic waste produced by autoinjectors alone was 8.05 thousand tons. The greatest plastic waste was generated by adalimumab (61.3 thousand tons) (**Figure 1**) and based on the estimated amount of plastic waste that is autoclaved and incinerated in the US (69-97%), we can estimate that between 5.55 and 7.18 thousand tons of plastic from these biologics were disposed of using harmful methods (**Table 1**).[4]

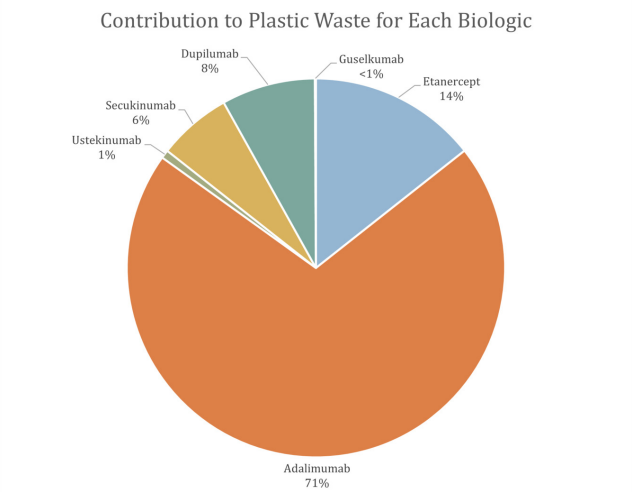

Figure 1. *Contribution to plastic waste for each biologic.*

In recent decades, incredible advancements have been made in the treatment of autoinflammatory skin diseases, and millions of patients have benefited. And while these drugs do great good, they also have the potential for unintended harm. The use of dermatologist-recommended biologics creates thousands of tons of plastic waste annually and contributes to detrimental effects on both public and environmental health. We focused exclusively on plastic used in 7 biologic drug autoinjectors and consequently, the true volume of plastic waste generated by their manufacturing, packaging, and delivery is of much greater magnitude. Dermatologists are well positioned to advocate for less harmful autoinjector disposal methods, packaging, and delivery in favor of environmentally conscious options. Even more so, manufacturers and waste disposal companies have a role to play in investing in methods that decrease plastic waste from biologics. It's estimated that only 4-5% of medical waste in the US is disposed of using a method

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Table 1. *Estimated Tons of Plastic Waste Generated by 6 Biologics Prescribed in 2019*

Biologic Drug	Autoinjector mass (g)	Number of Autoinjectors Needed to Maintain Use for One Year	Estimated Patients Treated (thousands)	Total Number of Autoinjectors Used (millions)	Estimated Total Plastic Waste (tons)
Etanercept	32	40	903	36.2	1,600
Adalimumab	35	25	6,490	162	5,680
Ustekinumab	35	4	409	1.64	57
Secukinumab	35	11	1,310	14.4	506
Dupilumab	42	17	903	15.4	645
Guselkumab	35	6	22.5	0.0135	7.00

other than autoclaving or incineration.[4] As plastic waste becomes an increasingly pressing issue in the US and globally, it is imperative that we take action in counteracting the consequences of biologic drug use by calling for innovation in manufacturing and waste management.

Potential conflicts of interest

Fleischer is a consultant for Bluefin and Incyte (fees). He is also an investigator for Amgen, Bayer, Cara, Galderma, Incyte and Trevi (research support).

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