

Supplementary Table S2

Explanation of the hypotheses supporting the directed acyclic graph (DAG) to represent the underlying process being analyzed; each node (variable) and edges (effects) are described. The data referred to are electronic health records (EHR) and daily accelerometer records.

Node, <i>description</i>	Edge	Description
Age, <i>age of the pet at the time of the activity record, using the timestamp of the activity record and the date of birth recorded in the EHR.</i>	Number of previous dermatitis visits	Age is expected to have a direct effect on the number of previous pruritic dermatitis-related visits as an older pet has a higher likelihood of having more visits than a younger pet, may have been affected by multiple pruritic dermatoses, and pruritic dermatoses may be diagnosed at different ages depending on type of condition.
Breed, <i>as recorded in the EHR.</i>	Age	Breed is expected to have a direct effect on age, as dogs of different breeds age at varying rates. For example, small dogs tend to live longer than large dogs, so an 8-year-old small dog is at an earlier stage of life than an 8-year-old large dog, and a 14-year-old dog is more likely to be a small dog as large dogs do not live as long.
	Number of previous dermatitis visits	Breed is expected to have a direct effect on number of previous dermatitis visits as certain breeds are more predisposed to dermatitis.
Allergies, <i>an unobserved variable – data was not available.</i>	Allergies	Breed is expected to have a direct effect on allergies as certain breeds are more predisposed to allergies
	Number of previous dermatitis visits	Allergies are expected to have a direct effect on number of previous dermatitis-related visits as they can cause dermatological issues for which may require veterinary attention.
Parasites, <i>an unobserved variable – data was not available.</i>	Behavior (baseline)	Allergies are expected to have a direct effect on behavior at baseline as allergies can cause pruritus which can lead to increased time spent licking and scratching.
	Allergies	Parasites are expected to have a direct effect on allergies as dogs may be allergic to certain parasites.

<p>Behavior (baseline), <i>the average daily time spent performing the pruritic behavior in the two weeks prior to intervention, where licking and scratching are measured as separate pruritic behaviors.</i></p>	<p>Behavior (baseline)</p>	<p>Parasites are expected to have a direct effect on behavior at baseline as parasites can cause pruritus which can lead to increased time spent licking and scratching.</p>
	<p>Intervention</p>	<p>Behavior at baseline is expected to have a direct effect on intervention type as the type of intervention may be based on the levels of scratching seen in the dog. For instance, a dog performing severe scratching may have a stronger intervention.</p>
	<p>Behavior (post)</p>	<p>Behavior at baseline is expected to have a direct effect on behavior post-intervention as the change in behavior is likely to be relative. For instance, a dog with severe scratching may have a larger reduction scratching compared to one with less-severe scratching, as there is more opportunity to reduce the levels of scratching.</p>
<p>Number of previous dermatitis visits, <i>count of visits in the EHRs specifically relating to dermatitis for a dog prior to the visit of interest for the analysis.</i></p>	<p>Intervention</p>	<p>The number of previous dermatitis-related visits is expected to have a direct effect on intervention type, as intervention may be tailored to the chronicity of the dermatitis condition and aligned with excluding possible causes. For instance, a dog early in its dermatitis journey may be more likely to be treated with antimicrobials and antiparasitics to rule out parasites or bacterial infection.</p>
<p>Intervention, <i>extracted from the visit record of interest in the EHR, and categorized into no intervention, anti-inflammatory, antibody, antihistamine, antimicrobial, antiparasitic, immunosuppressant, pain medication or shampoo.</i></p>	<p>Compliance</p>	<p>Intervention type is expected to have a direct effect on compliance due to the type of administration. Interventions administered by the vet may have better compliance than those administered by the pet owner at home.</p>
	<p>Efficacy</p>	<p>Intervention type is expected to have a direct effect on efficacy as different interventions will interact differently depending on severity and type of condition, and strength of intervention. For example, antiparasitic treatment would not work if the problem were not parasite related.</p>

Compliance,
whether the intervention was administered properly (tablets given daily, shampoo applied properly, etc.), an unobserved variable.

Efficacy,
how efficacious the intervention was at reducing pruritus, which depends on whether the treatment was appropriate for the type and severity of dermatitis, an unobserved variable.

Behavior (post),
taken as the average daily time spent performing the pruritic behavior in the 30 days following intervention, where licking and scratching are measured as separate pruritic behaviors.

Efficacy

Compliance is expected to have a direct effect on efficacy as an intervention applied improperly is less likely to be efficacious.

Behavior (post)

Efficacy is expected to have a direct effect on behavior post-intervention, as an efficacious intervention should reduce pruritus and therefore less time spent performing pruritic behaviors should be recorded.