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Understanding the Resistance to Damage (RD) score and its application

Public



Why physical net durability matters

Nets are not lasting as long as expected (3 y): median field retention time is 1.64 years

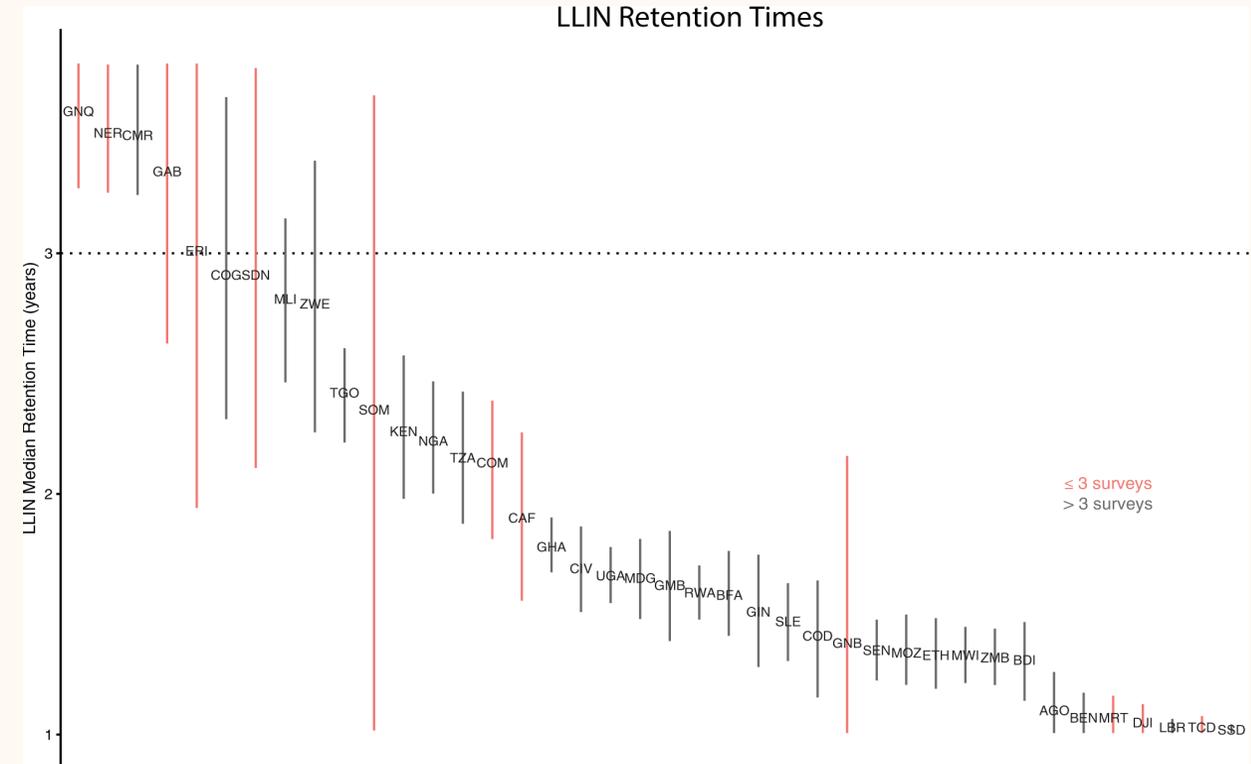
The condition of a net directly relates to operational life.

- Torn nets are discarded, creating coverage gaps.
- Damaged nets are used less consistently.

Physical durability is undervalued

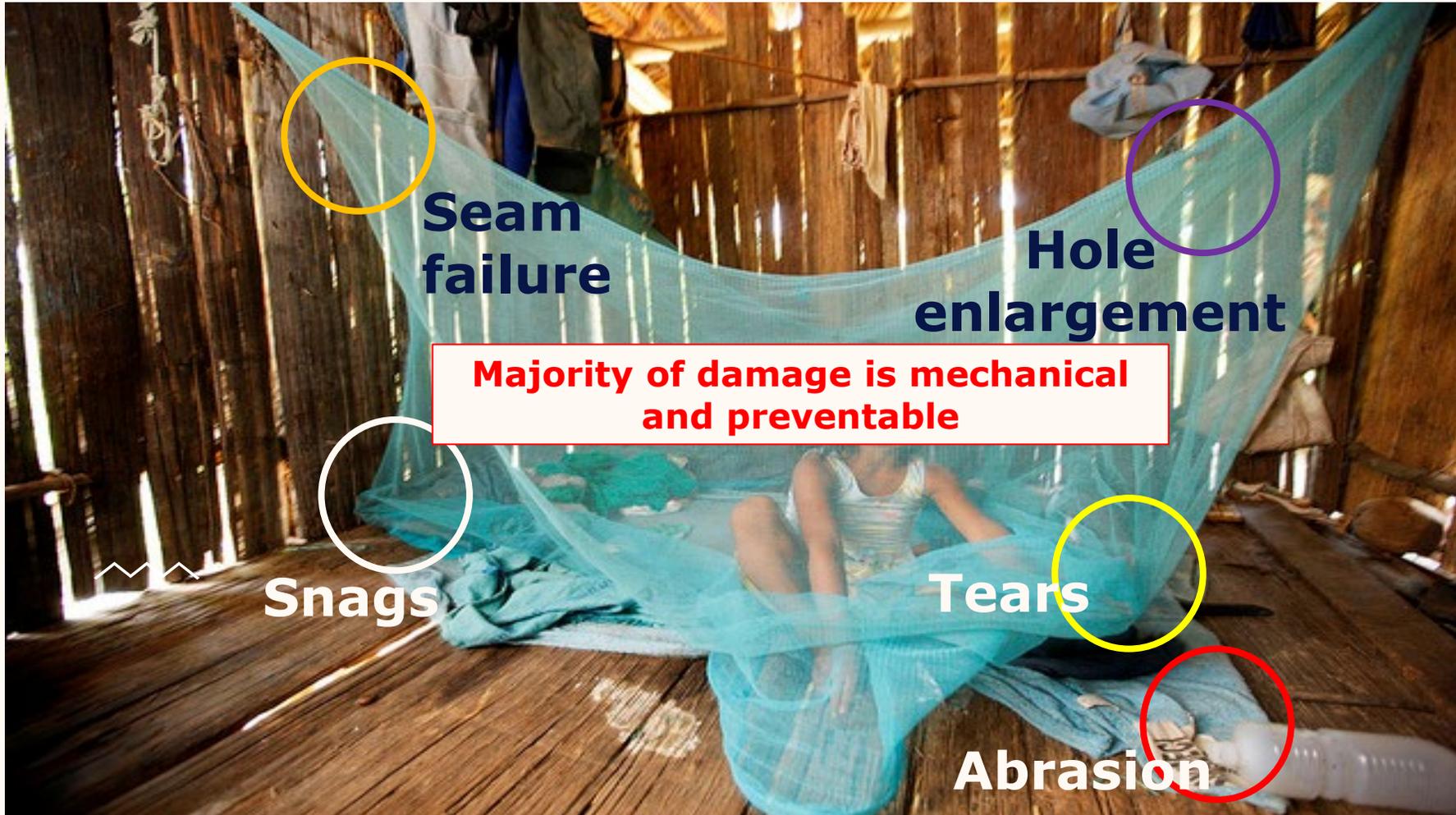
Despite routine data collection, physical performance rarely influences procurement decisions or drives innovation.

The **Resistance to Damage (RD) score** measures how physically durable a net is before it reaches the field: providing stakeholders a metric to inform procurement and deployment decisions.



Bertozzi-Villa et al., 2021

Net needs to withstand normal use



Does not need to withstand

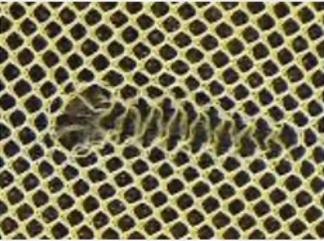


Three textile tests that reflect mechanical damage in the field

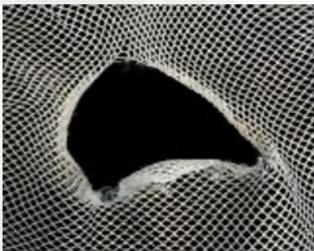
Snags



Hole Enlargement



Tears

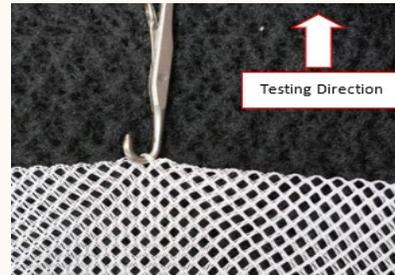


Responsible for ~63% of all ITN damage found in the field

Käse et al., 2014

Tests based on adapted ISO standards, used by textile industry

Snag strength



Bursting strength



Hole enlargement resistance



Since 2023, WHO PQ requires ITN manufacturers to submit these test results.

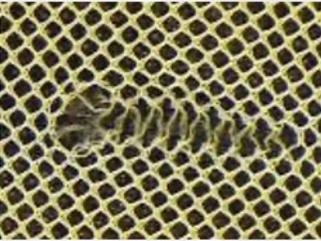
RD score metric summarizes output of lab tests.

Three textile tests that reflect mechanical damage in the field

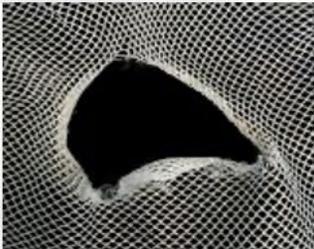
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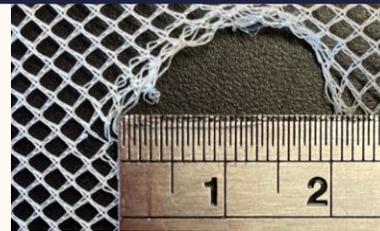
Tests based on adapted ISO standards, used by textile

The RD score presented here is a refined version of the original, with adjusted weightings and abrasion resistance testing removed due to its limited explanatory power.

Mechan et al., 2025

RD score metric summarizes output of lab tests.

Käse et al., 2014

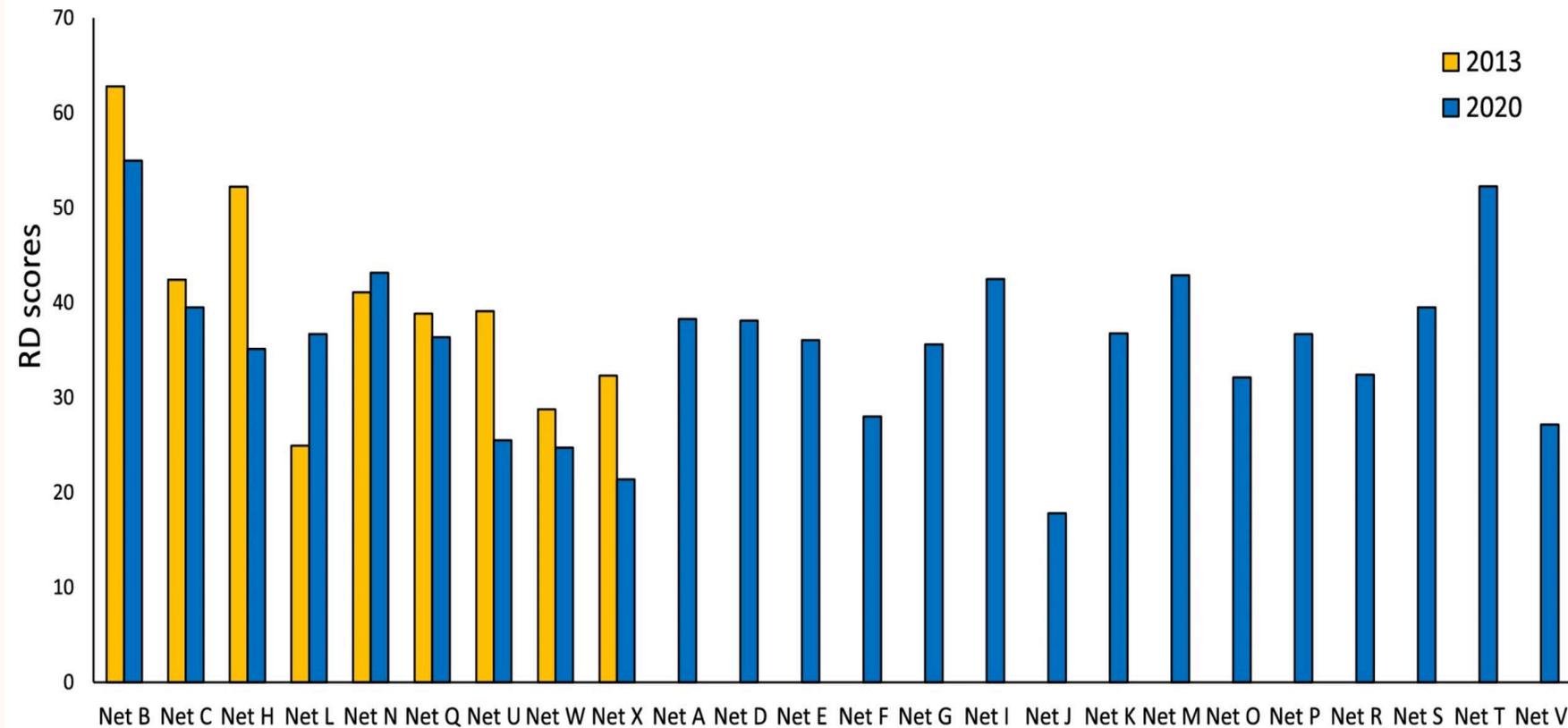


PQ requires ITN manufacturers to submit these test results.

Nets were tested for lab performance (2013 and 2020)



- Not all ITNs perform equally in lab testing.
- RD score outputs show no clear improvement in physical durability over time.

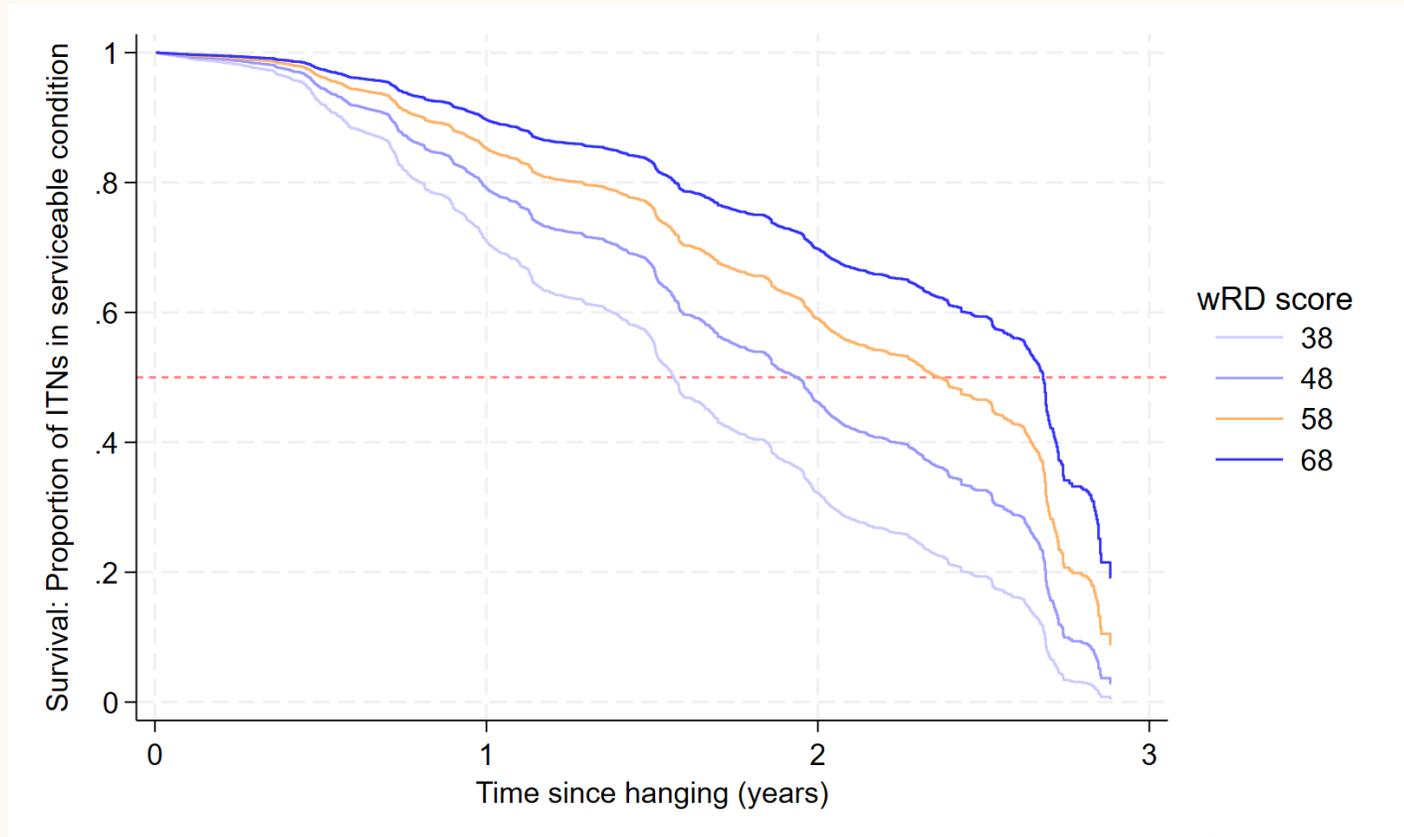


Original RD score calculations, *Wheldrake et al., 2024*

RD score (lab performance) of ITNs is linked to field net lifespan



Analysis conducted using data from 14 countries, 44 durability monitoring sites and 13 ITN products (17,466 observations of 9,237 hanging cohort ITNs).



Mechan et al., preprint, 2025

10-point increase in RD score is associated with a **3.5-month increase** in ITN lifespan.

Difference in lifespan across ITN product range (38-68) was **more than 13 months.**

But does this model reflect reality?



Hypothesis:

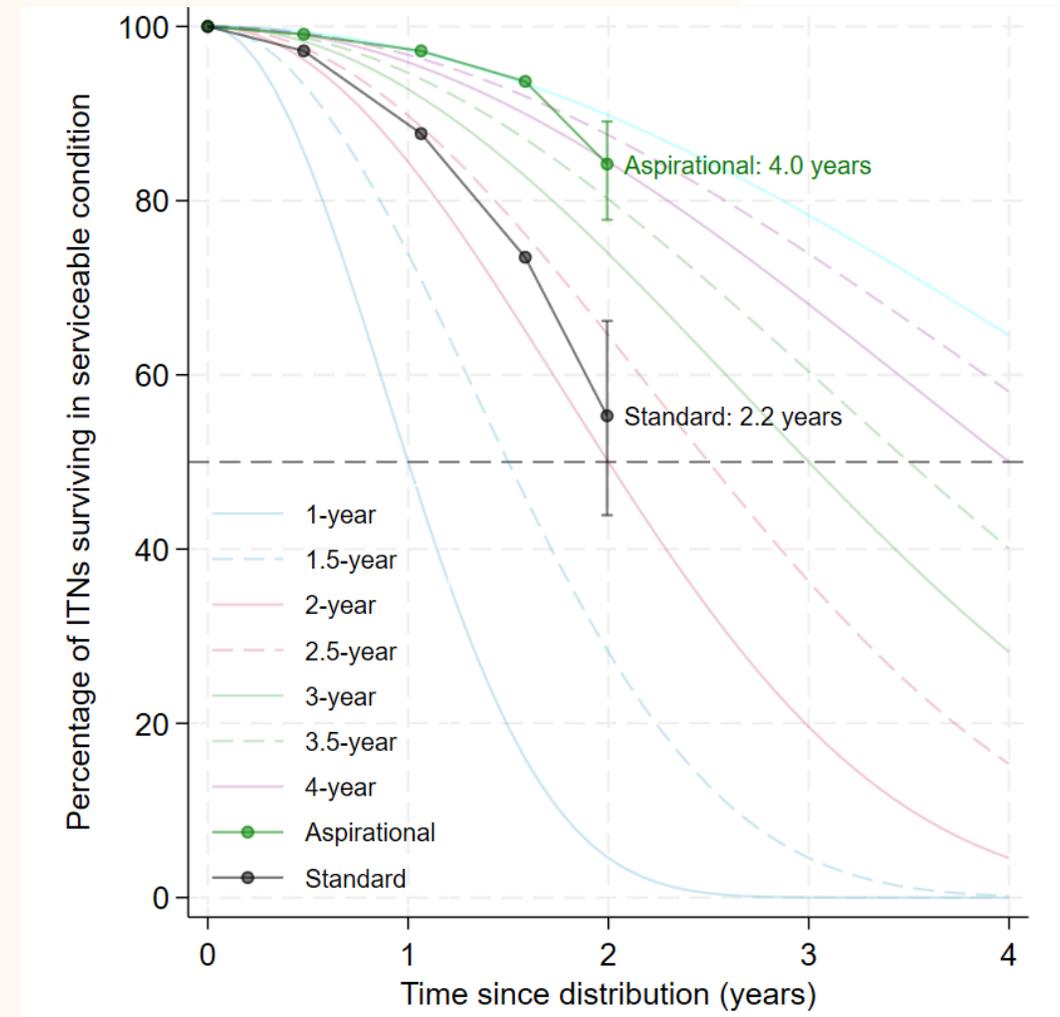
An ITN product with a high RD score (80-90) would result in median lifespan of at least 3.0-3.5 years.

Validation:

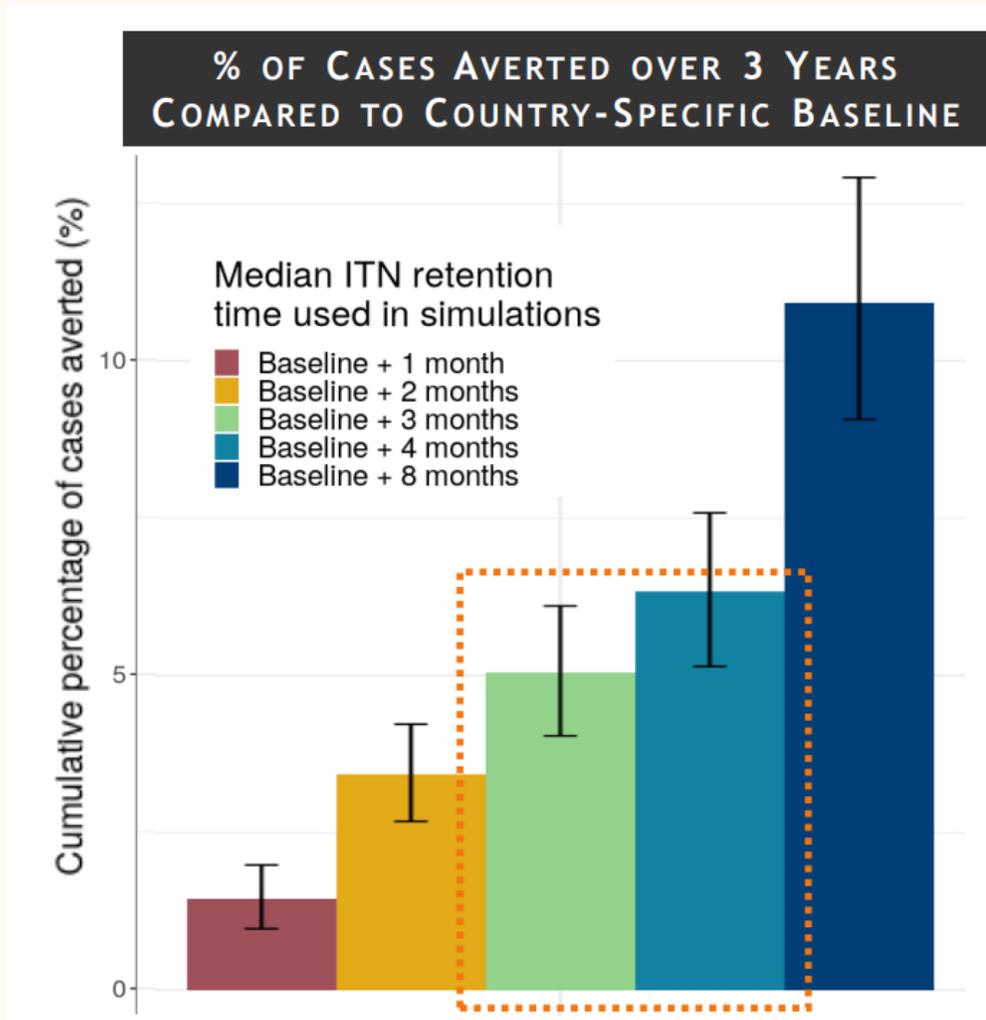
A randomised trial assessed survival of two ITNs with RD of 80 and 83, compared to ITNs with RD scores between 40-65.

Findings:

Trajectory of aspirational nets aligns with 4-year survival compared to standard net lifespan of just 2 years.



Improving net retention could yield massive health benefits



Reduce cases: A 3-to-4-month improvement in net retention (10 RD points) could reduce malaria cases by 5 to 6% in SSA over a 3-year period, compared to the baseline.

Floyd, Jessica et al., "Deriving greater value from malaria bed nets through extending net retention: A modelling study." Pre-print. August 2025.

An additional 10 RD points (4 months increase in net retention) could be worth \$1.35 in “durability premium” per net



BACK-OF-THE-ENVELOPE ESTIMATE, 3-YEAR PERIOD

Scenario	Total nets needed	Commodity & distribution cost*	Incremental cost vs. BAU	Durability premium per net
Business-as-usual (BAU)	506 Million	\$2.02 billion	-	
Greater Volume Scenario (~equivalent epi impact as 4 additional months retention, or ~10 RD points)	677 Million	\$2.7 billion	\$683 Million	Additional ITN commodity and distribution cost

*Assumes a fully loaded cost of commodity and distribution at \$4 per net

Environmentally, assuming a conservative 500g of plastic per net, this amounts to ~84k metric tons of plastic.

The application of the RD score

At the moment, higher RD score nets don't come at a higher price, yet they can deliver real value by keeping nets in use for longer.

- Adoption of the RD score has already started, with donors incorporating the RD score into their procurement processes.
- The upcoming publication of the WHO consultation meeting notes from August 2025, where the RD score was discussed, is expected to further drive uptake.

The RD score adds value by:

- **Donor procurement:** provides a clear, evidence-based metric for including physical durability into procurement decisions, resulting in longer-lasting nets for countries.
- **Country-level decision-making:** if countries move toward greater bilateral ITN purchasing, the RD score offers an additional, meaningful metric to ensure durability is part of procurement decisions.
- **Driving innovation:** IVCC is exploring net designs that offer greater physical durability, while keeping cost considerations in mind.

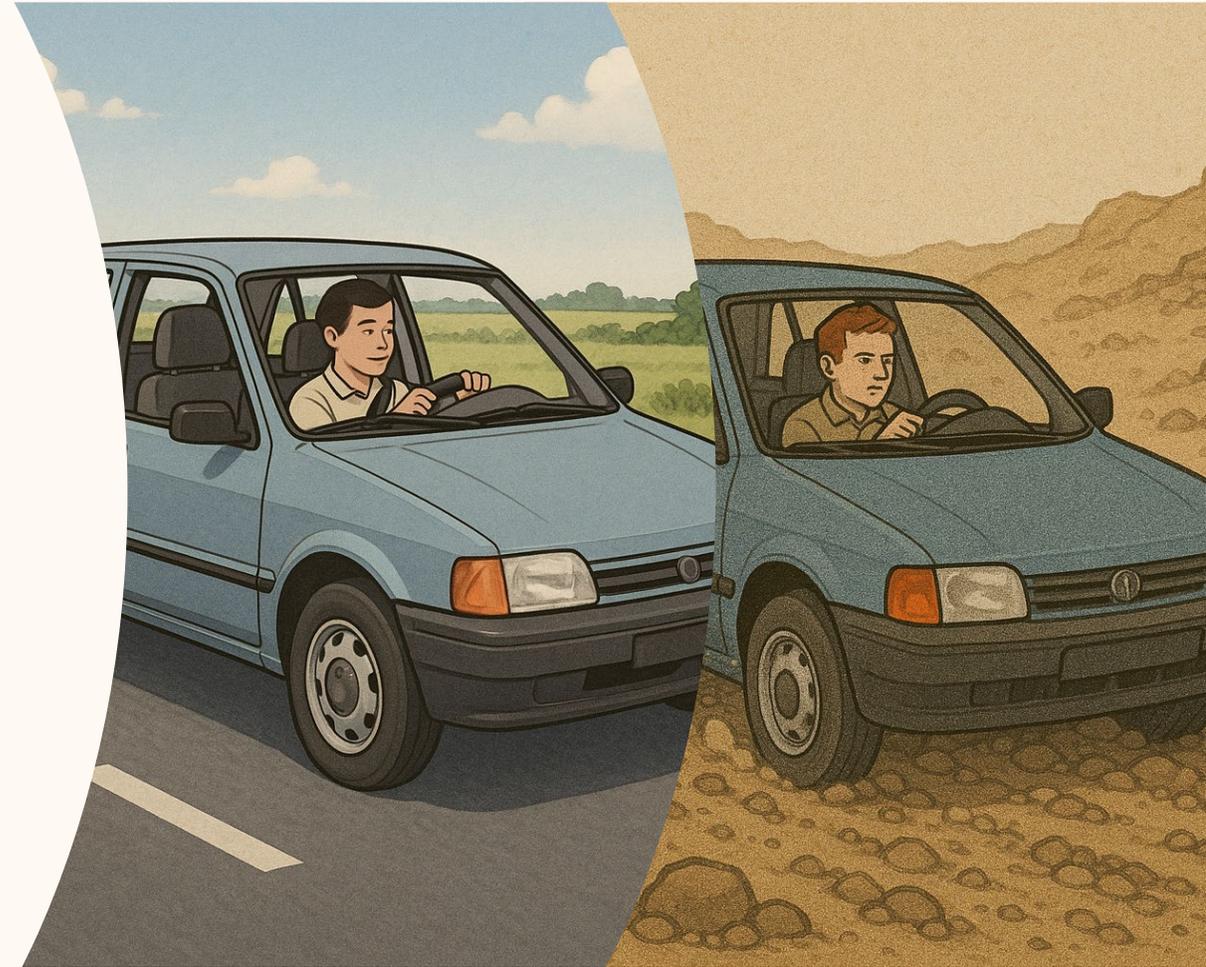
Physical durability cannot be understood in isolation

A net's lifespan is shaped by more than its physical properties. An ITN brand can perform very differently depending on:

- **Use setting**
- **Human interaction and attitudes**

Like a car → the same model, carefully driven and maintained, will far outlast one driven roughly on tough terrain without servicing.

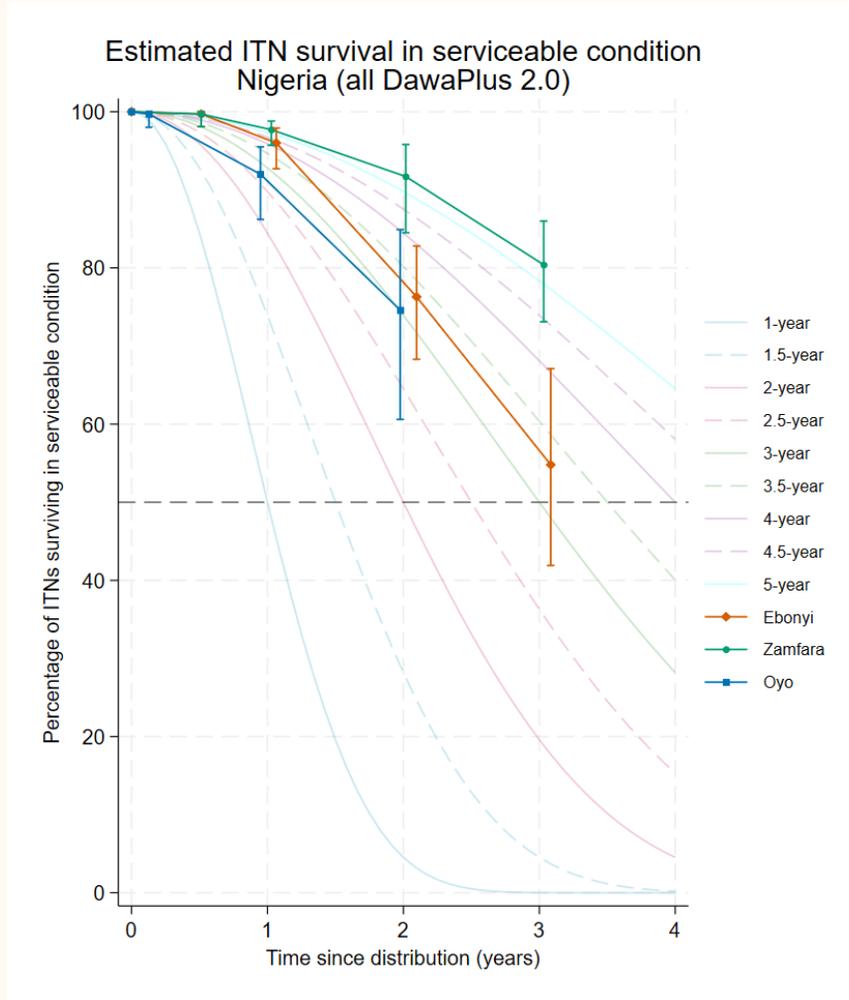
The Risk Index (RI) was developed to capture these external factors. It supplements the physical durability (RD score) by quantifying the social and environmental pressures a net faces in the household, providing a more complete picture of real-world performance.



High heterogeneity in net lifespan within and across countries that cannot be explained by physical durability alone.

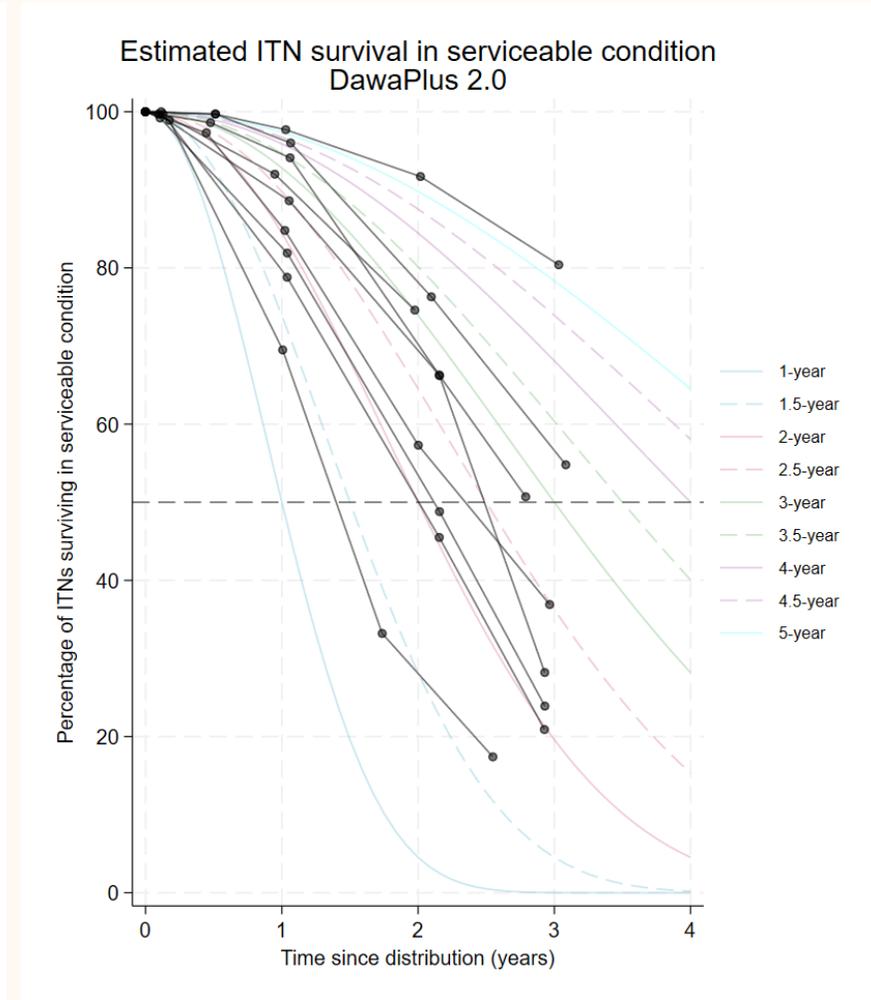
Similar variation seen for PBO and CFP ITNs.

DawaPlus 2.0 (Nigeria)



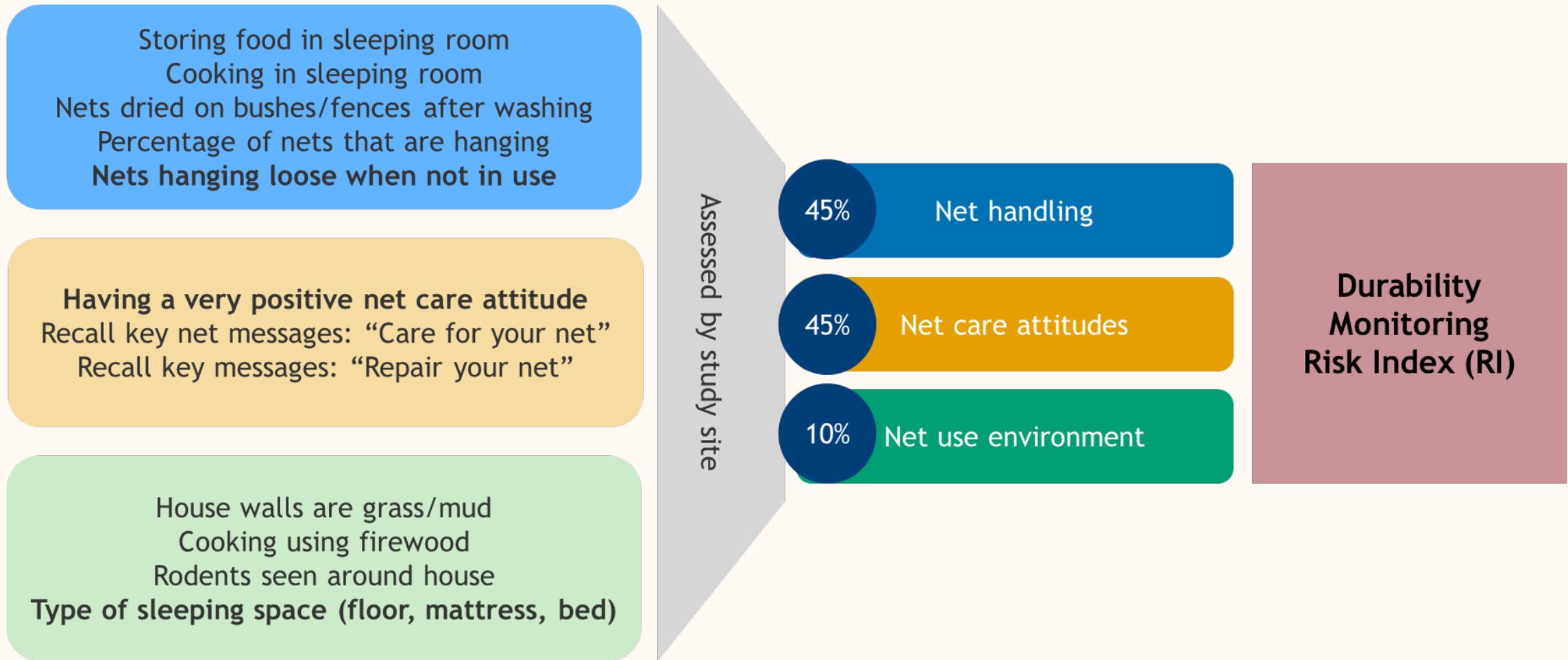
Range of median lifespans
3.2 - 5.3 years

DawaPlus 2.0 (all sites)



Range of median lifespans
1.6 years (DRC) - 5.3 years (Nigeria)

The Risk Index calculation



The Risk Index is associated with ITN survival in the field

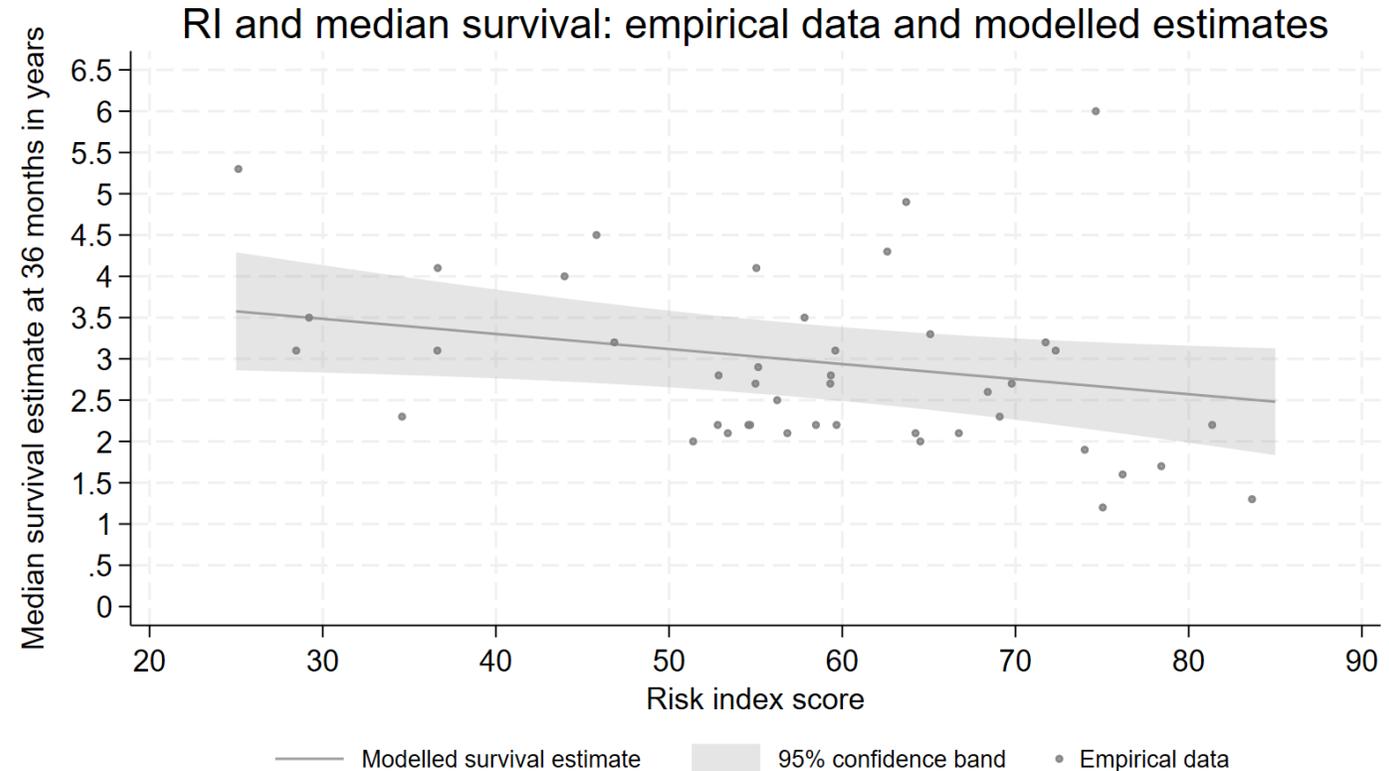


Higher RI scores were associated with shorter net lifespan.

Across study sites, RI scores ranged from 25 to 85, a 60-point spread.

Every **10-point reduction** in RI score corresponded to a **2-month gain** in net survival, translating to a total difference in net lifespan of up to 12 months across sites.

This could be an opportunity for more targeted social behaviour change activities



Multivariate model of the effect of RD score and Risk Index on ITN median survival, using data from 44 sites. RI results are shown for the median RD value.

There is no evidence of an interaction between RI and RD scores



This means switching to a higher RD score net has the same predicted survival gain in both low RI and high RI sites.

High-RI sites will struggle to reach 3 years lifespan in current RD range

Multivariate model using data from 44 sites in 15 countries, same model as RD score model

Current landscape
Aspirational

The application for national programmes

A WHO technical consultation in August 2025 brought together the work on the RD score and Risk Index. The report is expected imminently, opening the door for broader uptake and further net innovation.

RD Score: An opportunity for procurement decisions

- Practical, evidence-based tool for donors and countries to factor physical durability into procurement decisions.

Risk Index: Potential for more targeted in-country decisions

- Match net types, distribution channels, and vector control tools to the specific social and environmental pressures (RI) of each setting.
- The RI relies on post-market surveillance. Countries should identify how to sustain these systems going forward, especially as new funding cycles and grant applications are being developed.

Our values



Partnership

We believe in the power of partnership, collaboration and teamwork.

Innovation

We embrace ideas that drive vector control innovation, deliver impact and save lives.

Respect

We value diversity and treat each other with respect.

Gates Foundation

 **UK International Development**
Partnership | Progress | Prosperity

Australian Aid 

 Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC