Reprints from other journals

Comparative efficacy of insect repellents against mosquito bites
Mark S Fradin and John F Day

Abstract

Background: The worldwide threat of arthropod-transmitted diseases, with their associated morbidity and mortality, underscores the need for effective insect repellents. Multiple chemical, botanical, and ‘alternative’ repellent products are marketed to consumers. We sought to determine which products available in the United States provide reliable and prolonged complete protection from mosquito bites.

Methods: We conducted studies involving 15 volunteers to test the relative efficacy of seven botanical insect repellents; four products containing N,N-diethyl-m-toluamide, now called N,N-diethyl-3-methylbenzamide (DEET); a repellent containing IR3535 (ethyl butylacetylaminopropionate); three repellent-impregnated wristbands; and a moisturizer that is commonly claimed to have repellent effects. These products were tested in a controlled laboratory environment in which the species of the mosquitoes, their age, their degree of hunger, the humidity, the temperature, and the light–dark cycle were all kept constant.

Results: DEET-based products provided complete protection for the longest duration. Higher concentrations of DEET provided longer-lasting protection. A formulation containing 23.8 per cent DEET had a mean complete-protection time of 301.5 minutes. A soybean-oil-based repellent protected against mosquito bites for an average of 94.6 minutes. The IR3535-based repellent protected for an average of 22.9 minutes. All other botanical repellents we tested provided protection for a mean duration of less than 20 minutes. Repellent-impregnated wristbands offered no protection.

Conclusions: Currently available non-DEET repellents do not provide protection for durations similar to those of DEET-based repellents and cannot be relied on to provide prolonged protection in environments where mosquito-borne diseases are a substantial threat.


Mark Fradin is based at Chapel Hill Dermatology, Chapel Hill, NC, USA.
John Day is at the Florida Medical Entomology Laboratory, University of Florida, Vero Beach, FA, USA

Key words
Reprinted from, travel medicine, malaria, insect repellent

Editor’s comment:
At the 2002 SPUMS ASM, Dr Batchelor stated strongly her opinion that only DEET-containing repellents should be used, and this is clearly substantiated by Fradin and Day. In this study, volunteers inserted their repellent-treated arms into a cage with a fixed number of unfed mosquitoes and recorded the elapsed time to the first bite.

After the original study was completed, a new botanical repellent containing oil of eucalyptus was also tested and this had a mean protection time of 120 minutes. Alternatives to topically applied repellents have proven to be ineffective, such as ingested compounds including garlic or thiamine (vitamin B1).

Multiple factors determine how effective any repellent will be, so a given repellent will not protect all users equally. Only products containing DEET offer long-lasting protection after a single application. However, DEET is not perfect; it may be washed off by perspiration, rain or swimming, and its efficacy apparently decreases with higher environmental temperatures.

DEET has a remarkable safety profile after 40 years of use. Fewer than 50 cases of serious toxic effects have been documented, and three quarters of them were easily resolved. The Environmental Protection Agency has concluded that ‘normal use of DEET does not present a health concern to the general US population.’

Until a better repellent becomes available, DEET-based repellents remain the gold standard of protection.
A POEM a week for the BMJ
Richard Smith, editor BMJ

A POEM is Patient-Oriented Evidence that Matters. From now the BMJ will publish every week a POEM, a summary of a valid piece of research that carries information that is important to patients and so to their doctors. Unfortunately most research does not provide information that matters to patients. The POEMs will be published beside Editor’s Choice. POEM stands for Patient-Oriented Evidence that Matters, and the concept was developed by David Slawson and Allen Shaughnessy, academics in family practice from University of Virginia in the United States.1,2

The concept has its origins in a formula developed by Slawson and Shaughnessy:

\[ U = R \times V / W \]

where \( U \) = usefulness of the information to doctors, \( R \) = relevance of the information to doctors, \( V \) = validity of the information, and \( W \) = work to access the information. In words, the most useful information for doctors is information that is relevant to their practice, valid, and does not take too much work to access. After listening to a presentation by Maria Musoke, a researcher from Uganda, on the usefulness of information to rural health workers in Uganda I added ‘interactivity’ to the top line of the equation.3 The information is still more useful if you can interact with the source and interrogate it.

The formula provides a test of the ways in which doctors look for information they need. Traditional journal articles, although usually valid, are rarely directly relevant to a practitioner and are hard work to read and they cannot be interrogated, although rapid responses (electronic letters to the editor) provide a possible means of getting answers from authors. The usefulness of original articles might thus be categorised as low. Textbooks should be relevant, although it’s disturbing how often they fail to provide an answer to a direct question, and are comparatively easy to access. Their validity is questionable because they are rarely based on a systematic review of the literature and are often out of date, and they cannot be interrogated. They are thus of medium usefulness. In contrast, expert colleagues will give a direct and relevant answer to a question, should be little work to access, and can be interrogated. They are thus a highly useful source of information, although sometimes the validity of their answers may be low, ‘the blind leading the blind.’ The formula thus explains why doctors use colleagues most commonly to answer questions and journals least often.4

Doctors suffer from what Muir Gray, director of the National Electronic Library of Health, calls ‘the information paradox’: they are overwhelmed with information, many receiving their own weight in journals and newspapers every month, and yet cannot find the information they need when they need it. At least two questions arise during the average consultation between a doctor and patient.5 Most of those questions can be answered but few are. When I asked a sample of doctors to give me the one adjective they associate with their information supply, 90% gave a negative answer: overwhelmed, crushed, despairing. More than half of doctors feel guilty that they don’t read more. Information has negative connotations for doctors.

Doctors are in a ‘knowledge business’ and yet have severe information problems. The electronic age allows the possibility of a solution,6 but it hasn’t been found yet. POEMs are a step forward. The summary shows the three criteria that POEMs have to meet. Very importantly they have to provide information that will matter to patients. Will they live or die? Will they feel sick? Will they have pain? Will they be able to do what they want to do? A great many studies in medical journals give information on mechanisms of disease, aetiology, prevalence, pathophysiology, and pharmacology studies that may be important but don’t matter to patients. Faced with far more material than they can ever hope to master doctors might find it useful to concentrate on the studies that provide evidence that will matter to patients. They will discover that it is a minority of studies.

POEMs are selected by searching the current issues of 100 journals looking for relevant studies, potential POEMs, which are then evaluated for validity. The valid POEMs are summarised, and the summary is then reviewed and revised. The service is provided by InfoRetriever, who have kindly allowed us to publish a POEM each week. Those who would like to subscribe to their full service should access their site at <www.infopoems.com/index.cfm>.

Summary

POEMs have to meet three criteria:

• They address a question that doctors encounter
• They measure outcomes that doctors and their patients care about: symptoms, morbidity, quality of life, and mortality
• They have the potential to change the way doctors practise.

References

1 Shaughnessy AF, Slawson DC, Bennett JH. Becoming an information master: a guidebook to the medical information jungle. J Fam Pract 1994; 39: 489-499
2 Slawson DC, Shaughnessy AF. Obtaining useful information from expert based sources. BMJ 1997; 314: 947-949
4 Smith R. What clinical information do doctors need? BMJ 1996; 313: 1062-1068

Reprinted with kind permission of the BMJ Publishing Group from the British Medical Journal 2002; 325: 983
Edited to suit journal style only