

# Specifying skills for proficient control of *Aedes aegypti* oviposition in flowerpot saucers through the use of net covers

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## Abstract

Net covers have been used as physical barriers to prevent oviposition by the dengue vector *Aedes aegypti* into water-bearing containers. However, their efficacy as a prevention tool depends upon the proficiency (correctness) with which they are used. In the first part of this paper we describe the method by which a pattern of skills for the proficient use of a kind of net cover for flowerpot saucers (evidengue<sup>®</sup>) was empirically specified into verbal descriptions, or categories. After identifying by direct video observation a set of key-skills to meet predetermined specifications of the proficiency of the use of the evidengue<sup>®</sup>, we specified these skills in four categories of proficiency. In the second part of the paper we describe the procedure and the results of an experimental evaluation which aimed at measuring the extent to which the skills specified in the categories were performed by four groups of high school students, after an educational practice on dengue prevention in classroom. The evaluation compared two skills instruction procedures for the proficient use of evidengue<sup>®</sup>. In one of the procedures the skills were explicitly instructed through a video and/or leaflet in three experimental groups. In the other, the skills were not explicitly instructed. Trained observers independently recorded the frequency of the categories. The inter-observer agreement indices obtained show that the measurement of the frequencies of three of the four categories was reliable. In the inter-group comparison, the evaluation showed that the group that was submitted to explicit instruction of the skills through video and leaflet yielded relatively higher frequency of categories of proficiency than the others. Studies such as the one we present here make it possible to create reliable indicators of proper use of resources aimed at prevention of oviposition and consequent control of *Ae. aegypti* breeding at the household level.

**Keywords:** *Aedes aegypti*; Net cover; Skills; Proficiency of use; Flowerpot saucer; Dengue prevention; Health education.

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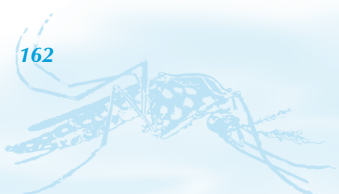
## Introduction

The most basic way of dengue vector control takes place in the household and depends on the residents' behaviour, notwithstanding the importance of infrastructure actions. It consists in the mere expedient of blocking the access of gravid female *Aedes aegypti* mosquitoes, the main urban vector of the disease, to the interior of storage tanks, buckets, flowerpot saucers and other kinds of domestic containers in which there is exposed and standing water.<sup>[1]</sup> Ideally, this action on the part of the residents will prevent the ovipositioning and the consequent development of the mosquito in the water.

Mosquito-proof net covers have been employed as physical barriers to prevent the ovipositing *Ae. aegypti* access to the interior of water-bearing domestic containers. One kind of cover (evidengue®) can seal off flowerpot saucers in such a way so as to confer complete protection against vector oviposition in these containers, which are frequently positive in south-eastern Brazil. Evidengue® has been shown to be 100% efficacious in preliminary laboratory evaluations.<sup>[2,3]</sup> However, as it happens with other kinds of mosquito-proof net covers,<sup>[4-8]</sup> its efficacy as a prevention tool depends upon the proficiency (correctness) of its use.<sup>[3,9]</sup> It is only by sealing the container that a resident can proficiently block vector access to its interior. The act of sealing is, thus, more proficient (in the sense of being more efficacious as preventive behaviour) than the mere use of lids, which often leave gaps for gravid female *Ae. aegypti* to enter and lay eggs inside the container.<sup>[10]</sup> When used with proficiency, evidengue® can be characterized as a sealing cover for controlling *Ae. aegypti* oviposition in flowerpot saucers.

Health education programmes routinely emphasize the importance of proficiency in using several kinds of prevention tools. Male condom is a case in point. One function of the condom is to prevent the spread of sexually transmitted diseases. But certain behavioural skills are needed to use it proficiently as non-proficient use may well prevent it from fulfilling such a function. This means to abide by some predetermined specifications. Briefly, the condom needs to be placed on the erect penis, then slipped integrally on to the member, squeezed at the tip to leave space for semen to collect, and so on. By the same token, the use of a net cover, to be proficient, must abide by its corresponding predetermined specifications. Operationally, such specifications constitute verbal descriptions of some pattern of behavioural skills that a resident must perform to seal off a water-bearing container proficiently.

The use of net covers for dengue prevention in households should of course be a part of integrated, community-based vector control measures.<sup>[11]</sup> But however much is known about the necessary sanitation measures for vector control at the household level,<sup>[11,12]</sup> it is surprising that little attention has been paid to the specification of behavioural skills required from residents for putting these measures into practice proficiently. Our own experience with evidengue® has shown<sup>[13]</sup> that a certain proportion of people are deficient in various skills to meet with proficiency a request for placing the cover on a flowerpot saucer, no matter



how simple this behaviour may be. Moreover, the design of a cover itself may not match the user's skills to place it on a container proficiently.

As in other scientific endeavours based on preventive behaviours (for instance, breast self-examination,<sup>[14,15]</sup> firearm injury prevention,<sup>[16]</sup> bicycle helmet use,<sup>[17]</sup> etc.), a health education programme intending to involve residents in dengue vector control by using mosquito-proof net covers needs to consider the prior specification of these skills in a practical and objective way.\* Developing a cover to prevent *Ae. aegypti* oviposition in domestic containers is one thing, but specifying behavioural skills ensuring its proper use by residents is quite another. As stated by Elder and Lloyd,<sup>[22]</sup> social mobilization efforts for dengue prevention may take different forms depending on whether their recipients provide evidence or not of the skills to engage in vector control. It is our contention that a vector control initiative involving the employment of net covers in households must specify those skills empirically through research of the proficiency of use of its particular kind of cover by prospective residents.

Such a specification of skills with respect to the proficient use of evidengue® was the object of the present study. Its aim was twofold. First, to describe a method through which a pattern of skills for the proficient use of this particular cover can be specified into a catalogue<sup>[23]</sup> of verbal descriptions, or categories, of proficiency; second, to evaluate the catalogue experimentally in order to measure the extent to which the skills specified in the various categories are performed by prospective users, after an educational practice on dengue prevention.

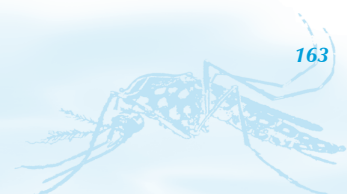
## Materials and methods

### Evidengue®

Structurally, evidengue® consists of a circular arrangement of synthetic polyester resin mosquito net, with mesh equal to or smaller than 2 mm x 1 mm.<sup>[2,3]</sup> Its sac-shaped design makes it possible for it to wrap the saucer and, at the same time, a portion of the flowerpot walls up to a height distant from the water. The cover has a frill along the aperture brim through which two straps of the same polyester material are embedded and, internally, there is also a rubber band. The straps have the function of firmly adjusting the aperture of the cover to the flowerpot so as not to leave any gaps for the passage of the vector, while the rubber band helps keep the edge of the cover adjusted and away from the water.

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\* We note that the term 'skill' is not employed here in the sense of an inner, inherited talent which would predispose an individual to behave in a predetermined manner. Rather, it is used in the sense of a specific ability or a particular dexterity that may be instructed, acquired and displayed by the individual in important situations.<sup>[18]</sup> In this acceptance, skill and proficiency are equivalent concepts. It draws on the empirical research literature from the psychology discipline that calls itself behaviour analysis.<sup>[19-21]</sup>



## Specification of skills and catalogue of categories of proficiency

The table presents an overview of the study design. Drawing on the literature about direct observation of human and animal behaviour,<sup>[23-28]</sup> the specification of the behavioural skills for the proficient use of evidengue<sup>®</sup> started with the observation, in a video, of a sequence of cover manipulation movements vis-à-vis its placement on a set of saucer and flowerpot. This sequence was taken as reference pattern for the identification and posterior specification of the skills. It was extracted from a 70-second domestic video produced in order to demonstrate the proficient placement of evidengue<sup>®</sup> on a flowerpot in a previous study.<sup>[3,29]</sup> The systematic observation of this sequence made it possible to: (a) identify a pattern of four key-skills for the proficient use of the cover; and (b) specify these skills in verbal descriptions (categories) of use proficiency (hereafter called categories of proficiency).

**Table:** Overview of the study design

### (1) Skills identification

- (a) Video observation of cover manipulation
- (b) Identification of key-skills (after a total of 22 skills identified)

### (2) Categorization

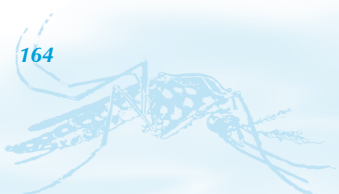
- (a) Gradual specification of key-skills in verbal descriptions or categories of proficiency
- (b) Filmed individual tests of categories
- (c) Repeated observation of filmed performances, rectification and adjustment of categories
- (d) Final specification of key-skills into a catalogue of categories of proficiency

### (3) Experimental catalogue evaluation

- (a) Educational practice (two instruction procedures, with and without explicit instruction of proficiency)
- (b) Demonstration and recording

The following key-skills were identified: (i) full insertion of the saucer and flowerpot into the cover; (ii) pulling the opening edge upwards so as to keep the rubber band suspended at a height of the flowerpot that is sufficiently distant from the water inside the saucer; (iii) contour flowerpot wall with the adjusting straps; (iv) making of a knot with the straps tight against the flowerpot wall. From a total of 22 skills identified in the video, these four were considered essential for compliance with the predetermined use proficiency specifications of the evidengue<sup>®</sup>.

Once identified through direct video observation, the skills started to be gradually specified in categories of proficiency. In many sessions held over several days, the categories were taken to individual tests with 57 voluntary participants (age range 15–76 years). In these



sessions, the participants were instructed by one of the researchers to place evidengue® on a flowerpot saucer. The instruction was given in conformity with the video's original sequence and the specifications of each tested category. The sessions were filmed. Eventually, through repeated observations of the participants' performances, the categories were successively rectified, and terms were added, substituted and suppressed until a catalogue was compiled and afterwards evaluated (see below).

The categories that constituted the catalogue were the following, in this sequence:

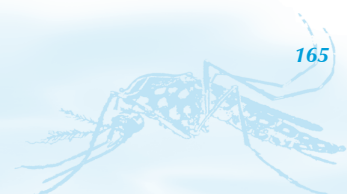
- *Insertion*: open evidengue®, position the saucer and the flowerpot at the cover's wrong side, totally fitting the flowerpot base inside the saucer.
- *Pulling*: elevate the edge of evidengue® to a height that reaches the higher half of the flowerpot, without reaching the aperture.
- *Contour*: surround evidengue® with the polyester straps, in opposing directions, at the height of the rubber band, and bring them close.
- *Knot*: cross the straps and knot them close to the flowerpot's wall, stretching the straps to their maximum, in opposing directions.

## Catalogue evaluation

The catalogue evaluation compared the relative frequency of occurrence of the categories of proficiency (dependent measure) in two instruction procedures for the use of the cover. In one of them, the proficiency was explicitly instructed according to the various categories, whereas in the other (control), the proficiency was not explicitly instructed. The procedures were carried out in a classroom during an educational practice of dengue prevention with high school students. Prior to the study, ethical clearance was granted from the Ethics Committee of René Rachou Research Center and informed consent was obtained from all participants.

The evaluation was based on the frequency records of the categories obtained in a demonstration session of the placing of evidengue® on flowerpot saucers, carried out by students immediately after an educational practice. The participants were 96 students from both sexes (age range 16–31 years), gathered into four classes (1 to 4) of a public school in a dengue-endemic district in the city of Belo Horizonte, Minas Gerais state, Brazil.

The instruction procedures followed an experimental design composed by three components: lecture on dengue (LD), delivery of a leaflet (LF) instructing how to seal a flowerpot saucer using evidengue®, and exhibition of a video (VI) about the correct way of placing the cover on the saucer. The components were differentially associated in classes 2, 3 and 4 (hereafter called experimental groups), whereas class 1 was considered control group. The modalities of association were as follows: Group 2: LD+LF (N = 22); Group 3: LD+VI (N = 30); Group 4: LD+LF+VI (N = 22). In Group 1 (LD), N was 22.



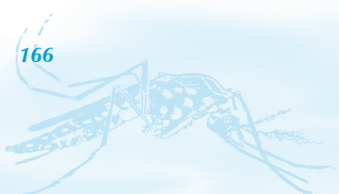
*Lecture on dengue:* Adapted from a previous study,<sup>[29]</sup> the 8-minute lecture was given by one of the members of the present study's team (second author). It succinctly comprised six topics related to dengue: (i) concept of dengue; (ii) symptoms of the disease; (iii) forms of clinical manifestation; (iv) transmission; (v) life-cycle of *Ae. aegypti*; and (vi) prevention. Pictures related to these topics were projected onto a screen through 28 PowerPoint colour slides. Though seven of the slides showed illustration photos of covered and uncovered flowerpot saucers, including a saucer sealed with evidengue®, no explicit instruction was given in the lecture in connection with the proficiency in the use of the cover.

*Leaflet and video:* The proficiency was explicitly instructed in print (leaflet) and electronic (video) media. In the leaflet, the categories were represented by colourful photos, with legends in conformity with the specifications of the skills in the catalogue. In two imperative sentences, the leaflet highlighted the importance of sealing with evidengue® and asked the student to follow a sequence of steps (numbered in the legends) to seal the flowerpot saucer with the cover. In the 52-second, mute, coloured semi-professional video, the categories were converted into moving images. In it, the instructor showed the proficient placing of evidengue® on to a flowerpot and saucer set similar to the one that was subsequently used in the demonstration through which the catalogue was evaluated. In addition to the key-skills, four skills considered non-essential were added to the leaflet and video: taking evidengue® off its package, stretching the cover's aperture before insertion, placing the saucer separately (before) the flowerpot, and tying a bow with the straps after the knot.

*Demonstration:* The demonstration was carried out individually, immediately after the educational practice. Two benches from a science laboratory contiguous to the classroom were used. Each bench had a violet flowerpot with its respective saucer and a plastic package containing one evidengue® in a size that corresponded to the saucer's dimensions. Each student received oral instruction, individually, from the instructor, about the demonstration, at the bench. The instruction followed a standard text. The students from Groups 2 and 4 could freely consult the leaflet they received in the educational practice. The demonstration started with the removal of the evidengue® from its package. After each demonstration was concluded, the respective student exited the laboratory and the remaining students, who waited in the classroom, were successively called by the instructor for demonstration on one bench or the other.

Two pairs of previously trained observers, one at each bench, recorded independently, in a paper-and-pencil observation form, the frequency of the occurrence of each of the four categories in the catalogue. The educational practice and the demonstration were carried out in a single morning during school hours, following a predetermined sequence for the four groups.

*Results:* We calculated the inter-observer agreement (IOA) index in order to estimate the reliability of the records in each pair. Reliability concerns the extent to which a given measurement is consistent and repeatable.<sup>[27]</sup> In the present study, the IOA index was

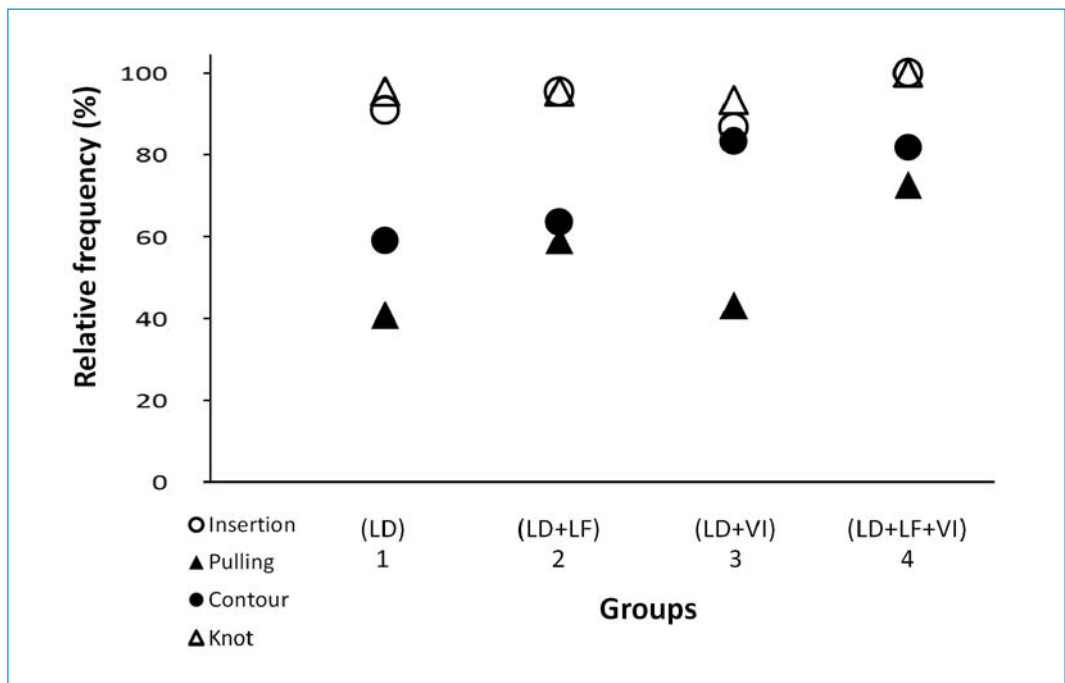


expressed as the percentage of all occurrences of a given category about which the two observers of each pair have agreed, i.e.  $\text{Agreements}/(\text{Agreements}+\text{Disagreements}) \times 100$ . This index is widely used in behavioural observation studies<sup>[30-33]</sup> and is particularly suited to nominal or categorical measures.<sup>[23]</sup> We also calculated the *kappa* correlation coefficients in each pair.

In the whole set of records, the IOA index of pair 1 was smaller (87.5%) than the index of pair 2 (97.9%). When calculated separately for each category of proficiency, the indices of pair 1 were smaller for *pulling* (79%), *contour* (83%), and *knot* (81%), whereas the *insertion* index was the same (100%) in both pairs. All the *kappa* values for both overall and individual categories were inferior to 0.05. Taken together, these results indicated that the measurement of the frequencies of the categories *insertion*, *contour* and *knot* was consistent and repeatable. The *pulling* index in pair 1 was relatively low and did not allow for this conclusion.

The figure shows the relative frequency of the categories of proficiency in each of the four groups. In the inter-groups comparison, the relative frequency of the categories *insertion* and *knot* was consistently higher (minimum of 86.7% for *insertion* in Group 3) than of the categories *pulling* and *contour*. *Pulling* was the less frequent category (minimum of 40.9% in Group 1). The difference between the relative frequencies of the four categories

**Figure:** Relative frequency of the categories of proficiency in each of the four groups



of proficiency of the four groups was statistically significant (Cochran-Mantel-Haenszel test,  $p$ -value  $< 0.05$ ). Group 4 produced more categories of proficiency. The average relative frequency of categories was as follows: Group 1 (LD) = 71.6%; Group 2 (LD+LF) = 78.4%; Group 3 (LD+VI) = 76.7%; Group 4 (LD+LF+VI) = 88.6%.

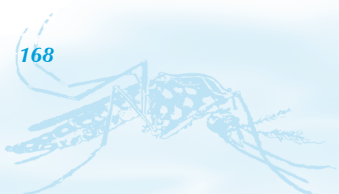
## Discussion

Although some researchers have called attention to the need for taking into account the behavioural skills of participants in the initiatives for dengue prevention at the household level,<sup>[12,34]</sup> as of now, no research seems to have sought to specify empirically the skills necessary for residents to prevent proficiently *Ae. aegypti* breeding in domestic water containers.

The present method of specifying skills for the proficient use of evidengue® was conducted in a way similar to a procedure for developing a task analysis.<sup>[35]</sup> Quite often a task analysis begins with a broad scope and uses the information gathered during its development to narrow its focus. This is generally a laborious task, which requires numerous observations and rectifications. In this study, the method involved the preliminary breaking down of a previously recorded sequence of cover manipulation movements into 22 skills. It is worthy of the attention of researchers and practitioners engaged in dengue health education that, in the end, the catalogue of categories of proficiency comprised a small proportion (18.2%) of these skills. That is to say, only a few behavioural skills appear to be the underlying determinants of the proficient use of evidengue®. Field studies on the efficacy of the cover's use might test this conjecture.

The method described here becomes more significant for health educators as we move from evidengue® to other kinds of net covers that can be employed in vector control initiatives. The generality of the method has of course to be demonstrated, but it looks as if its main features may well be extended to other kinds of covers. These features can be summarized as follows: (a) the empirical identification of a pattern of essential skills for compliance with predetermined proficiency specifications in the use of a cover; (b) the specification of the essential skills in terms of verbal categories of use proficiency; and (c) the test and, if necessary, the concomitant refining of these categories so as to obtain a set that will compose a catalogue for posterior use.

Mosquito-proof net covers are prevention tools designed to be a hindrance or obstacle to the egg stage of *Ae. aegypti* life-cycle. Several kinds of covers now exist, yet their employment, even when insecticide-treated,<sup>[7,36]</sup> is somewhat unsystematic and thus their efficaciousness is still questionable.<sup>[7,10]</sup> In general terms, this is a problem related to the skills of the people (residents or others) using the cover. But however much the users are heterogeneous in their skills, this may be a problem also related to the design itself of a given kind of cover. In the present study with evidengue®, the catalogue evaluation showed that *pulling* and *contour*





were the categories less frequently performed in all four groups. The relative frequency of *pulling*, in particular, was specially low in Groups 1 and 3. A behavioural skill deficit can be remediated by training,<sup>[18]</sup> but if one knows beforehand that the proficient use of a cover requires a skill that is performed with a frequency so low by a sample of potential users, the problem should probably be addressed by changing the design of the cover, not the behaviour of the user.

Evidengue® is still being developed, and although previous evaluations have shown its efficacy in the laboratory, the current study pointed out the need for a structural change. For one part, the contour has been eliminated in a new design that does not require the knot, substituting it with a sliding acrylic lock, which brings the polyester strips together in parallel and adjusts them firmly to the flowerpot, at the same height of the rubber band, thereby sealing the saucer with a proficiency probably greater than the one previously obtained with the knot. On the other hand, the *pulling*, as specified in the catalogue, became unnecessary, since the elevation of the edge of the evidengue® may now be carried out through the movement of the lock to the required height. The new behavioural skills resulting from the change still need to be evaluated.

It should be noted that the IOA index of the *pulling* category remained below 80%, which is the lower edge of the range of acceptability of the majority of studies that use direct observation in educational, clinical and other settings.<sup>[23,26,37]</sup> Thus, in addition to a likely skill deficit<sup>[22]</sup> or an inadequate design, we cannot exclude the possibility that the low frequency of *pulling* was also related to some deficiency in the verbal description of this skill. Still another possibility is an insufficiency in the training of observers.<sup>[23,26]</sup>

We are not aware of any procedure or measure that has associated school education to the proficiency in the use of a net cover to prevent *Ae. aegypti* oviposition in water-bearing containers in households. Proficiency involves behavioural skills that can be dealt with quantitatively, as shown in the present study. We measured the frequency of occurrence of a set of categories of proficiency for placing evidengue® in flowerpot saucers after a classroom educational practice, and found that a procedure in which the proficiency is explicitly instructed through leaflet and video (i.e. showing through these means *how* a container should be sealed) results in substantially higher proficiency indices than a procedure in which the proficiency is not explicitly instructed. In other words, our evaluation suggests that without the explicit instruction of *how* to use proficiently a net cover, students may not acquire sufficient skills to achieve the proficiency required for vector control with this device at the household level.\*\* This topic needs investigation.

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\*\* It is, in short, a variation of the theoretical question of distinguishing the learning which involves words from the learning which involves actions,<sup>[38]</sup> something that has been addressed, in the case of dengue prevention, in terms of a “know-do gap”<sup>[39]</sup>.



It should be stressed that the explicit instruction and the instruction media (leaflet and video) were not mutually exclusive. A study interested in determining the differential influence of one or another of these factors should employ a design which allows manipulating them independently. In this event, it might be specially interesting to investigate the specific influence of the leaflet, whose modalities of association in Groups 2 and 4 (LD+LF and LD+LF+VI) yielded relatively higher frequency of categories of proficiency than the modality of Group 3 (LD+VI).

The study of proficiency through behavioural science methods can open up research lines to other prevention fields, such as insecticide-treated bednets for malaria control,<sup>[40]</sup> where the literature has shown frequent inadequacies and protection failures. Also, behavioural methods can be employed in asthma cases in which simple technologies are often used in a non-proficient way by patients and professionals.<sup>[41]</sup>

## Acknowledgement

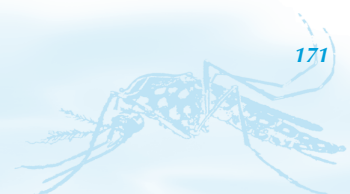
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## References

- [1] Morrison AC, Zielinski-Gutierrez E, Scott TW, Rosenberg R. Defining challenges and proposing solutions for control of the virus vector *Aedes aegypti*. *PLoS Med.* 2008; 5: e68.
- [2] Schall VT, Barros HS, Jardim JB, Secundino NFC, Pimenta PFP. Dengue prevention at the household level: Preliminary evaluation of a mesh cover for flowerpot saucers. *Rev Saude Publica.* 2009; 43: 895-897.
- [3] Jardim JB, Barros HS, Gonçalves CM, Pimenta PFP, Schall VT. The control of *Aedes aegypti* for water access in households: Case studies towards a school-based education programme through the use of net covers. *Dengue Bull.* 2009; 33: 176-186.
- [4] Kittayapong P, Strickman D. Three simple devices for preventing development of *Aedes aegypti* larvae in water jars. *Am J Trop Med Hyg.* 1993; 49:158-165.
- [5] Socheat D, Chantha N, Seta T, Hoyer S, Chang MS, Nathan MB. The development and testing of water storage jar covers in Cambodia. *Dengue Bull.* 2004; 28:8-12.
- [6] Seng CM, Seta T, Nealon J, Chanta N, Socheat D, Nathan MB. The effect of long-lasting insecticidal water container covers on field populations of *Ae. aegypti* (L.) mosquitoes in Cambodia. *J Vector Ecol.* 2008; 33: 333-341.
- [7] Chuang HY, Huang JJ, Huang YC, Liu PL, Chiu YW, Wang MC. The use of fine nets to prevent the breeding of mosquitoes on dry farmland in southern Taiwan. *Acta Trop.* 2009; 110: 35-37



- [8] Kittayapong P, Chansang U, Chansang C, Bhumiratana A. Community participation and appropriate technologies for dengue vector control at transmission foci in Thailand. *J Amer Mosq Cont Assoc.* 2006; 22: 538-546.
- [9] Jardim JB, Schall VT. Dengue prevention: Focus on proficiency. *Cad. Saude Publica.* 2009; 25:2529-2530.
- [10] Strickman D. Laboratory demonstration of oviposition by *Aedes aegypti* (Diptera: Culicidae) in covered water jars. *J Med Entomol.* 1993; 30:947-949.
- [11] Renganathan E, Parks W, Lloyd L, Nathan MB, Hosein E, Odugleh A, Clark GG, Gubler DJ, Prasittisuk C, Palmer K, San Martin J-L. Towards sustaining behavioural impact in dengue prevention and control. *Dengue Bull.* 2003; 27: 6-12.
- [12] McCall PJ, Kittayapong P. *Control of dengue vectors: Tools and strategies. Scientific Working Group, Report on Dengue.* Working paper 6.2. Geneva: World Health Organization, Special Programme for Research and Training in Tropical Diseases, 2007.
- [13] Bocewicz ACD. *Um modelo experimental (evidengue®) para o desenvolvimento de tecnologia de instrução de proficiência na área da saúde.* Belo Horizonte, 2009. (<http://is.gd/Xk62Vn> - accessed 12 Jan 2012).
- [14] Pennypacker HS, Iwata MM. MammaCare: A case history in behavioural medicine. In: Blackman DE, Lejeune H eds. *Behaviour analysis in theory and practice: Contributions and controversies.* Hove, East Sussex: Lawrence Erlbaum, 1990.
- [15] Saunders KJ, Pilgrim CA, Pennypacker HS. Increased proficiency of search in breast self-examination. *Cancer.* 1986; 58: 2531-2537.
- [16] Miltenberger RC, Flessner C, Gatheridge B, Johnson B, Satterlund M, Egemo, K. Evaluation of behavioral skills training to prevent gun play in children. *J Appl Behav Anal.* 2004; 37: 513-516.
- [17] Van Houten R, Van Routen J, Malenfant JEL. Impact of a comprehensive safety program on bicycle helmet use among middle-school children. *J Appl Behav Anal.* 2007; 40: 239-247.
- [18] O'Donohue W, Ferguson KC, Pasquale M. Psychological skills training: Issues and controversies. *Behav Anal Today.* 2003; 4:331-335.
- [19] ABAI. *Association for Behavior Analysis International.* <http://www.abainternational.org/> - accessed 13 Jan 2012.
- [20] Blackman DE, Lejeune H eds. *Behaviour analysis in theory and practice: Contributions and controversies.* Hove, East Sussex: Lawrence Erlbaum, 1990.
- [21] Lattal KA, Chase PN. *Behavior theory and philosophy.* New York: Plenum, 2003.
- [22] Elder J, Lloyd LS. Achieving behaviour change for dengue control: Methods, scaling-up, and sustainability. In: World Health Organization. *Report of the Scientific Working Group meeting on dengue, Geneva, 1-5 Oct 2006.* Geneva: WHO, 2007. pp 140-149. (<http://is.gd/1o2Ny2> - accessed 12 Jan 2012).
- [23] Martin P, Bateson P. *Measuring behaviour: An introductory guide. 2<sup>nd</sup> edn.* Cambridge: Cambridge University Press, 1993.
- [24] Hutt SJ, Hutt C. *Direct observation and measurement of behavior.* Springfield IL: Charles C Thomas, 1970.



- [25] Bijou SW, Peterson RF, Ault MH. A method to integrate descriptive and experimental field studies at the level of data and empirical concepts. *J Appl Behav Anal.* 1968; 1:175-91.
- [26] Hartman DP. *Using observers to study behavior.* San Francisco: Jossey-Bass, 1982.
- [27] Hartman DP, Wood DD. Observational methods. In: Bellack AS, Hersen M, Kazdin AE eds. *International handbook of behavior modification and therapy.* New York: Plenum, 1982.
- [28] Thompson T, Symons FJ, Felce D. *Behavioral observation.* Baltimore: Paul H. Brooks, 2000.
- [29] Barros HS. *Investigação de conhecimentos sobre a dengue e do índice de adoção de um recurso preventivo (capa evidengue®) no domicílio de estudantes, associados a uma ação educativa em ambiente escolar.* Rio de Janeiro: Instituto Oswaldo Cruz, 2007.
- [30] Williams JH, Geller ES. Behavior-based intervention for occupational safety: Critical impact of social comparison feedback. *J Safety Res.* 2000; 31:135-142.
- [31] Hanley GP, Cammilleri AP, Tiger JH, Ingvarsson ET. A method for describing preschoolers' activity preferences. *J Appl Behav Anal.* 2007; 40: 603-618.
- [32] Iwata BA, Pace GM, Kissel RC, Nau PA, Farber JM. The self-injury trauma (SIT) scale: A method for quantifying surface tissue damage caused by self-injurious behavior. *J Appl Behav Anal.* 1990; 23: 99-110.
- [33] Kent RN, O'leary DK, Dietz A, Diament C. Comparison of observational recordings in vivo, via mirror, and via television. *J Appl Behav Anal.* 1979; 12:517-522.
- [34] Winch PJ, Leontsini E, Rigau-Pérez, JG, Ruiz-Pérez M, Clark GG, Gubler DJ. Community-based dengue prevention programs in Puerto Rico: Impact on knowledge, behavior, and residential mosquito infestation. *Am J Trop Med Hyg.* 2002; 67:363-370.
- [35] Sulzer-Azaroff B, Reese EP. *Applying behavior analysis: A program for developing professional competence.* New York: Holt, Rinehart & Winston, 1982.
- [36] Kroeger A, Lenhart A, Ochoa M, Villegas E, Levy M, Alexander N, McCall PJ. Effective control of dengue vectors with curtains and water container covers treated with insecticide in Mexico and Venezuela: Cluster randomized trials. *BMJ.* 2006; 392: 1247-1252.
- [37] Bailey JS, Burch MR. *Research methods in applied behavior analysis.* Thousand Oaks: Sage, 2002.
- [38] Catania AC. *Learning.* Englewood Cliffs: Prentice Hall, 1998.
- [39] World Health Organization. *Bridging the "know-do" gap: meeting on knowledge translation in global health.* Geneva: WHO, 2006.
- [40] Kroeger A, Mancheno M, Alarcon J, Pesse K. Insecticide-impregnated bed nets for malaria control: Varying experiences from Ecuador, Colombia, and Peru concerning acceptability and effectiveness. *Am J Trop Med Hyg.* 1995; 53: 313-323.
- [41] Frade JCQP. *Avaliação de conhecimentos, habilidades e atitudes de farmacêuticos inseridos em um Projeto de Educação em Saúde relativo à asma.* Belo Horizonte MG: Centro de Pesquisas René Rachou, 2006. (<http://is.gd/hfWQ88> - accessed 12 Jan 2012).

