

ANALYSIS OF MOSQUITO CONTROL AGENCY PUBLIC EDUCATION PROGRAMS IN THE UNITED STATES

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ABSTRACT. Mosquito control is an important element of public health maintenance in the United States. Mosquito control agencies in this country have embraced the concept of Integrated Mosquito Control for the last decade or more. This concept ideally integrates the elements of chemical control, biological control and physical control, augmented by a planned public education program, into the total operational mosquito control program.

Public education is the activity of routinely providing mosquito control information to the public-at-large, so that breeding sources on private properties can be reduced or eliminated. Public education appears to be highly regarded by the vast majority of American mosquito control workers. Despite this, it is not used as extensively by most mosquito control agencies as the more traditional chemical, biological and physical control methods. This study indicates that only a very small portion of the budgets of this country's mosquito control agencies is allocated to public education activities.

INTRODUCTION

Organized mosquito control is an effective and important element within the public health scheme in the United States. For the last several decades, mosquito control agencies have relied on the availability and use of chemical pesticides for routine mosquito control. Many of these chemicals have become expensive and some ineffective because of resistance development.

In the past several years, the concept of Integrated Pest Management has come into general use among mosquito control workers in this country. The stated purpose of this concept is to rely less on routine application of pesticides in favor of a more balanced approach to mosquito population management. Ideally, integrated pest management utilizes chemical, physical and biological control, augmented by a planned public education program.

In a policy statement adopted in May 1979, the American Mosquito Control Association declared that mosquito management programs should be tailored to the individual situation and that:

"The combination of methods for mosquito control should be chosen after careful consideration of the efficacy, ecological effects and costs versus benefits of the various options, including public education, legal action, natural and biological control, elimination of breeding sources, and insecticide application" (Hart 1980).

Public education programs in mosquito control agencies in the United States range from well-organized, vigorous programs to simple in-

formational handouts distributed by field workers. Public education efforts are highly regarded by most mosquito control workers, but the resources of many agencies are often insufficient for elaborate programs.

A study completed by the National Academy of Sciences in 1976 concluded that:

"... there appears to be a direct relationship between urbanization and the need for continuously educating the public in mosquito prevention and control. The denser the human population the greater the likelihood of domestic mosquito (mostly *Culex* spp.) production from storm drainage and water supply installations, unsanitary disposal of wastes, and neglected water containers. Education is the most effective and least expensive way to eliminate such mosquito breeding" (National Academy of Sciences 1976).

This study examines mosquito control agency public education programs as they currently exist in the United States, and attempts to determine the level of effort toward public education exerted by mosquito control agencies.

MATERIALS AND METHODS

The data gathering method utilized was a 2-page, 15-question survey questionnaire. This questionnaire was mailed to 193 of the 650 United States mosquito control agencies in 35 states. This 30% sample size was chosen as a representative number of control agencies in the United States.

Questionnaires were sent to agencies in the following states: Arizona, California, Colorado, Connecticut, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kentucky, Louisiana, Massachusetts, Minnesota, Montana, Nevada, New

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Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin and Wyoming.

The survey was mailed to the agencies on March 5, 1982 with a request that it be completed and returned not later than mid-April, 1982. Each questionnaire was accompanied by a cover letter, written on American Mosquito Control Association letterhead (with the Association's knowledge and approval), and personally addressed to the agency's manager or director. On April 15, 1982, 55 reminder post-cards were sent to the agencies that had not responded by that date. The number of mosquito control agencies that responded by returning the completed questionnaire is 138, which is 72% of the questionnaires mailed, and 21% of all mosquito control agencies in the United States.

The purpose of the questionnaire was to gather data relative to each agency's level of effort toward carrying out a public education program within its jurisdiction, as well as the agency administration's philosophy toward public education as a *bona fide* complement to a comprehensive mosquito control program.

AGENCY COMPOSITION

Agencies were selected using the *Directory of Mosquito Control Agencies in the United States and Canada* (Challet and Keller 1981) published by the American Mosquito Control Association at approximate 5-year intervals. The data contained in the *Directory* are for the years 1979-80. Of the 193 mosquito control agencies contracted, 135 (70%) are special-purpose mosquito or vector control districts or commissions. Forty-nine other organizations (25%) are part of city or county health departments, and nine others (5%) are divisions of state or local agriculture departments, special multiple-service districts, public works or public safety departments.

SURVEY QUESTION DISCUSSION AND RESULTS

The survey questions and the tabulated results will be discussed here.

1. "Does your agency control vectors other than mosquitoes?"

A response choice of "Yes" or "No" was given. Additionally, the agencies were asked to indicate which other vectors they controlled, with response choices being "Flies," "Biting Gnats," "Rats/Rodents," "Ticks," "Yellow Jackets/

Wasps" and "Other." This question was asked to determine the depth and versatility of the agencies' mosquito/vector control programs, and to see if there is any correlation between more complex programs and greater allocation of resources for public education activities. Forty-three percent of the responding agencies replied that they controlled other vectors. "Rats/Rodents" were the most numerous other vectors controlled, with 49% of the agencies doing other vector control reporting that they controlled rats or other rodents. Other vectors controlled by these agencies are flies, ticks, biting and nonbiting ants, yellow jackets and wasps, roaches, fleas, bats and skunks. The majority of the responding agencies (57%) reported that they were responsible only for mosquito control in their jurisdictions.

2. "Does your agency make mosquito/vector control information literature (brochures, leaflets, pamphlets, etc.) available to the public?"

The purpose of this question was to learn the extent to which these agencies provide written mosquito control information to the public. This type of communication is very basic and can be an inexpensive public educational tool. The majority of the agencies responding (86%) indicated that they had some type of written information routinely available to the public. The remaining 14% reported that they did not make this type of information available. A sampling of brochures returned with the completed questionnaires showed a broad assortment of public informational material, ranging from crudely drawn and duplicated single-sheet flyers to professionally produced pamphlets.

The third question in the survey explores the extent to which agency manpower is committed to public education effort through in-person educational presentations to various types of audiences.

3. "Does your agency make mosquito/vector control educational presentations available to schools, service organizations, homeowners' associations, etc.?"

Once again the response choices were "Yes" or "No." Again, the majority (86%) responded that they did offer some kind of in-person educational program to a variety of groups. Fourteen percent did not offer such a program.

Question number 4 was used to determine the types of groups to which agency public education efforts are aimed.

4. "If yes to number 3, which of these groups do you devote the most public education effort?"

The response choices were 5 groups consisting of "Schools," "Service and Fraternal Organizations," "Homeowners' Associations," "Other

Special Interest Groups" (agricultural organizations, business associations, etc.) and "Political Groups" (city councils, boards of supervisors, commissioners, etc.). The agencies were then asked to indicate the degree of public education effort given to each of the groups, with the choices of "Most Effort," "Equal Effort" and "Least Effort." If all choices were left blank, it was assumed that no effort was expended.

The response results are shown in Table 1. Schools have the highest priority with responding agencies, with 43% of the agencies reporting that they expended "Most Effort" on the schools. "Other Special Interest Groups" had the fewest "Most Effort" responses (4%). Schools had the fewest "No Effort" responses, with only 8% of the reporting agencies indicating that they made no effort to go into schools with educational presentations. Homeowners' associations received the largest number of "no effort" responses, with 29% of the agencies saying that they put forth no effort to speak to homeowners' groups.

5. "How many full-time employees do you have on your mosquito/vector control staff?"

This question is used to determine if there is any correlation between the size of mosquito control agency staffs and the vigorousness of public education efforts. Sixty-five percent of the responding agencies have 10 or fewer full-time employees. Seventeen percent of the organizations reported staffs of between 11 and 20 full-time employees. Eight percent have 21 to 30 employees, while 5% employ 31 to 40 persons. Two percent reported between 41 and 50 staff members, and 3% indicated that they have more than 50 workers.

6. "Which of your staff are primarily responsible for the public education activities within your agency?"

The purpose of this question is to learn at which organizational levels public education responsibilities principally fall. The response choices for this question were "Manager/Director," "Biologist/Entomologist," "Educational Specialist" and "Other." Several agencies replied to

more than one category, indicating that two or more staff members share public education responsibilities. Seventy-three percent of the responding agencies reported that the Manager/Director does the primary public education work for the agency. Thirty-three percent of the organizations assigned these duties to their staff Biologist/Entomologists. Eleven percent have a staff Educational Specialist whose primary responsibility is public education. Twenty-one percent of the agencies responded that staff members other than the first three categories are responsible for the agencies' public education efforts. Two percent reported that none of their staff does this type of work.

Question number 7 is a follow-up question to number 6.

7. "What percentage of total staff time is used by the above staff in public education activities during the course of a year?"

The response choices for this question were "% of total time—Manager/Director," "% of total time—Biologist/Entomologist," "% of total time—Educational Specialist," "% of total time—other." Of the 138 agencies responding, 98% indicated that at least one staff member is assigned some public education duties. Two percent of the agencies responded that none of their personnel engage in public education activities. Seventy-three percent of the agencies which do public education reported that their Manager/Director participates in educational activities. Of these, 81% said the Manager/Director spends from 1 to 10% of his or her time carrying out educational activities. Thirteen percent indicated that people in this same position spend 11 to 20% of their work time in educational projects. Finally, 6% of the agencies responding stated that their Manager/Director uses 21 to 30% of his or her work time educating the public. None of the agency managers is involved in public education activities more than 30% of his or her work time.

"Biologist/Entomologist" was the next most frequently mentioned staff member doing public education work. Thirty-three percent of

Table 1. Comparison of U.S. agency effort levels to schedule educational presentations to various groups.*

	Schools	Service and fraternal organizations	Home-owners' associations	Other special interest groups	Political groups
Most effort	43%	11%	10%	4%	14%
Equal effort	38%	52%	37%	46%	33%
Least effort	11%	13%	24%	23%	29%
No apparent effort	8%	24%	29%	27%	24%

* One hundred nineteen out of the 138 responding replied that they offered some type of in-person, educational presentation to groups within their jurisdictions. Percentages rounded to the nearest whole number.

the 135 educationally oriented mosquito control agencies assign education duties to this position. Seventy-six percent of these agencies said their Biologist/Entomologist spends from 1 to 10% of his or her time on educational activities. Thirteen percent spend 11 to 20% of their time educating, and 9% of the agencies reported that the Biologist/Entomologist is able to devote 21 to 30% of staff time to educational work. Two percent of the agencies indicated that persons in this position spend 31 to 50% of their work time in mosquito control public educational activities.

Only 11% of the reporting agencies have an Educational Specialist on staff. Of these, 54% devote up to 10% of their time on educational work, 13% are involved in educational projects from 11 to 20% of their work time, another 13% of these workers devote 51 to 75% of their time to these duties, and 20% are involved in educational work from 76 to 100% of their work time.

The last category, "Other," consists of field inspectors, office and administrative workers. Twenty-one percent of the agencies doing public education have persons in these positions engaged in some kind of public education work. Sixty-three percent of these agencies allow up to 10% of staff time for "Other" workers to accomplish educational projects. Twenty-one percent of the organizations indicated that "Other" workers are involved in educational activities 11 to 20% of their work time, and 7% of the organizations reported that "Other" staff members devote 21 to 30% of their time to education. Finally, 9% of persons in this category reported spending between 30 and 100% of their duty time educating the public.

8. "What percentage of your total annual budget is earmarked for public education activities (pamphlets, brochures, displays, salary of educational specialist, etc.)?"

This question seeks to determine the level of budgetary allocation to be used for public education activities. Ninety-seven percent of the responding agencies allow less than 10% of their annual budget for public education. Two percent of the organizations allow 11 to 20% of their budgets to be utilized for these activities, and 1% reported that over 30% of their annual budgets are allocated for educational efforts. For American mosquito control agencies reporting, the average percentage of annual budget earmarked for this type of activity is 1.7%.

The ninth question was meant to determine the extent to which the agency's governing body is involved in public information work on behalf of the organization.

9. "Does your governing body (Board of Trustees, Commissioners, etc.) engage in

public education activities on behalf of your organization?"

Thirty-three percent of the responding agencies stated that their governing bodies are involved in educational work for the organization, while 67% said that these members do not participate in educational work for the agencies. Of the ones who stated that their policymakers did do educational work, 7% said that they are very involved, 15% stated the governing body is moderately involved, and 78% responded that their governing members are only minimally involved in educational efforts.

10. "Does your agency offer facilities tours to interested groups?"

Seventy-one percent of the agencies responding do offer some kind of group tour of their operational facilities, while 29% do not.

11. "Does your agency use public education displays at county fairs, libraries, health fairs, schools, etc.?"

Fifty-one percent of the reporting agencies provide displays for the public, and 49% of them do not.

12. "Do you send press releases to local newspapers?"

Eighty-three percent of the reporting agencies send out press releases to the local press on a regular basis. Seventeen percent of them do not. Of the organizations that do, 62% send out between 1 and 5 releases a year, 26% mail out from 6 to 10 annually, another 11% send 11 to 25 annually, and 1% generate more than 25 press releases a year.

13. "Are your agency activities covered by local television or radio on a regular basis?"

Forty percent of the agencies reporting said that they are covered by television in their areas, and 60% are not. At the same time, 45% of the agencies responded that they had regular radio coverage, while 55% do not.

Question number 14 is used to determine how the responding staff member evaluates the importance of mosquito control public education activities.

14. "How would you rank public education as an element of a comprehensive mosquito control program?"

The response choices for this question are: "More important than chemical, biological or physical control"; "As important as chemical, biological or physical control"; "Not as important as chemical, biological or physical control, but should be used where practical"; and "Public education should not be a part of a mosquito/vector control program." Of the 138 agencies responding, 10% said they thought that public education is more important, 50%

felt that educational activities are as important, and the remaining 40% indicated that public education is not as important as the other three elements of mosquito control. None of the agencies responded that public education should not be a part of a mosquito/vector control program.

15. "If you have an active public education program, how would you rate its overall effectiveness?"

In retrospect, this question should have offered more specific response choices. Because it did not, each answer required subjective interpretation and assignment into one of six categories. Those categories are "Excellent," "Good," "Fair," "Poor," "Variable" and "No Opinion." The results of this question are as follows: 3% replied "Excellent," 31% stated "Good," 16% "Fair," 11% "Poor," 2% felt their programs were variable, and 37% gave no opinion on the effectiveness of their public education programs.

SURVEY ANALYSIS

There appears to be a relationship between diversity of control programs and a tendency to allocate a larger percentage of funds to public education. The reporting agencies that do other vector control in this country allocate an average of 2.3% of their annual budgets for educational purposes, while the agencies that control only mosquitoes earmark an average of 1.2% of their budgets for this type of work.

Responses to the second question show that the majority of the reporting agencies (86%) provide the public some form of informational pamphlet or brochure on the subject of mosquito prevention and control. The conclusion to be drawn from these data is that most agencies make an effort to provide this service to the public (Table 2).

The responses to question 3 also indicate the desire of most mosquito control agencies to provide certain fundamental educational services to the public. Eighty-six percent of the responding United States agencies indicated that they made some effort to provide educational presentations to a variety of audiences. This activity also seems to be a basic obligation that many organizations attempt to fulfill.

The responses to question 4 indicate to whom American mosquito control agencies aim their educational efforts. Schools are ranked highly, with 43% of the agencies responding that they put forth most effort in their attempts to schedule educational presentations to public schools. Thirty-eight percent of the agencies allow equal effort to schools. Only 19% of the reporting agencies indicated that they made lit-

tle or no effort in making public school presentations. As a rule, schools are ready-made vehicles for educational presentations, and are easily scheduled through the central school district office or regional department of education. The same is usually true of service and fraternal organizations, which are always looking for speakers for their meetings. Eleven percent of the United States agencies put forth most effort, and 52% expend equal effort to Rotary, Lions, Elks and similar organizations. Homeowners' associations and political bodies were given the least amount of effort, with only 47% of the agencies allowing most or equal effort in each of these audience categories. All other special-interest groups were evenly divided, with 50% of the agencies giving most or equal effort to these groups and 50% giving least or no effort to special-interest groups.

These data indicate that much more effort could be applied to a more diverse group of audiences. It may be difficult for agencies to make contact with these groups on a regular basis, in order to announce the availability of these kinds of programs. This could be one reason that these groups are not given a higher priority by these agencies.

Responses to question 5 show a correlation between the size of the agency staff and the percentage of total staff time used for public education activities. Mosquito control agencies in the United States that have fewer than 10 employees reported that they devote an aggregate of 12.8% of their staff time to public education. Those that employ more than 10 persons use an aggregate average of 21% of staff time for these activities. It is concluded that agencies with a larger number of employees tend to devote more staff time to public education efforts than do the smaller organizations.

Question 6 responses indicate that in most agencies, the manager/director is the primary staff member doing public education work. Seventy-three percent of the agencies have their chief executives performing educational tasks. Only 11% of the United States mosquito control agencies reporting have an educational specialist on staff.

The manager/director of 81% of the reporting agencies utilizes a maximum of 10% of his or her staff time for public education activities, according to responses to question 7. It must be concluded from the responses to questions 6 and 7 that public education activities are given a low priority, in terms of both allocation of staff time and the creation and use of staff positions (educational specialist, for instance). By virtue of their job description, these employees would be expected to devote a greater amount of time to educational efforts.

As has been previously discussed, question 8 shows that 97% of the agencies spend up to 10% of their annual budgets for public education. The remaining 3% allow more than 10% for use in these activities. A full 10% allocation to public education is probably an adequate

percentage of the annual budget for an agency committed to a vigorous public education program. However, agencies actually reported an average budget allocation of only 1.7% for this type of work. These percentages seem inadequate for strong public education programs

Table 2. Recap of United States agency survey (193 agencies were contacted, 138 responded and the response was 72%).

Question	Response	Percent	
1. Control other vectors.	Yes	43	
	No	57	
2. Provide mosquito control literature.	Yes	86	
	No	14	
3. Make educational presentations available.	Yes	86	
	No	14	
4. Level of effort to schedule presentations to various groups.	Most effort	Schools	43
	No effort	Homeowners' assoc.	29
5. Number of full-time employees.	1 to 10	65	
	10 or more	35	
6. Staff member responsible for public education.	Manager/Director	73	
	Biologist/Entomologist	33	
	Educational specialist	11	
	Other	21	
	None	2	
7. Percent of total staff time in public education activities.		Less than 10%	More than 10%
	Manager/Director	81	19
	Biologist/Entomologist	76	24
	Educational specialist	54	46
	Other	63	37
8. Percent of total annual budget earmarked for public education.		Less than 10%	More than 10%
	Average % of budget for all reporting agencies	97	3
9. A. Does your governing body participate in public education activities. B. Of those answering "yes" to what extent?	Yes	33	
	No	67	
	Very involved	7	
	Moderately involved	15	
10. Offers facilities tours to groups.	Minimally involved	78	
	Yes	71	
11. Uses educational displays.	No	29	
	Yes	51	
12. Sends out press releases.	No	49	
	Yes	83	
13. Are activities covered by local television or radio?	No	17	
		TV	Radio
14. How would you rank public education as an element of comprehensive mosquito control?	Yes	40	45
	No	60	55
15. How would you rate your public education program?	More important	10	
	As important	50	
	Not as important	40	
	Excellent	3	
	Good	31	
	Fair	16	
	Poor	11	
	Variable	2	
	No opinion	37	

when compared to the average 30% of the total budget earmarked for chemical control reported by United States mosquito control agencies in 1976 (National Academy of Sciences 1976, Vol. V, p. 60).

The use of members of the agencies' governing bodies has been advocated for public education activities on behalf of the mosquito control agencies. They are usually well-known, active, and influential in the community. Each is usually capable of providing basic information on mosquito control, as well as preventive measures to the public that he or she represents. The responses to question 9 indicate that governing body members are being underutilized for public education work within the community. Sixty-seven percent of the reporting agencies said that their policymakers did not involve themselves in educational work. Of the agencies that do involve their governing body members in this type of activity, 78% reported only minimal involvement. One must conclude that a great deal more responsibility for public education could be assumed by members of the agencies' governing bodies.

The responses to question 10 show that the majority of mosquito control agencies offer group tours of their operational facilities. This is an excellent way of introducing the public to information concerning mosquito prevention and control. It does, however, require manpower allocation, if done with any frequency.

The question 11 responses show that many agencies do not take advantages of opportunities to present mosquito control displays at fairs, schools and libraries. Of the agencies, 51% regularly participate in such activities. These efforts require some capital outlay for the displays themselves, as well as staff expenditure to man them. Here again, an available public education opportunity appears to be underutilized by the mosquito control agencies in this country.

The response to the twelfth question shows that mosquito control agencies in this country maintain frequent contacts with the press. Eighty-three percent of the agencies issue at least one to five press releases per year pertaining to mosquito prevention and control. Issuing press releases is not an expensive activity, but it does require staff time as well as coordination with local newspapers. It may be one of the most basic and useful public education tools available to mosquito control agencies.

Question 13 responses indicate that electronic media such as radio and television are not as aggressively exploited by this country's mosquito control agencies as they could be. Only 40 to 45% of American agencies are covered by these media. These two media are ex-

cellent vehicles for public education. News and public service programs frequently are in need of human interest or real news stories. As an example, an announcement that an agency is using a totally new agent for mosquito control, such as the bacterial pathogen, *B. t. i.*, will usually bring a response from radio and television reporters in most areas. It appears that American mosquito control agencies need to actively work with the electronic media much more than they apparently are at this time.

The responses to question 14 seem to contradict most of the data analyzed thus far. Sixty percent of the American mosquito control agencies that responded stated that their management felt that public education is either more important or as important as chemical, biological or physical control. One must conclude that while public education is held in high regard by the majority of American mosquito control workers contacted, its practical implementation falls far short of what could be done with some redirection of agency resources.

Question 15 will not be used as part of this analysis, due to its poor construction and the need to subjectively interpret the responses.

CONCLUSIONS

The result of analysis of the foregoing data shows that the original hypothesis of this study is correct. Public education is regarded, at least philosophically, as a worthwhile element of comprehensive (or integrated) mosquito control by most mosquito control workers. However, in terms of effort in staff time allocation and use, as well as financial resource allowance, public education activities are not engaged in as frequently as are the primary elements of comprehensive mosquito control. The reasons for this contradiction are not clear. However, the following factors may shed light on attitudes of mosquito control workers toward implementation of broader public education programs.

BUDGETARY CONSTRAINTS. All mosquito control agencies surveyed in the study are public, tax-supported organizations. Revenues of these agencies have seen significant reductions, or at the very most seen only modest increases in recent years. For this reason, scarce resources tend to be utilized for more traditional methods of mosquito control. The amount of money used by 106 American mosquito control agencies surveyed in fiscal year 1975-76 was \$35,403,366—an average of \$333,994 per agency (Challet and Keller 1977). In the 1979-80 fiscal year, those same agencies expended \$44,946,401, or an average of \$424,023 per organization. In the five year period from

1976 through 1980, the surveyed mosquito control agencies' budget averages increased by only an average of 5.4% per year. This is significant, as this country's average consumer price index (a measure of inflation) increased 5.8% in 1976, 6.5% in 1977, 7.7% in 1978, 11.3% in 1979 and 13.5% in 1980 (Statistical Abstract of the United States, 1984). This calculates to an average 8.9% annual inflationary increase, which is 3.5% more per year than these agencies budgets increased in the same time period.

ADHERENCE TO TRADITIONAL PROCESSES. Mosquito control workers have successfully used a variety of chemical pesticides for over half a century. Integrating a familiar process such as routine chemical application with a less familiar one such as public education may be difficult for mosquito control managers and policymakers. This may explain many workers' reluctance to pursue public education in a more routine way.

POLITICALLY EXPEDIENT SOLUTIONS VERSUS MORE PERMANENT, LONG-TERM SOLUTIONS. The use of chemical pesticides to control mosquitoes gives rapid and noticeable results in the majority of control situations. Development and implementation of a public education effort to support the total control program, however, requires a much longer period of time, and tangible results may not be seen for years. Program effectiveness is also difficult to measure and evaluate. All mosquito control agen-

cies surveyed are public organizations governed by a political body. It may be that the political reality of public pressure for immediate control results (especially where a severe infestation or disease is present) may slow the development of individual mosquito control agency operational public education programs in the United States.

ACKNOWLEDGMENTS

I gratefully acknowledge the assistance and support of colleagues and friends Gilbert L. Challet, Justine Keller and Viki L. Blaylock.

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