

Baltimore's Community Rat Control Program*

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POPULAR demand for a reduction of the property damage and disease hazards caused by rats in residential communities, and a wartime need for extensive field tests with ANTU raticide have resulted in the development of an unusual type of program of rat control in Baltimore, Md. This program emphasizes suppressive measures as opposed to exclusion measures (rat-proofing), and is based on the fundamental premise that the rat population of a city block is essentially isolated so that it can be treated as an independent unit. Management of block programs including the execution of periodic eradication campaigns is, in most cases, handled by block residents themselves under the supervision of a central city organization. Business districts are treated as demands arise, but emphasis is placed on residential communities for which the system appears to be particularly applicable.

HISTORY AND SCOPE OF THE PROGRAM

About 200 residential blocks were used as a testing ground for new thiourea rat poisons by Dr. C. P. Richter in the fall of 1942.¹ Results in many instances were good and the recovery rates of the decimated rat population were unexpectedly slow. On the basis of these successes, the City of Baltimore undertook an ambitious city-wide program based on the block unit principle. An organization was set up in June, 1943, with a field crew of from 8 to 15 men, and about 1,877 city blocks were treated before the end of 1944. A system of volunteer inspectors was concurrently organized to report persistent infestations and reappearances in treated blocks, and to request follow-up treatments as needed. Many of the block campaigns completed during the period were highly successful; a few were unsuccessful.

Encouraged by a favorable public response, the work was reorganized as a Division of the Bureau of Street Cleaning on January 1, 1945. The program was continued in much the same manner as in 1944 except that new emphasis was placed on volunteer coöperators who were authorized to do the poisoning work in their home blocks after receiving appropriate instructions. By the end of 1945, 2,120 citizens had registered as volunteer workers in the program, and 4,160 city blocks had been treated one or more times with a total

* A municipal enterprise supported by city appropriation and established in January, 1945, as a Division of Rodent Control in the Bureau of Street Cleaning. Research studies were conducted partly under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and The Johns Hopkins University Medical School, and partly under a grant from the Rockefeller Foundation International Health Division to The Johns Hopkins University, School of Hygiene and Public Health.

† Contribution from the Rodent Ecology Research Project, Department of Parasitology, The Johns Hopkins University, School of Hygiene and Public Health, and The Psychobiological Laboratory, The Johns Hopkins Medical School.

of approximately 100,000 pounds of poisoned bait.

Special attention was given to repeat treatments during the first 6 months of 1946, but 964 new blocks were poisoned, raising the total of blocks treated to 5,574 out of about 6,800 in the city.

ENVIRONMENT

Baltimore is a thriving seaport city of 860,000 people, augmented during recent years by an additional 70,000 war workers. Residential structures in downtown areas are almost entirely row houses, two or three stories high, constructed of brick. Small, fenced back yards are usual, opening in the rear onto paved alleys which run through the center of each block and are used for collecting trash and garbage.

The rat population, all brown rats (*Rattus norvegicus*) except in a few waterfront buildings, averages about 75 per block in downtown residential areas.² This is believed to be roughly comparable with rat population levels in other cities along the North Atlantic Coast and in the Midwest. About three-fourths of the rats in residential areas live outdoors in yards, garages, and sheds, and one-fourth, indoors; very few rats are found in the sewers.

PLAN OF PROCEDURE

Areal Units

The adoption of an essentially isolated areal unit was found to be fundamental to successful rat control in Baltimore. Eradication jobs in single "open" buildings and in small, non-isolated sections of a block have given very incomplete and temporary relief and frequently have led to prejudices against baits among surviving rats, a condition which seriously complicates subsequent control efforts.

Experiments with marked rats have demonstrated the essentially isolated character of a city block, the area bounded by four city streets³; and ex-

perience gained in poisoning over 5,500 city blocks has indicated the adequacy of this unit for control operations.

In most cases a plan is followed for coordinating eradication campaigns in neighboring blocks so that sizeable tracts are covered in a single operation. This is largely a measure for convenience and efficiency, for there is no indication at present that isolated blocks recover or are reinvaded any more rapidly after treatment than grouped blocks.

Organizing Block Rat Control Programs

Since January, 1945, the program has emphasized the scheme of getting citizens to do the work themselves with instructions and materials furnished by the city. Blocks are organized for treatment by soliciting interest among residents or by persuading those people who write or telephone the city office for help that the solution to their personal problem with rats lies in a community program in their block.

Once a person has been found who will assume the responsibility of organizing a block team, mimeographed bulletins prepared by the city on "How to Organize and Practice Community Rat Control" and "Rat Control in Urban Residential Baltimore" are forwarded together with a petition form which may be filled out and returned, ordering the baiting materials and instructions necessary for staging a community campaign.

Upon receiving a completed petition form, the city issues an identification card to the responsible leader who is designated as the "block captain." A community meeting may be scheduled and field demonstrations of eradication procedures are given by experienced city men before any work is undertaken.

Not all blocks are handled by volunteers. A city crew performs the work in cases of special urgency and in blocks where a local lack of public response has resulted in the leaving of heavy infestation spots in otherwise clean sections of the city.

Eradication Campaigns

The first activity of a block rat control team is the staging of an intensive eradication campaign through all buildings, yards, and lots in the block. This is done in a single operation. The steps of an eradication campaign are:

1. *Notification of block residents*—Residents are notified of a prospective campaign by means of placards which are posted in conspicuous places through the block and by notice cards which are distributed to all houses. The notices inform the residents of the intentions of the volunteer team and the mutual benefits which can be had through coöperation. They ask resident to clean up all exposed garbage, to leave their gates and outbuildings unlocked at a designated time and to confine their pets. At the same time they warn of the potential danger of the poison to unconfined pets and irresponsible children.

Requests to withhold poison from specified places are, of course, honored. Direct verbal permissions are sought whenever possible, but are not required. A city ordinance directing that properties shall be maintained free of rat infestation may be invoked in stubborn cases as needed.

2. *Distribution of poison bait*—Poison bait, generally ANTU at 3 per cent in finely ground corn,³ is distributed one or two days after notification or as soon as weather conditions permit. Each registered worker takes a bucket of prepared bait, as supplied to a local headquarters by the city crew, and proceeds through the block from the alley, placing small spoonful-sized piles in exposed and protected sites around all real or potential harborage, food sources, runways, and trails in yards and buildings. From 10 to 50 piles may be placed in an infested property, and from 10 to 40 pounds of bait is commonly used in an average sized block. Thoroughness is emphasized as fundamental to success; and places which cannot be entered are listed for further inspection and attention.

Prebaiting with unpoisoned food for several days or weeks before poisoning, as recommended by various workers, was tried experimentally in sample blocks in Baltimore. Its value, as demonstrated in these tests, did not appear sufficient to warrant the adoption of a prebaiting procedure which would greatly increase and complicate the work of the volunteer coöperators.

3. *Check-up of results*—When ANTU baits are used rats will die during the two days fol-

lowing treatment. Counts of dead rats are made during these two days, and all signs such as rat holes and fresh droppings obliterated on the second or third day, in preparation for further checks on survivors. Residents are asked to sweep up and discard all dead rats and all uneaten bait. A report on the operation is then prepared by the block captain and submitted to the city office.

4. *Follow-up*—Eradication campaigns are followed up immediately with special measures at all sites of persisting infestation. City crews assist in this work with burrow fumigation and traps. (This phase of the work is, at present, inadequately done as a result of poor reporting and technical difficulties.)

5. *Repeat campaigns*—Complete eradication is rarely achieved in a campaign. Thus, repeat treatments are usually indicated once a year and sometimes more often.

Experience with campaigns in the Baltimore program is still limited. The repetition of ANTU-corn campaigns at yearly intervals has been successful, but repeat campaigns at shorter intervals have given some poor results, apparently as a result of bait refusal. The present policy is, therefore, to use ANTU-corn in overall block campaigns once a year, and other measures, such as burrow fumigation, trapping and poisons with alternate poisons and baits, in interim treatments, as needed.

Sanitation Program

Community sanitation, particularly garbage disposal, is regarded as an integral part of rat control in the Baltimore program. Volunteer rat control teams usually take considerable interest in correcting insanitary conditions in their blocks. As an aid in this work one or two sanitary inspectors are assigned to the Rodent Control Division by the Health Department, and sanitary inspector authorizations are given to a limited number of volunteer leaders. More than a thousand notices and several dozen summonses have been handed out in connection with rat control programs during 1945 and the first six months of 1946. As a result of these activities thousands of regulation garbage containers have been installed in treated blocks and hundreds of "unsanitary conditions" eliminated.

Ratproofing Program

Householders are encouraged and instructed in methods of repairing breaks and closing openings in their houses as a means of protecting their homes, breaking up the rat ranges within the block, and delaying reinfestation.

ADMINISTRATION OF PROGRAM

A small office force and field force are maintained by the city for the purpose of: (1) handling requests and complaints, (2) organizing volunteer groups, (3) supervising control operations, (4) preparing the delivering baiting materials, (5) giving demonstrations and talks to volunteer groups, (6) coördinating field programs, and (7) conducting eradication work in unorganized blocks. A budget of \$44,000 served to run the program in 1945; the major items of expense were labor and baiting materials.

The coördination of volunteer programs is facilitated by a system of regional and district leaders. Following the pattern of Civilian Defense, the city is divided into ten districts, each placed under the direction of a volunteer "Chief Inspector." The subdivisions and the alignment of officers within a district vary according to the conditions and wishes of the local groups. District captains and their assistants do most of the work of organizing the coördinating block programs. A close coöperative arrangement is maintained between the city officials and the research departments of The Johns Hopkins University, where studies on rat ecology and rat control techniques are conducted.

RESULTS OBTAINED

The success of block eradication campaigns and of the overall program may be evaluated on the basis of: (1) public reaction, and (2) measured changes in the rat populations.

Public Reaction

Public reaction often gives an errone-

ous impression of the actual results obtained. It is, however, a measure of the popularity and hence the "health" of the program. Enthusiasm is generally proportional to the number of dead rats recovered rather than the percentage killed and, therefore, is greatest in warm weather when more rats die in places where they are readily found. There is some loss in enthusiasm in repeat campaigns which give poor kills even when the workers recognize that the small recovery may reflect a reduced capital population. Conspicuous failures, as they occasionally occur through faulty technique, are quite damaging to volunteer morale.

Volunteer leaders, taught to expect a 90 per cent reduction, reported their reactions as follows during 1945: Good, 178; Fair, 65; Poor, 48.

Block residents who took no part in the program were questioned in one group of blocks a year after the first poisoning campaign. Their reactions on the success of the campaign were as follows: Good, 73; Fair, 9; Poor, 3.

Measured Results

Measurements of the success of poisoning campaigns were obtained by making detailed surveys in sample blocks before and shortly after treatment.⁴ A comparison of rat signs in these pre- and post-treatment surveys indicates that reductions of between 85 and 95 per cent are commonly obtained in residential blocks when the job is done thoroughly. Kills of from 50 to 80 per cent are encountered where the operators miss a few important yards or buildings, or where recent applications of poison have resulted in bait prejudices among local groups of rats. Heavy rains on the day of poisoning may result in a poor kill, and an inferior quality of corn has been responsible for some poor results during periods of grain shortage.

Periodic censuses following poisoning campaigns show that a decimated popu-

lation in a block will usually increase at a rate of between 2 and 6 per cent of the original population of the block per month.⁵ Thus a population reduced to 10 per cent of its original level requires from 15 to 44 months to recover. The average block reaches 58 per cent in one year and will approach complete recovery in 22 months. Populations reduced to 5 per cent or less of the original level often show retarded or delayed recoveries, so that the total period required for recovery is considerably prolonged.

With these reductions and rates of recovery it is clear that repeat campaigns at yearly intervals can hold a rat population well below its saturation level. Where successive campaigns serve to reduce the population to the same point (about 10 per cent of the original level) each year, the average population curve will describe a course like that shown in Figure 1, and the number of rats present will never exceed about 58 per cent of the original population. Should each successive campaign succeed in removing 90 per cent of the rats present, the population can well be forced down to a level from which recovery is very slow and irregular or is delayed for an indefinite period (E in

Figure 1). Special measures at such times may lead to complete extirpation. In one test block which was completely cleared of rats by persistent efforts, no rats reappeared for three years although neighboring blocks were moderately infested.⁵

Significance of Results

The value of control of the type here described is, of course, limited to the area treated and must be measured in terms of the local destructiveness of rats. Under most circumstances the destructive potentialities of a rat population are probably proportional to its size, and the benefits derived from a reduction campaign proportional to the reduction effected. Thus, in a block population under annual treatment, following the course shown in Figure 1, the total benefits may be appraised by measuring the area above the population line. In this case the benefits vary from 42 to 90 per cent and average 66 per cent throughout the year (C-D in Figure 1.) The greatest benefits may be realized by scheduling campaigns so that the lowest population levels coincide with the season of greatest local destructiveness or disease hazard, generally the summer.

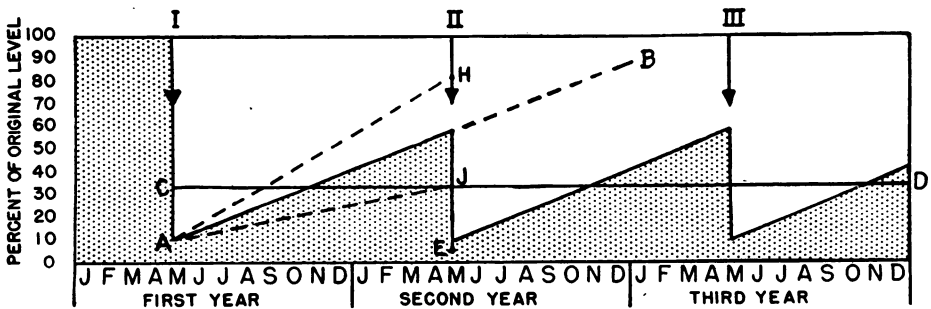


FIGURE 1—Fluctuations of a hypothetical (average) rat population subjected once a year to a thorough eradication campaign. The reductions effected by poisoning (vertical declines) and the slopes of recovery (sloping inclines) are based on actual measurements made on experimental block population in Baltimore. The line A-B represents an average recovery rate; A-H and A-J represent the extremes encountered in measurements in 23 sample blocks.

LIMITATIONS AND HAZARDS

Baltimore's program of rat control in residential communities as described in this report has a number of limitations which should be considered.

As with any type of suppression program, benefits can be measured only in short-term values. A number of improvements are believed to have been made over other types of suppression campaigns, but any long-term benefits must necessarily rest on continued public support. A serious accident resulting from misuse of poison or a few outstanding failures could greatly injure volunteer morale and thereby disrupt the whole program. Furthermore, it is a common attribute of human beings to drop their enthusiasm as soon as an unfavorable situation has been alleviated and before it has been eliminated.

After a series of comparative field tests, ANTU is still the only raticide considered effective and safe for this type of program.⁴ ANTU is of little value against roof rats (*R. rattus*) which occur abundantly in many cities, particularly in the South. When properly used in Baltimore, ANTU gave excellent results against brown rats (*Rattus norvegicus*), but irregular usage has already led to a number of local complications and failures in repeat treatments. A widespread dissemination of ANTU to householders, now that all government restrictions have been lifted, might seriously reduce the effectiveness of ANTU campaigns against brown rats.

Hazards to humans and to pets seem to be relatively small in the type of program used in Baltimore. Every available source of information points to a high tolerance to ANTU by humans, but the potential dangers are still incompletely known. Ten children have been reported to have eaten ANTU baits since 1943; all but one had their stomachs emptied by stomach pump, and none showed any ill effects.

Cats, chickens, and rabbits are rel-

atively resistant to ANTU poisoning, but dogs succumb to doses of as little as 50 mg. per kg.⁶ Several dozen dogs, mostly vagrants, have been killed in the Baltimore program. This number is very small, however, when compared with the number of dogs exposed. Close cooperation between dog owners and poison crews minimizes the hazard to dogs, but occasional slips are hard to avoid.

The question of personal and property liability among volunteer workers poses a minor problem which in Baltimore is handled, as it was with air raid wardens, by assigning all responsibility to the volunteer.

SUMMARY

A procedure for rat control in residential communities has been developed in Baltimore, Md., on the basis of intensive local eradication campaigns repeated at appropriate intervals by volunteer residents under city direction. Four-fifths of the residential blocks of Baltimore have been treated one or more times in the eighteen months since the start of the full-fledged program in January, 1945.

All work is done on an areal unit basis, the square city block being the unit employed. ANTU in ground yellow corn is used as the standard poison bait. Community sanitation and ratproofing are encouraged in conjunction with the baiting campaigns.

Reductions of 85 to 95 per cent are generally obtained in well conducted block campaigns. Populations so decimated usually require from 15 to 44 months to recover to their original levels. Repeat campaigns once a year can thus hold a block population well below its original level and reduce the annual rat damage by about two-thirds.

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A.D.A. Council Rules on Bone Meal and Flourine Products

The Council on Dental Therapeutics of the American Dental Association, Chicago, has recently ruled that bone meal preparations for the prevention of dental decay are not acceptable to the Council.

It is pointed out that during recent months there have appeared on the market a number of preparations containing powdered cattle bone, supplemented with vitamin D, for the treatment and prevention of dental caries. In view of the lack of evidence to show that they are effective for this purpose, preparations of bone meal for the treatment of dental caries are declared not acceptable for inclusion in Accepted Dental Remedies.

The Council has also considered the role of fluorine in dental caries with special reference to synthetic fluoride tablets. It is pointed out that the mechanism through which fluorine produces a lowered caries attack rate is not known. In the opinion of the Council there is no evidence that the protective mechanism, whatever it is, can be effective through fluoride-bearing water supplies in persons after they have reached the age when the teeth are fully formed. It also has not been demonstrated that

the ingestion of fluorine after the teeth are calcified will make the mechanism operative to arrest caries activity in man. They point out that, because of the great popular interest in the potential value of fluorine as an effective agent of caries control, there is ample opportunity for the exploitation of the public and of the professions through the sale of useless and even harmful preparations.

The Council has concluded with reference to many different tablet preparations containing some synthetic salt of fluorine and one or more vitamins, which recently have been offered that, though probably not dangerous in amounts recommended for daily consumption, fluoride added to diets already high in fluorine content or consumed in areas where water supplies contain significant concentrations of fluorine may constitute a health hazard. This possibility and the inconclusive nature of experimental evidence concerning their effectiveness render synthetic fluoride and fluoride-vitamin preparations for use in the treatment of dental caries not acceptable for inclusion in Accepted Dental Remedies at this time.