City of Berkeley
Department of Health and Human Services
Public Health Division

A Tool Kit for Rapid Epidemiologic Assessment in a Public Health Emergency, Berkeley, California

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Rapid Epidemiologic Assessment for a Public Health Emergency, Berkeley

EXECUTIVE SUMMARY

Rapid Epidemiologic Assessment is an approach to estimating a population's needs by surveying a statistical sample of about 200 households clustered on 30 city blocks in the disaster area, which can be as small as a census tract (~4000 residents) or the entire city. In a 5-minute household visit using a standardized questionnaire, residents are asked about their health status and access to food, water, shelter, sanitary, gas/electric, medical and mental health care, communication/information, and other basic services. The results are statistically extrapolated to all households in the disaster area, and include the number of households and individuals with and without service. The results are typically available to emergency managers within 72 hours and the surveys can be repeated at weekly or other time intervals to monitor the impact of relief efforts and guide demobilization. The approach already has been successfully used in storms, floods, and other natural disasters (e.g., hurricanes Andrew, Mitch, Katrina).

This document describes the development of a REA methodology for the City of Berkeley and provides a tool kit for the implementation of a REA in the event of an actual public health emergency.

BACKGROUND

Rapid Epidemiologic Assessment (REA) is used to assess the needs of a population after a disaster or other public health emergency. The cluster sampling method of REA is modeled after the WHO's Expanded Program on Immunization (EPI), originally designed to estimate immunization coverage.[1]

REA using a modified EPI design has been used after hurricanes, floods, conflicts, earthquakes and tsunamis. It is an essentially a two-stage cluster sample of 30 clusters and 7 households within each cluster (N=210). The sample design, which is easily applied in the field, generates valid and reasonably precise population estimates. The sample design facilitates a survey that takes days, rather than weeks, to complete. In general, survey questionnaires are short and consist of close-ended questions. Domains of questions vary but most include questions on: water and food access, vulnerable groups, utilities, injuries and medical needs. Thus, REA responds to the need for actionable management information in a time-urgent setting.

In contrast to determining frequency of health events of individuals, REA has been modified to sample households rather than individuals in each cluster. The method of selecting clusters has varied in response to the availability of population and geographic information. Hlady *et al*[2] used a grid method to identify and randomly select clusters to perform a REA after Hurricane Andrew. After an earthquake in north-western Turkey, Daley *et al*[3] lacked detailed maps of the area to be surveyed and adapted the methodology to randomly select clusters by walking in random directions from a starting point. Methodology for selecting individuals or households within clusters also varies. In general, due to a lack of sampling frame, households are randomly selected in the field. Using different methods for selecting the first house and continuing from the first house to six other consecutive houses, Drysdale *et al*[4] selected households by walking in a random direction (selected by the toss of a coin) from the center of the cluster, and proceeded from the first house to interview households until 7 interviews were completed. Grais *et al*[5] state that this method of selecting households is biased because it favors houses closest to the center of the cluster. Grais *et al*[5] propose using a grid or a GPS device to select a starting point and then continue to survey 7 households from the starting point. Extensions of the REI[1] incorporate a weighting procedure for each selected household, making it possible to estimate the number of individuals in the pre- and post-disaster population.

The purpose of this report is to document how existing REA methodologies have been adapted to the population and geographic information systems of the City of Berkeley and to illustrate the REA tools in a hypothetical citywide disaster. The goal is to provide the City's emergency managers timely and accurate information on which to base their decisions.

METHODS

Target Population and Sample

The City of Berkeley is located on the east shore of the San Francisco Bay and north of the city of Oakland. Berkeley occupies 10.5 square miles of land, and, in 2008, its ethnically diverse population was estimated by the California Department of Finance to be approximately 106,700 residents. Berkeley is home to a major campus of the University of California, and has a reputation for its sophisticated solutions to urban social issues. Berkeley can be topographically and socioeconomically subdivided into "flatlands" in the south, west, and central areas and "hills" (maximum elevation 1,320 feet above sea level) flanking its north and east boundaries.

Significant health disparities occur in residents in the south and western census tracts, where a large proportion of the African American and Latino communities live.[6]

A disaster can affect any part of the City of Berkeley, and the geographic extent of a disaster area for a REA can be built from small, modular geographical units. Like most fully incorporated municipalities in the United States, Berkeley is divided into census tracts. Berkeley's 33 census tracts are comprised of roughly rectangular geographic units 0.25 to 0.3 miles (width) by 0.5 to 1 miles (length). Irregularly shaped census tracts predominate along the waterfront (1 census tract) and the hill ridgeline of the north-east border (5 census tracts). For REA, any combination of census tracts, whether contiguous or not, are used to define the geographic boundaries of a disaster area.

Sample Design and Data Sources

The sample design for REA is a two-stage cluster sample with U.S. Census blocks as the primary sampling unit and households selected within blocks. Blocks are selected proportional to the number of households on the block, or probability proportional to size (PPS), rather than simple random sampling. Census blocks are polygons, and, in urban areas such as Berkeley, are generally rectangular in shape and include only one side of a street (e.g. even or odd street numbers). The geographic boundaries of U.S. Census blocks are publicly available for geographic information systems (GIS) from the U.S. Census.[7]

For the purpose of tax assessment and other governmental functions, cities and counties further divide blocks into parcels of land ("real property with an owner") and, in the case of residential property, housing units within parcels. The City of Berkeley maintains a geographic database of parcels, their land use descriptions (Table 3), and addresses of housing units within parcels. The addresses include street name and apartment number, and for the purposes of REA, these addresses constitute a household in which related or unrelated persons live together. In July 2008, the City's GIS database had 50,323 residential addresses. The parcel database in considered highly accurate, although some housing units may not be registered with the City or county tax assessor. In a separate analysis to validate the parcel list, the number of housing units per block was found to be highly correlated with those enumerated in the 2000 Census.[8]

Census block identifiers (block FIPS) of address points were assigned using a spatial join (Appendix A) in ArcGIS 9.3 (ESRI, Redlands, CA, www.esri.com). Table joins using parcel ID as the primary key were used to assign residential land use codes from parcels to address points. The resulting database was exported as a plain text file, and is input to a statistical package (STATA 10, StataCorp, College Station, TX).[9]

A batch program in STATA (cluster_sample.do, Appendix B) counts the number of households per block in the disaster area. For a citywide disaster, this would be all 1029 census blocks. PPS sampling is also implemented in the STATA batch file as a systematic sample using a sampling interval of 1667 (50,323/30) and a random start (random number between 1 and 1667). Blocks were sorted in geographic proximity order using their FIPS number. The cumulative number of housing units from 1 to 50,323 was calculated. Multiples (1x, 2x, 3x, 4x, . . . 30x) of the sampling interval were added to the random start number to create 30 sample selection numbers. Thirty (30) block clusters were selected in which the sample selection number fell in the block's sequence of cumulative housing units.

After 30 blocks are identified, the STATA program selects 7 housing units per block using simple random sampling (SAMPLE command) for each of the 30 blocks, giving a total N of 210 housing units in the sample. Output of the STATA batch program includes two plain text files:

- all housing units on a sample block sorted by street name in ascending street number order (Table 2), and

- sample households on a sample block.

The first file facilitates the enumeration of households on the sample block for field operations. The file of sample households can be imported into an MS Access database which can be used to generate forms (See instrument below and Appendix C) that are pre-populated with address and block ID and household ID.

Using table joins in ArcGIS, the file of sample blocks and sample households is used to create route maps that visualize and list sample households for persons administering the REA questionnaire (Figure 1-2). Appendix C has additional route maps for each of 30 blocks for a hypothetical citywide emergency.

Instrument

The strategy was to develop a comprehensive questionnaire with the ability to pare down to domains that are relevant to a specific disaster. An examination of instruments used in previous REAs suggested 13 potential domains for REA (Table 3). The observation that disaster victims resist evacuation if pets are not cared for[10] led to the creation of a new domain. Questions in each domain were compiled with minor changes from 4 previous rapid needs assessments (Hurricanes Isabel, Charley, Katrina, and Wilma).[11-15] The items on pets were reviewed by a representative of the City of Berkeley animal services department (Katherine O'Connor, Animal Services, City of Berkeley, 2008). A draft of the questionnaire was submitted to an external reviewer (Wayne Enanoria, University of California, Berkeley) whose comments and suggestions were incorporated into the final version (Figure 3).

Questionnaires in REA are typically administered in face-to-face interviews in which responses are recorded manually using paper and pencil, or electronically using a hand-held computer (pocket computer, PDA). Several versions of the same questionnaire were developed: 1) a data entry form in an MS Access database, and 2) a paper-and-pencil questionnaire, which is a PDF, file print-out of the MS Access data entry form. A form for a PDA running the Windows mobile operating system 5.0 and HanDBASE form generation software (DDH Software, www.ddhsoftware.com) is under development.

Community Engagement/Participant Recruitment

<u>Pre-disaster</u>

A successful implementation of a door-to-door survey depends on a receptive community, even in the setting of a disaster. Relationships cultivated before the disaster will inform community engagement during a disaster. For this reason, community involvement in pre-disaster preparedness is essential.

Community-based organizations (CBOs) can play a special role in rapid epidemiologic assessment. As a trusted community reference steeped in the knowledge of a particular

community, CBOs can provide a context for REA organizers and a vehicle by which a community may be notified in advance of the REA. CBOs may be able to allay potential suspicions of an official governmental presence in neighborhoods where members of their service population reside. CBOs may alert survey organizers of special needs and concerns of community members that may impact the survey. They may also provide an endorsement and technical assistance such as assisting the development of the content of surveys (e.g., how members get information), providing language translation, providing survey personnel, and educating survey staff on appropriate and respectful treatment of persons from diverse cultures.

The Public Health Division is creating an alliance with a network of CBOs that serve vulnerable populations in Berkeley (Berkeley Emergency Action and Communication Network, BEACON). Activities include informational/exploratory meetings with key agencies, market research to explore how CBOs receive emergency information and how they communicate with their service population, disaster preparedness training of city-contracted CBOs, and the creation of a database of CBOs.

Post-Disaster

Key stakeholders should be notified that a REA is being planned or underway (Table 4). For disaster management, Berkeley uses the Incident Command System (ICS), which is a standardized approach to organize the personnel and functions of emergency response.[16] The incident commander (Berkeley City Manager) and section chiefs in the citywide emergency operations center (EOC) are key consumers of the information gathered in a REA. Notification of law enforcement, fire, and public works personnel is essential so that surveyors can be authorized to enter areas with restricted access. The REA itself is a type of mobile, field operation that fits into an ICS site management model (discussed below).

Field Operations

Field operations includes organization of work flow and staffing; creation and scheduling of routes; coordination, supervision, and assignment of interviewers to block routes; training of survey teams; provisioning of staff (food, safety items, and administrative forms); validation of the block sampling frame and tools to resample households in the field, if necessary; administration of questionnaires; data collection and quality assurance; supervision of staff; and communication between staff.

Organization Work Flow

We envision a survey manager, an analyst, a modular number of data collection teams, and a data entry clerk to carry out the steps of resource planning, coordination, data collection, analysis, and reporting. We propose that each data collection team have 6 members including 1 supervisor, 2 pairs of interviewers (N=4), and 1 runner (Figure 5). This does not include persons who provide clerical support or maintenance of the city's IT and other infrastructure.

Based on the boundaries of the disaster area, the survey manager will direct the analyst to run the batch files in STATA and ArcGIS 9.3 previously described (Methods. Target Population and Sample) to select blocks and households for interviews. If the disaster area comprises the entire city and no computers are functioning, forms in the Appendices of this report can be used.

The basic work cycle of the data collection team consists of interblock travel, enumeration of housing units on block, and conducting 7 interviews per block. After several of these cycles, the

team converges at a central point with a supervisor and a runner, who transports completed questionnaires (or electronic media) to a data processing center. These basic work cycles are bracketed by training/briefing sessions and daily travel from headquarters to the first block, and travel from the last block to HQ at the end of a work day and debriefing. Paper forms or media collected by the runners or hand carried by data collection teams at the end of their work shifts is key entered by the data entry clerk. The analyst runs a pre-existing batch computer file to generate statistical estimates. The analyst generates a technical report from a template, and prepares a slide show from a template for the EOC management.

Estimate of Throughput

We estimate (see Pilot in Results) that the basic data collection cycle takes approximately 54 minutes per block, assuming:

- interblock travel on foot takes 15 minutes on average
- enumeration of blocks is done in 15 minutes
- interviews take 6 minutes to complete, including travel between households on a block
- interviewers conduct interviews alone rather than in pairs so that there is a maximum of 4 interviews per interviewer per block (4 interviews $\times$ 6 minutes/interview = 24 minutes)

Given these assumptions, each interview pair can complete up to 8 blocks and 56 interviews in an 8 to 9 hour workday. Likewise, each 6-member team can complete 16 blocks and 112 interviews per day. Under these assumptions, two 6-member teams could complete 210 interviews on 30 blocks in 1 day. A longer basic cycle will require either additional 6-member teams to conduct interviews for a fixed time (1 day), or an increase in the number of days for data collection.

Coordination of Staff and Routing

Blocks are geographically clustered into routes that provide clear lines of supervision, balance workload between blocks, and balance travel times from headquarters to blocks (Figure 6). The blocks comprising the four routes in Figure 6 were manually composed from visual inspection of the blocks in the sample. Routes with blocks far from headquarters and those involving strenuous walking to ascend hills had fewer blocks (6 vs. 8) to account for greater travel times. Automated tools and semi-automated can be used to assist route creation. These may include interblock travel time based on pedestrian flow models accounting for elevation, or simply dividing the interblock distance by an estimate of walking speed taking into account elevation. Appendix D provides alternative number of routes for interviewing under less favorable assumptions that have fewer blocks per route.

An Excel spreadsheet (Appendix E) was developed (using the spreadsheet TIME function) to help design a feasible 8-9 hour daily work schedule for each route. The inputs to the spreadsheet are the time (HH:MM) the workday starts and the duration of each activity. Travel time to and between blocks can be adjusted to reflect proximity of blocks in a given route. A hypothetical daily schedule is presented in Table 5.

Sample Frame Validation and Resampling

The first task upon arriving at a sample block is validating that the list of all households in the parcel database is the complete enumeration households. The pair of interviewers divide up the listings, checking off each house number and annotating addresses of demolished and

abandoned housing units and adding previously unlisted housing units to the end of the enumeration list. The revised total number of housing units is also entered onto a data collection form so that the probability of selection can be updated for the statistical analysis. If a discrepancy of greater than ±10% exists between the original listing and the actual enumeration in the field actual, resampling should be done. This "10%" decision rule balances the need for unbiased selection of households while maintaining the rapid nature of the survey. We recognize that undersampling of "mother-in-law" units (i.e. those few occupants per housing unit) may occur. A step-by-step procedure has been developed and field-tested for taking a systematic sample of 7 households (Appendix F).

Administration of Questionnaires and Completion of Forms

The surveyors packet includes questionnaires for household interviews (Figure 3) and additional forms to capture information on resampling and time accounting (Figure 4). If a hand-held device is used, paper-and-pencil back up should also be provisioned in case of an equipment malfunction or power failure.

The surveyors use the script on the cover of the questionnaire to introduce themselves. Household informants can be adults aged 18 years and older. If a household is completely destroyed or if a resident is not at home, the surveyors complete the form to the best of their ability, including gathering information from a neighbor. Also, if a resident is not home, surveyors may return at a different time during the same day in order to complete the survey, if resources and routing make this feasible.

Communication

The survey manager must be able to communicate with headquarters staff and supervisors, and supervisors must be able to communicate to their interviewers and runners. Depending on damage to infrastructure, telecommunications networks and modes of access (cell phones, Web-based hand-held devices) may be unavailable.

Several approaches can be used to facilitate communication with minimal dependence on electronic devices. Battery-operated walkie-talkies can be used in relatively small areas free of geographic and other physical obstructions. Creating designated meeting points for survey teams at specified times also facilitates communication, resupply, and may provide useful information about local conditions in which the survey is being conducted (e.g., impassable streets, down power lines, civil disturbance, etc.).

Supplies

The provisioning of staff includes food, water, protective gear and safety items, and tools for questionnaire administration. A list of supplies is provided in Table 6. Supplies will be distributed at the conclusion of the training session. Runners can resupply teams with handheld devices or charged batteries, paper questionnaires, food, water, and other supplies.

Training

A training program was created to rapidly train field teams. The program was adapted from a surveyor training developed by the Alameda County Public Health Department CAPE Unit.[17] The topics of the training include:

- Purpose of the survey
- Overview of cluster sample (blocks and households)
- What to do when you reach a selected block
- How to resample households in the field
- What to do with a non-response
- What to do with a refusal
- What to do when you reach the door
- How to use handhelds
- How to use radios
- How to stay safe
- A schedule of the day's activities
- List of items to bring

The topics were developed in 18 PowerPoint slides (Appendix G) and the training is intended to be delivered in a group setting in less than 1 hour. The handouts should be printed prior to any disaster to ensure a computer is not needed to complete the training.

Data Quality Control (Field)

A task of supervisors is to check the quality of data collected in the field, especially before questionnaires are passed to runners to bring to the data processing center. Additional data quality control is part of statistical analysis (see below).

Data Centralization

Runners are responsible for retrieving completed questionnaires and distributing supplies. While interviewers are surveying households, the supervisor remains at a designated location. At a specified time (e.g. 2-hour intervals), teams meet at the designated location. The supervisor leader then meets up with the runner. Runners deliver completed questionnaires or magnetic media to the central coordinating office to be entered/uploaded into a computer database. At the end of the day, the supervisor reviews the remaining completed questionnaires and returns the questionnaires to the central coordinating office, where the questionnaires are key entered into the computer database.

Data Management

Data from the questionnaires are input into a MS Access database. The database documentation includes a data dictionary (Appendix H), which provides variable names, operational definitions, storage type (text, numeric), length of fields, and valid code lists. This documentation is used to program edit checks in the key entry database form, and to define invalid data when analyzing outliers. The Microsoft Access database was used as a template in forms generation software (HanDBase), so that variable names, definitions, would be consistent independent of the source of data (paper forms, download from a handheld device).

Statistical Analysis

To assess data quality, each item is analyzed for outliers and for missing data. Patterns of item nonresponse may indicate that questionnaire items were not understood. The outcomes are calculated for households and for the population based on the number of post-disaster residents indicated in item 3 of the questionnaire (Figure 3). A batch file in STATA (cluster_analysis.do,

Appendix I) is used to generate the frequency distributions, taking into account the sample design and sample weight.

The STATA program also recalculates sample weights using revised data from the field (see resampling above). The analyses include the sample N, the weighted N, the weighted percent, and the 95% confidence interval for the weighted N.

Reporting

The output of STATA will be used to populate key tables in a technical report (Tables 6-7). The key tables will the basis for a brief PowerPoint presentation for the Emergency Operations Center (Appendix J).

Incident Command System

The personnel and workflow can fit into the Incident Command System (Figure 7) using a site management or point of dispensing (POD) model. The hierarchical command structure is made up of an incident commander who is served by units for planning and intelligence, (thinkers/planners), operations (doers), logistics (materials gatherers), and administration/ finance (payers). Collectively, personnel who embody these high level functions constitute an emergency operations center (EOC) that can expand and contract depending on the magnitude of the response to an emergency. A mobile field operation such as an REA can be established as a survey unit within the operations section of the EOC. Typically there is a Site Manager, which in an REA would be the Survey Manager. A Safety Officer attached to either the EOC or the Site Manager him/herself would assess physical, environmental, and social hazards (civil unrest, angry residents, etc.), facilitate countermeasures in coordination with police, fire, and public works personnel, and monitor employee health and safety during an emergency. If hand-held or other communications devices were used, the Site Manager may require Communications personnel to assist with maintenance and replacements. Depending on the scale of response, the four functional areas (planning & intelligence, operations, logistics, finance) may be reproduced at the site or be carried out at the EOC. For a relatively small survey like REA, many functions could be done at the EOC. For example, data collected by the survey teams could be key entered by a Data Unit (not shown) within the EOC Operations section. The personnel with GIS and statistical skills might include analysts assigned to the EOC Planning & Intelligence section.

Human Subjects

The rapid epidemiologic assessment is a public health activity. It is not a research project or a provision of medical services that falls under the Health Insurance Portability and Accountability Act (HIPAA). Nonetheless, treating subjects with respect and dignity and protecting their confidentiality is essential. The preface to the survey explains the project, the risks and benefits of participation in the survey, and safeguards on confidentiality, and who to contact if they have questions. In addition, participants are told that the data will be presented as aggregate statistics rather than individual responses. Participants are also given the right to refuse participations in the survey. Names, dates of birth, or gender of participants will not be included in data collection.

RESULTS OF A PILOT

A pilot of the rapid epidemiologic assessment was carried out on two blocks to gather planning data on the logistics of survey administration and validate the parcel database as a sample frame. A block in the Berkeley Hills was chosen because it is far from headquarters and requires a vigorous walking ascent of approximately 850 feet. Such a block represents those with the longest travel times from and to headquarters. This block also presented an opportunity to test the reliability walky-talkies in hilly terrain. A second block in the Berkeley flatlands was chosen to simulate survey logistics for a less physically challenging location. Both blocks were residential and comprised of single-family homes. We did not conduct household interviews with residents because most questions are not appropriate in a non-disaster situation. Handheld computers were tested for their display's readability in strong sunlight.

The logistics of survey administration included using: route maps to locate the sample block, lists generated from the parcel database to enumerate all housing units on the sample block, using tools to resample households (Appendix F), and forms to capture time steps of survey administration. All activities were timed in order to provide planning data to create realistic a schedule for survey teams (Table 9). The pilot activities were carried out in the mornings of sunny (~75-85° F), windless days in August 2008.

The pilot of the first block (Hills) revealed several issues:

- With minor exceptions, the households listed in the parcel database were present on the block, and visa versa
- The travel time to and from the block was longer than expected (>60 minutes)
- The walky-talky radios did not work in hilly terrain without an unobstructed line of sight
- The handheld devices were difficult to view in direct sunlight
- There was a burdensome amount of paper (forms, instructions, maps) that hindered survey administration.
- The ascent to the ridge of the hills was physically demanding and requires appropriate outfitting for the climatic conditions (strong sun, fog, rain, etc.)

Based on the pilot on Block 1, the schedule, forms and instructions were modified. After these modifications, few problems were encountered in the pilot on Block 2.

TIME LINE

The time line will depend on the degree to which preparations can be done in advance of the public health emergency. A time line is presented in Figure 8. This time line assumes that the disaster area is not known beforehand, but that staffing resources are available.

1. Identify perimeter of disaster area

Sample selection cannot occur before this step is completed. It is likely that the EOC will define the geographic extent of the disaster.

2. Sample Selection

Electronic data processing to sample blocks and create block maps and enumeration lists of housing units takes 4-6 hours by a trained analyst using batch programs in STATA and ArcGIS.

3. Modify questionnaire

Questionnaire items (Figure 3) that are not applicable can be ignored, but new items specific to the emergency will require modification of the questionnaire. It is estimated to take 15 minutes per questionnaire item for a trained MS programmer to update database tables, forms, and the data dictionary.

4. Print forms

210 two-page questionnaires with preprinted addresses and block/household identifiers can be printed double sided as a PDF file from the MS Access database. Using a high speed printer this will take approximately 15-30 minutes. Blank block activity log forms (N=30), some blank questionnaires, instructions, block maps and household enumeration lists also will require light formatting in Word or Excel (title of disaster and date) and printed in sufficient quantities for surveyors and supervisors.

5. Assemble supplies

Supplies that are not cached a head of time will require several hours to assemble.

6. Notify stakeholders

The notification of city stakeholders (<20) can be accomplished at the EOC in a few minutes. Assuming 3 minutes per contact, 25 external stakeholders can be notified in approximately 75-90 minutes.

7. Recruit survey teams

Requests for personnel will probably take several hours, depending on the availability of City resources, external stakeholders, or spontaneous volunteers.

8. Train survey teams

Training of survey teams requires the pre-production of training material (Appendix H) and meeting space. The training course is approximately 40 minutes in duration.

9. Collect survey data

Interviewing residents is the most time consuming step. Time estimates based on a pilot have been presented (Field Operations).

10. Key enter surveys in database

If electronic media from handheld devices record survey responses, the steps preceding analysis will be to append different files from of data collection teams into a single file for analysis.

Assuming paper forms can be key entered at the rate of 1 per 2 minutes, 210 questionnaires will take approximately 420 minutes (7 hours). Data entry will overlap with data collection because runners will start to deliver completed questionnaires at the data center midway through the work day. When data teams come in from the field at the end of the workday they will be carrying approximately one-third of their daily output. These 70 questionnaires are key entered in approximately 3 hours.

11. Analyze data

The analysis will be done from batch files (Appendix J). If the questionnaire has been modified in any way, the statistical programming will also have to be modified to reflect the change. This will require 15 minutes of programming per questionnaire item by a skilled statistical programmer. The preparation of key tables requires that output of statistical program be reformatted using Word in a key table (Table 8). This task will take approximately 1-2 hours.

12. Prepare/give EOC Presentation

Based on the key tables, a template (Appendix K) presentation must be modified to reflect the actual findings of the survey. This will require approximately 1-2 hours of an analyst's time knowledgeable with PowerPoint. The presentation can be made to the EOC in less than 15 minutes.

BUDGET AND JUSTIFICATION

Budgeting for a rapid epidemiologic assessment is strongly influenced by the staffing model; a budget based on the staffing model described in previous sections is presented in Table 10. The budget reflects a survey conducted over a 3-day period with 11 different staff persons contributing 80 person-hours. Using the mid-step in salary of City of Berkeley job classifications that match the job duties, the total cost of the survey is $7,480, including fringe benefits. The cost per household is approximately $36.

Some of the key assumptions are:

- Travel to households will be done by walking
- In-kind contributions will be made for pre-existing software and computer equipment
- All labor will be compensated, including paid volunteers

Personnel

Survey Manager (Senior Health Management Analyst)

The Survey Manager is responsible for the overall conduct of the survey and would most likely report to the Chief of Operations in the EOC/DOC. The Survey Manager organizes the personnel, identifies work tasks and makes job assignments, specifies the scope and content of the survey with a lead person in Planning & Intelligence, creates a project timeline, oversees the implementation of the daily schedule, and directly supervises the GIS/Statistical analyst, and Survey Supervisors. The Survey Manager organizes and conducts the training of all personnel, and presents the findings of the survey to the management of the EOC. The Survey Manager will have 100% effort for 3 days (24 hours).

GIS/Statistical Analyst (Applications Programmer/Analyst II)

The GIS/Statistical Analyst (GSA) reports to the Survey Manager. The GSA must have working knowledge of GIS software (ArcGIS 9.3 software), statistical packages (STATA), relational databases (MS Access), spreadsheets (Excel), word processing (Word), and presentation graphics (PowerPoint).

The GSA prepares base maps of Berkeley from US Census and City of Berkeley parcel databases, and maps of sample blocks and survey routes. The GSA prepares enumeration lists of all households on a sample block and the sampled households. The GSA generates household interview questionnaires from a MS Access database that is pre-populated with the addresses of sample households.

The GSA implements changes to the questionnaire (add/delete/change items) and database directed by the Survey Manager. The GSA supervises the key enterer. The GSA modifies pre-existing batch statistical code to take a sample of blocks and households, and batch statistical code to analyze the data collected from completed surveys. The GSA assists the Survey Manager in developing PowerPoint presentations of the results to the EOC.

The GSA will have a 100% effort on days 1 and 3 for sample selection and data analysis, and a 50% effort on day 2 (data collection), primarily to supervise key entry (20 hours total).

Surveyor Supervisor

The Surveyor Supervisor reports to the Survey Manager and is responsible for supervising the surveyors and runners in his/her assigned route of blocks. The supervisor assures that Surveyors and Runners are trained. The Survey Supervisor assures that each Surveyor receives a complete packet of survey forms and supplies, is oriented to the route and meeting points and times, enumerates households on each sample block, administers surveys and completes the block activity log form. The supervisor reviews questionnaires administered in the field for completeness and data quality problems and directs the surveyors on areas for improvement. The Survey Supervisor assures that the Runners are oriented to their routes and meet at designated locations and times and shuttle successfully between pick up and delivery points for data and supplies. The Surveyor Supervisor maintains regular contact with the Surveyors and Runners and with the Surveyor Manager to detect and report potential problems. Surveyor Supervisors will have a 50% effort on Day 1 for training and gathering and packaging supplies for their supervisees, and have a 100% effort on Day 2 in the field (12 hours total).

Surveyor

The Surveyor is responsible for carrying out the survey at the households of his/her assigned blocks. The Surveyors enumerate all housing units on their sample block and note any additions and demolitions. Surveyors resample households from the enumeration lists when necessary. The Surveyors administer the questionnaires to households, and are responsible for completing every item on the form, or provide notes on forms why data was not able to be collected. The Surveyors also complete the block activity log form. Surveyors will have a 100% effort for 1 day (8 hours).

Data Entry Clerk

The Data Entry Clerk key enters questionnaire data into a relational database. The Data Entry Clerk may also perform some secretarial tasks such as assisting with the call down of stakeholders. The lead for the Data Entry Clerk is the GIS/Statistical Analyst, who checks key entry work for accuracy and completeness. Key entry at the average rate of 2 minutes per questionnaire, key entry will take approximately 7 hours (420 minutes). To maximize timeliness, data entry can start as soon as questionnaires are returned from the field by runners in the mid morning to early afternoon of Day 2. The effort will be 8 hours.

Consultants/Contracts

If the Survey Manager and/or GIS/Statistical Analyst do not have the technical skills to implement the survey, acquiring the services of a consulting epidemiologist/biostatistician may be necessary. Eight hours of consulting (at a market rate of $75/hour) will provide sufficient effort to assist with technical issues.

Equipment

A high capacity desktop computer (2 GHz CPU/1GB RAM/HD100GB) is required for GIS and statistical analyses. A high-speed printer or networked photocopier is required for reproducing questionnaires, household enumeration lists, maps, training materials, presentations and other. Hand-held computers may be used to administer surveys. It is assumed that this equipment is pre-existing and available during an emergency (In-kind, $0)

Supplies

Supply items (Table 6) for all 11 staff based on Office Depot's on-line catalogue (accessed 9/8/08) is $1452, including sales tax. Printing costs ($.05/page) for forms, training materials, and presentations is 1150 sheets ($57.50). Assuming each staff person receives two meals per day for their percent effort, 34 meals will be provided. At an average price of $10 per meal, food will cost $340.

It is assumed that software for GIS, statistical, database, and office productivity (e.g., MS Office Suite) is pre-existing and available during an emergency (In-kind, $0).

DISCUSSION

A tool kit to conduct a rapid epidemiologic survey for the City of Berkeley was developed and key components were tested. The toolkit consists of:

- sample selection procedures and statistical code to select a cluster sample of 30 blocks and 7 households within each block using probability proportional to size allocation from the City of Berkeley GIS database of parcels.
- a questionnaire to assess living conditions and service needs of households residing in a disaster area
- a staffing and work flow model to schedule and implement the survey
- procedures, databases, and statistical code to analyze and present the results of the survey to disaster managers.

Some of the strengths, weaknesses, and limitations of the toolkit are discussed below.

Sample

The strengths of the sampling methods are that they follow established procedures for rapid cluster samples.[2, 1] The City parcel database appears to be accurate based on direct observation in the field. In a related project, 4 census blocks in South West Berkeley were enumerated using lists generated from the parcel database and were found to be accurate. As a weakness, we were not able to pilot the enumeration on blocks with group housing, such as college dormitories or coops, whose land use is classified as "exempt" in the parcel database, rather than residential.

Based on our personal knowledge of group housing associated with the University of California Berkeley campus, we reviewed residential and nonresidential listings in the parcel database for selected addresses of dormitories (Units 1, 2, and 3 at Durant and Haste) and group housing (International House, Coop Davis House). Individual address points were not listed for dormitory Units 1-3 at 2650 Durant Ave., but individual address points were listed for International House and the Davis House. Given the localized nature of the dormitory housing administered by the University of California, it may be prudent to exclude these locations from the sample frame of a citywide survey and request that the University of California survey dormitory residents.

Instrument

Strong points of the instrument are that it is short, comprehensive, and many of the items have been field tested in emergency situations. A new domain of questions regarding pets responds to a gap in previous instruments. The weaknesses is that this specific version has not been field tested. This was a limitation of survey in that we did not believe we could adequately simulate an emergency to test the instrument content. The questionnaire will be translated into Spanish and other non-English languages that are prevalent in Berkeley.

Field Operations

Berkeley's size and compact geography allows walking as the principal means to travel to blocks and households. In situations in which streets are not passable with motorized vehicles, walking may be the only means to conduct a survey. Jurisdictions with a greater geographic extent may have to consider other means of travel including bicycles and motorized vehicles. The staffing model has assumptions on skills sets of key staff and on workflow and productivity. One key assumption is the availability of a GIS/Statistical Analyst and their prior knowledge of the City's parcel database and GIS/statistical software. The skill sets in this position may involve two distinct job classifications and individuals.

Some of the assumptions were tested or were derived from information collected during piloting survey logistics on two Berkeley blocks. Our pilot was too limited to assess whether housing units in apartment buildings or condominiums may not be accessible due to locked entrances or gates. However, using the same methods in a community survey of 4 South Berkeley census blocks, we found that 60% of 329 households were located in apartment buildings with a locked or potentially locked gate. To physically access households, an REA will require pass keys for apartment buildings from the Berkeley Fire Department and notification of landlords or property managers. The exclusion or nonresponse of eligible households living in apartment buildings is likely to introduce a significant bias.

Timeline and Strategies to Improve Timeliness

The overall timeline is based on generally reasonable assumptions and information obtained during pilot testing. However, even for a skilled GIS/Statistical Analyst, more than 4 hours may be required to carry out block and household selection, routing, and mapping if they are not already familiar with the City's parcel database and GIS software.

There may be situations that were not encountered during pilot that impact the timeline. For example, we know that inter- and intra-block travel times will increase with significant presence of downed tree limbs and other debris that may obstruct streets and sidewalks. Staff conducting REAs will be in contact with the public and may encounter medical emergencies and will be asked about relief services. Surveyors may also play an important role in delivering prevention messages. Time to distribute referral information and educational materials will require additional on-block time not currently included in the overall timeline. Surveyors will also encounter medical emergencies and requests for medical assistance during surveying. Protocols must be developed ahead of time for this contingency and procedures should be included in surveyor training.

There are concerns that REAs in practice are not rapid, and have taken up to 2 months to complete.[18] Moreover, with increasing methodological rigor, timeliness of recent REAs in response to major hurricanes (e.g. Charley, Katrina, Wilma) took from 8 to 17 days. Several strategies for the proposed Berkeley 30 by 7 cluster sample could enhance timeliness without substantially diminishing the accuracy of the estimates. Our pilot indicates the parcel database is highly accurate for residential properties. Enumeration of all housing units on a sample block may be not be necessary. Moreover, selecting seven consecutive houses from a random start rather than seven houses at random is another time saving option. However, because blocks are relatively small in Berkeley, the time saving from this option is likely to be marginal. Much time may be expended in making multiple attempts to contact nonrespondents or using neighbors to be proxy respondents for unoccupied households. To improve timeliness, sampling with replacement for present households may be considered with attention to potential biases this may introduce.

Timeliness and routing depend in part on the availability of personnel, who may include a substantial number of volunteers. If the personnel available were doubled in the Berkeley 30 by 7 REA, instead of two, 4-hour data collection shifts on Day 2 (Figure 8), one 4-hour shift might suffice. This would obviate the need for lunch, resupply, and hand-off of surveys to runners at collection points. Multiple persons doing data entry will also improve timeliness.

Budget

The survey is very inexpensive compared to other types of door-to-door surveys, and is likely to be a very small fraction of the expenditures for emergency management. Even if a REA saves 1-2% in a multimillion dollar response by improving targeting and timing of resources, there would be a significant return on investment.

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Table 1. Land USE CODES AND DESCRIPTION (SORTED BY NUMERIC CODE), PARCEL DATABASE, 2006

Code	Description	Code	Description
0	UNKNOWN	44	MISCELLANEOUS INDUSTRIAL
3	EXEMPT PUBLIC AGENCIES	45	NURSERIES
4	LEASED BY PUBLIC UTILITY	48	TERMINALS, TRUCKING/INDUS
5	OWNED BY PUBLIC UTILITY	49	WRECKING YARDS
7	MOBILE HOME IN MH PARK	64	SCHOOLS
10	VACANT RESIDENTIAL LAND	66	CHURCHES
11	SINGLE FAMILY RESDENTIAL	67	OTHER INSTITUTIONAL LAND
12	HOME + 2ND LIVING UNIT	68	LODGEHALLS & CLUBHOUSES
13	HOME + SLIGHT COMMERCIAL	70	VACANT APT. LAND 5+ UNITS
16	HOME+COMMUNAL IMPROVEMENT	71	5+ SINGLE FAMILY HOMES
17	BOARDING/ROOMING HOUSE	72	RESDENT.PROPERTY 5+ UNITS
18	PLANNED DEVELOPMENT	73	CONDOMINIUMS
19	MOBILE HOME ON RESD. LAND	74	COOPERATIVES
21	2,3,OR 4 SINGLE FAM. HOME	75	RESTRICTED INCOME PROPERT
22	DOUBLE OR DUPLEX	76	FRATERNITIES/SORORITIES
23	TRIPLEX	77	MULTIPLE RESIDENTIAL PROP
24	FOURPLEX	79	RESD WELFARE EXEMPT PROP.
25	HOME + 2 LIVING UNITS	80	CAR WASHES
26	HOME + 3 LIVING UNITS	81	REPAIR GARAGES
27	HOME + 4 LIVING UNITS	82	AUTOMOBILE DEALERSHIPS
28	HOME WITH BOARDING USE	83	PARKING LOTS
29	MORE THAN ONE MOBIL HOME	84	PARKING GARAGES
30	VACANT COMMERCIAL LAND	85	SERVICE STATIONS
31	ONE-STORY STORE	86	FUNERAL HOMES
32	STORE ON FIRST FLOOR	87	NURSING/BOARDING HOMES
33	MISCELLANEOUS COMMERCIAL	88	HOSPITALS
34	DEPARTMENT STORE	89	HOTEL
36	RESTAURANT	90	MOTEL
38	SUPERMARKET	92	BANKS
39	COMM/INDUS CONDO B4 SALE	93	MEDICAL-DENTAL
40	VACANT INDUSTRIAL LAND	94	1 TO 5 STORY OFFICES
41	WAREHOUSE	95	OVER 5 STORY OFFICES
42	LIGHT INDUSTRIAL	97	WALK IN THEATERS
43	HEAVY INDUSTRIAL	99	MISC. RECREATIONAL

Note: Residential codes include 7,11-17, 19-29, 71-79, 87

Table 2. Enumeration List of All Households on Sample Blocks for a Hypothetical Citywide Disaster, Berkeley

Block/ Cluster	Address Count	Street Address	Description of Housing Unit
1	1	XX1 CRESTON RD	Single Family Residence
	2	XX2 CRESTON RD	Single Family Residence
	3	XX3 CRESTON RD APT A	Single Family Residence
	…	…	…
	45	XX1 WOODMONT AVE	Single Family Residence
	46	XX2 WOODMONT AVE	Single Family Residence
	47	XX3 WOODMONT AVE APT A	Single Family Residence
2	1	XX1 ARLINGTON AVE	Single Family Residence
	2	XX2 ARLINGTON AVE	Single Family Residence
	3	XX3 ARLINGTON AVE	Single Family Residence
	…	…	…
	77	XX1 VISALIA AVE APT LOWR	2-4 Units
	78	XX2 VISALIA AVE	Single Family Residence
	79	XX3 VISALIA AVE	Single Family Residence
3	1	XX1 BEVERLY PL	Single Family Residence
	2	XX2 BEVERLY PL	Single Family Residence
	3	XX3 BEVERLY PL	Single Family Residence
	…	…	…
	40	XX1 HOPKINS ST	Single Family Residence
	41	XX2 HOPKINS ST	Single Family Residence
	42	XX3 HOPKINS ST	Single Family Residence
…			
30	1	XX1 CALIFORNIA ST APT A	Multiresidential
	2	XX2 CALIFORNIA ST APT B	Multiresidential
	3	XX3 CALIFORNIA ST APT C	Multiresidential
	…	…	…
	69	XX1 KING ST APT A	2-4 Units
	70	XX2 KING ST APT B	2-4 Units
	71	XX3 KING ST APT C	2-4 Units

Table 3. Domains and number of questions for each domain on the rapid epidemiologic assessment questionnaire

Domain	Number of Items
Food access	1
Health care access	4
Housing, damage	1
Information access	2
Medical needs	5
Number of people in residence pre and post disaster	2
Pets, number, type, relief needs	3
Relief services utilization	3
Sanitation	2
Social support	1
Transportation	1
Utilities	6
Vulnerable groups	3
Water access	2

Table 4. Key Stakeholders to Notify for a REA

Group/Individual	Incumbent	Phone	Email @ci.bekeley.ca.us
City Agencies			
City Manager	Kamlarz, Philip	981-7000	pkamlarz
Public Information Officer	Mary Kaye Clunies-Ross	981-7008	mclunies-ross
Neighborhood Services	Angela Gallegos-Castillo	981-2491	agallegos-castillo
Police Department, Chief	Hambleton, Douglas	981-5700	DOH3
Fire Department, Chief	Pryor, Debra	981-3473	dpryor
Public Works, Head	Ford, Claudette	981-6300	cford
Health and Human Services	Fred Medrano	981-5107	fmedrano
Public Health Division			
Health Officer	Janet Berreman	981-5300	jberreman
Public Information Officer	Zandra Lee	981-5356	zlee
ICS Command Structure			
Incident Commander			
Internal Liaison			
External Liaison			
Section Chiefs (P&I, Operations, Logistics, Finance)			
Elected Officials			
Mayor's Office	Tom Bates	981-7100	
District 1	Linda Maio	981-7110	
District 2	Darryl Moore	981-7120	
District 3	Maxwell Anderson	981-7130	
District 4	Vacant	981-7140	
District 5	Laurie Capitelli	981-7150	
District 6	Betty Olds	981-7160	
District 7	Kriss Worthington	981-7170	
District 8	Gordon Wozniak	981-7180	
Community-Based Organizations			
BEACON Database*			

* 79 community based organizations in Berkeley serving vulnerable populations (homeless, housing, faith-based, disability, employment assistance, food pantry, youth development, drug and rehabilitation services, etc.)

Table 5. Sample of An Interviewer's Daily Schedule

Start Time	Finish Time	Activity	Duration (min)
8:00	8:05	Assemble at head quarters/staging area	5
8:05	8:45	Training and route assignments	40
8:45	9:15	Travel to Block 1 with partner	30
9:15	9:30	Enumerate households on block with partner	15
9:30	9:54	Household 1-7 interviews and intra-block travel	24
9:54	10:09	Travel to Block 2 with partner	15
10:09	10:24	Enumerate households on block with partner	15
10:24	10:48	Household 1-7 interviews and intra-block travel	24
10:48	11:03	Travel to Block 3 with partner	15
11:03	11:18	Enumerate households on block with partner	15
11:18	11:42	Household 1-7 interviews and intra-block travel	24
11:42	11:57	Travel to central meeting point, exchange data with supervisor/runner	15
11:57	12:27	Break for lunch	30
12:27	12:42	Travel to Block 4 with partner	15
12:42	12:57	Enumerate households on block with partner	15
12:57	13:21	Household 1-7 interviews and intra-block travel	24
13:21	13:36	Travel to Block 5 with partner	15
13:36	13:51	Enumerate households on block with partner	15
13:51	14:15	Household 1-7 interviews and intra-block travel	24
14:15	14:30	Travel to Block 6 with partner	15
14:30	14:45	Enumerate households on block with partner	15
14:45	15:09	Household 1-7 interviews and intra-block travel	24
15:09	15:24	Travel to central meeting point, exchange data with supervisor/runner	15
15:24	15:39	Travel to Block 7 with partner	15
15:39	15:54	Enumerate households on block with partner	15
15:54	16:18	Household 1-7 interviews and intra-block travel	24
16:18	16:33	Travel to Block 8 with partner	15
16:33	16:48	Enumerate households on block with partner	15
16:48	17:12	Household 1-7 interviews and intra-block travel	24
17:12	17:42	Travel from Block 8 to HQ, exchange data with supervisor/runner	30

Table 6. Basic Supplies for Each Member of a Survey Team

Item	Inter-viewer	Super-visor	Runner
Backpack	1	1	1
Walky-Talky	1	1	1
Hand held device	1		
Pencils	12	12	
Lunch bucket	1	1	
Vests	1	1	1
IDs	1	1	1
Whistle	1	1	1
Contact information for survey team leaders	1	1	1
Sunscreen	1	1	1
Poncho	1	1	1
Plastic covering for pages	1	1	1
Clipboards	1	1	
Forms:			
Map of Sample Block	1	1	1
Map of All Blocks	1	1	1
List of Selected Households	1	1	
List of All Households	1	1	
Questionnaires for 3 blocks	21		
Step-By-Step Guide	1	1	
Re-Sample Procedures	1	1	
Schedule	1	1	
Additional Households	1	1	
Re-Sample	1	1	
Time Tracking	1	1	1

Table 7. Key Table: Number of Households and Response Rate, Cluster Sample of Rapid Needs Assessment Berkeley, Date of Disaster

		Weighted	
Characteristic	Sample N	N	%
Sample	210	50,322	100
Visited	198	48,021	95
Completed interview* (Response rate)	187	41,984	83

* Completed interview means household representative completed a face-to-face interview with resident or neighbor, or the interviewer recorded some information for an uninhabited dwelling

Table 8. Key Table: Post-Disaster Characteristics of Households and Population, Hypothetical Disaster, Berkeley

Characteristic	Sample N	Households (Weighted) Percent	Households (Weighted) N	Households (Weighted) $CI_{95\%}$	Population (Weighted) Percent	Population (Weighted) N	Population (Weighted) $CI_{95\%}$
Total	210	100	50,322	–	100	91,538	–
Housing							
Type of housing structure							
Single family home	103	49.0	24,682	21,040 – 28,323	49.7	45,529	36,687 – 54,372
2-5 family unit	42	20.0	10,064	7,024 – 13,105	22.3	20,368	13,828 – 26,909
≥6 units	24	11.4	5,751	2,896 – 8,606	10.2	9,346	4,353 – 14,338
Migrant Camp	41	19.5	9,825	7,142 – 12,508	17.8	16,295	11,118 – 21,472
Damage to home							
None	116	55.2	27,797	24,084 – 31,509	55.2	50,562	43,287 – 57,836
Damaged	94	44.8	22,525	14,660 – 30,390	44.8	40,976	24,103 – 57,850
Habitable	25	11.9	5,991	3,441 – 8,541	11.8	10,783	5,663 – 15,903
Uninhabitable/repairable	25	11.9	5,991	3,644 – 8,338	13.1	11,981	6,240 – 17,723
Uninhabitable/destroyed	44	21.0	10,544	7,575 – 13,512	19.9	18,212	12,200 – 24,224
Shelter							
Where displaced households stayed							
Shelter	96	45.7	23,004	19,182 – 26,827	45.8	41,935	34,883 – 48,987
Special Needs Shelter	33	15.7	7,908	4,971 – 10,844	14.9	13,659	8,228 – 19,090
Hotel/Motel	25	11.9	5,991	3,866 – 8,115	13.1	11,981	6,416 – 17,547
Neighbor's home	24	11.4	5,751	3,590 – 7,912	11.0	10,064	6,039 – 14,089
Other	32	15.2	7,668	4,944 – 10,392	15.2	13,898	8,721 – 19,076
Food and Water							
<3 days supply of food	70	33.3	16,774	13,756 – 19,792	64.7	59,188	50,535 – 67,842
Primary access to drinking water							
Well	18	8.6	4,313	2,018 – 6,608	7.3	6,710	3,120 – 10,300
Bottled	85	40.5	20,368	17,289 – 23,448	40.6	37,142	30,756 – 43,529
Public	85	40.5	20,368	17,723 – 23,014	40.8	37,382	31,180 – 43,584
None	22	10.5	5,272	3,165 – 7,379	11.3	10,304	6,093 – 14,515
Utilities							
No running water	174	83.0	41,695	38,671 – 44,719	84.6	77,400	69,624 – 85,176
No functioning toilet							
No electricity from power company	167	80.0	40,018	37,054 – 42,982	80.9	74,045	65,096 – 82,994
Using generator	12	5.7	2,876	1,064 – 4,687	5.5	5,032	1,714 – 8,350
No working toilet	166	79.1	39,778	36,810 – 42,747	77.7	71,170	62,160 – 80,180
No access to working toilet	153	72.9	36,663	34,087 – 39,239	70.9	64,939	57,631 – 72,248
No working telephone	120	57.2	28,755	25,525 – 31,986	55.2	50,562	42,665 – 58,458
No access to transportation	84	40.0	20,129	17,362 – 22,895	38.2	34,986	28,574 – 41,398

Table 8. (Continued) Post-Disaster Characteristics of Households and Population, Hypothetical Disaster, Berkeley

Characteristic	Sample N	Households (Weighted) Percent	N	$CI_{95\%}$	Population (Weighted) Percent	N	$CI_{95\%}$
No working radio	52	24.8	12,461	10,130 – 14,792	24.9	22,765	17,300 – 28,229
No access to news	28	13.4	6,710	4,853 – 8,566	13.6	12,461	8,062 – 16,859
Gas turned off	25	11.9	5,991	3,866 – 8,115	12.8	11,742	6,988 – 16,496
No trash pick-up	180	85.8	43,133	1,290 – 45,771	86.4	79,077	70,618 – 87,537
Vulnerable Populations							
Disaster relief services not provided	29	13.9	6,949	4,175 – 9,723	13.1	11,981	7,395 – 16,568
<2 year olds	15	7.1	3,594	2,058 – 5,131	5.5	5,032	2,678 – 7,386
>64 year olds	63	30.0	15,097	12,722 – 17,472	26.4	24,202	19,194 – 29,211
Pregnant	7	3.3	1,677	324 – 3,030			
Anyone injured	6	2.9	1,438	346 – 2,530			
Injured get care	28	13.3	6,710	4,274 – 9,145			
Anyone ill	19	9.0	4,553	2,062 – 7,044			
Ill get care	22	10.5	5,272	3,706 – 6,838			
Require medical care	13	6.2	3,115	1,590 – 4,641			
Diarrhea	34	16.2	8,147	4,861 – 11,434			
Respiratory illness	10	4.8	2,396	929 – 3,864			
Rash	44	21.0	10,544	6,700 – 14,388			
Chronic illness	37	17.6	8,866	5,819 – 11,913			
Emotional illness	57	27.1	13,659	11,083 – 16,235			
< 3 days supply of meds	23	11.0	5,511	3,434 – 7,589			
No access to meds	44	21.0	10,544	8,028 – 13,059			
Emotional support need	166	79.0	39,778	36,647 – 42,910			
Pets							
Pets at home	78	37.1	18,691	15,651 – 21,731			
Cats	47	22.4	11,263	8,958 – 13,567			
Dogs	110	52.4	26,359	23,510 – 29,208			
Needs							
Food	12	5.7	2,876	1,364 – 4,387			
Medication	12	5.7	2,876	1,207 – 4,544			
Crate	18	8.6	4,313	2,246 – 6,381			
Leash	13	6.2	3,115	1,293 – 4,938			
Greatest need							
Food	22	10.5	5,272	3,416 – 7,128	10.5	9,585	4,998 – 14,172
Water	72	34.3	17,253	13,686 – 20,820	35.3	32,350	23,412 – 41,288
Electricity	24	11.4	5,751	3,478 – 8,024	11.5	10,544	6,100 – 14,987
Medical care	32	15.2	7,668	4,854 – 10,482	14.9	13,659	8,228 – 19,090
Medications	26	12.4	6,230	4,270 – 8,191	11.3	10,304	6,399 – 14,209

Table 9. Duration (minutes) of Activities on Sample Blocks*, Pilot

Activity	Block 1 8/11/08	Block 2 8/14/08
Travel from headquarters to Block 1	61	29
Enumeration of Block 1	19	8
Resample of Block 1	8	3
Household 1 (H1) to Household 2 (H2)	6	1
H2 to H3	3	1
H3 to H4	<1	<1
H4 to H5	<1	1
H5 to H6	1	2
H6 to H7	1	<1
Total time (H1 to H7)	12	6
Travel from Block 1 to headquarters	58	27
Total pilot	183	73

* Block 1, Berkeley Hills
Block 2, Berkeley Flatlands

Table 10. Budget for a Rapid Epidemiologic Assessment

Item		Hours	Hourly Rate, $	Number	In-Kind, $	Amount Requested, $
Personnel	City of Berkeley Job Classification					
Survey Manager	Senior Health Management Analyst	24	40.22	1		965
GIS/Statistical Analyst	Applications Programmer/Analyst II	20	41.08	1		822
Surveyor Supervisor	Office Specialist Supervisor	12	31.78	2		763
Surveyor	Office Specialist II	8	24.64	4		788
Runner	Office Specialist II	8	24.64	2		394
Key Enterer/Secretary	Office Specialist II	8	24.64	1		197
Subtotal		80		11		3,929
Fringe @25%						982
Total personnel						4,911
Contracts						
Consulting Epidemio-logist/Biostatistician	Senior Health Services Program Specialist	8	75	1		600
			Unit/			
Supplies			Cost			1,572
Printing						57
Software						
MS Word, Excel, PowerPoint, Access					680	
ArcGIS 9.3					5,000	
STATA					1,500	
Forms generation software for hand-held			35	12	420	
Equipment						
Desktop Computer			1500	1	1,500	
Hand-held computer			200	12	800	
Food and water						
34 meals			10	34		340
Total, Direct					9,900	7,480
Cost per Household						36

Figure 1. 30 Blocks by 7 Households Cluster Sample for a Hypothetical Citywide Disaster, Berkeley

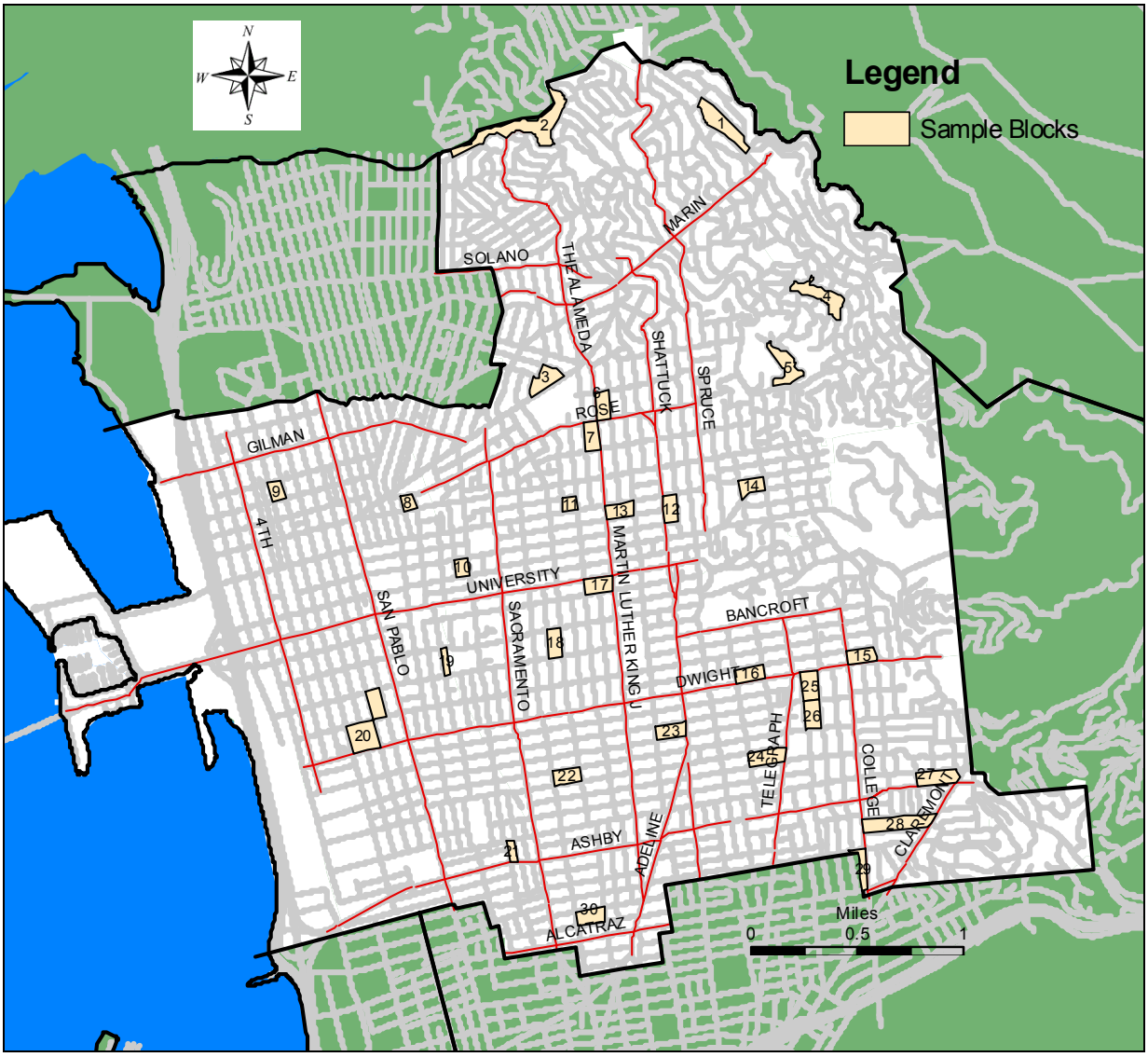
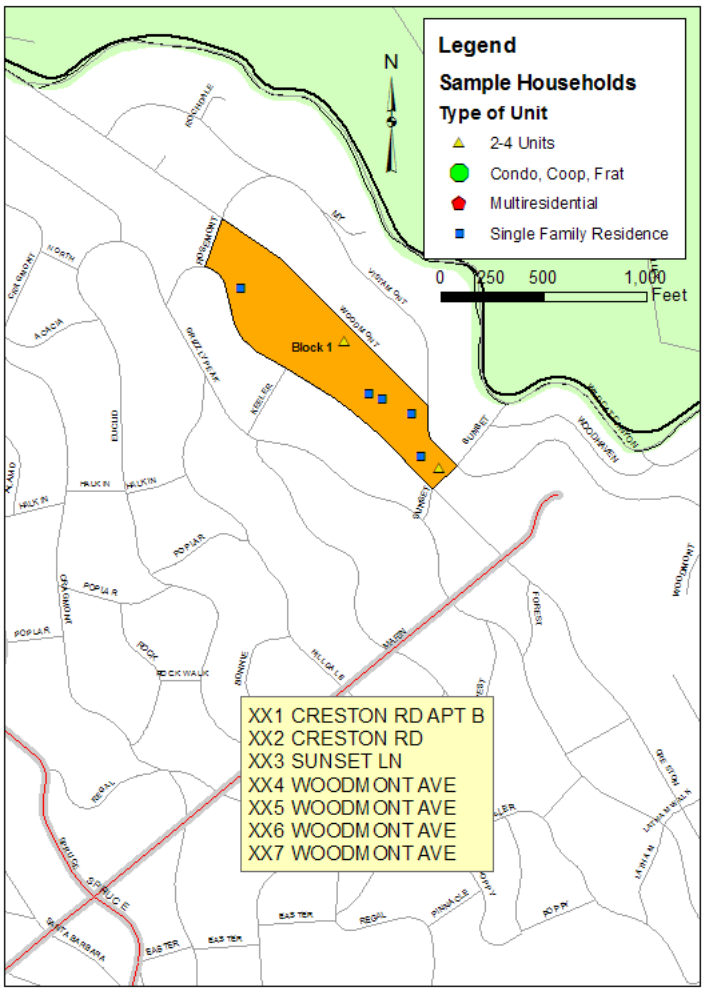
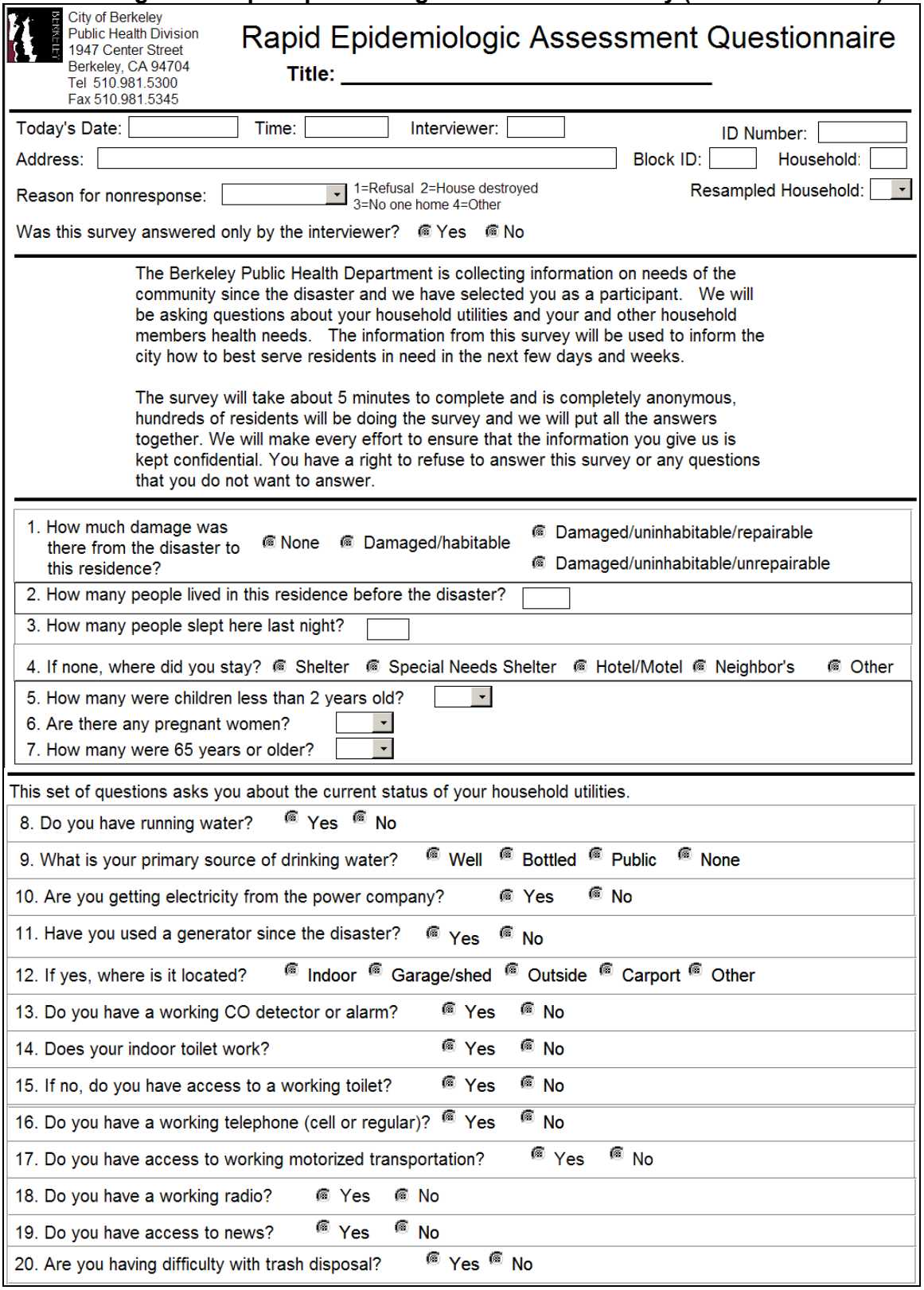


Figure 2. Households Sampled in Block Cluster 1 for a Hypothetical Disaster, Berkeley



1	XX1 CRESTON RD APT B	Single Family Residence
2	XX2 CRESTON RD	Single Family Residence
3	XX3 SUNSET LN	2-4 Units
4	XX4 WOODMONT AVE	2-4 Units
5	XX5 WOODMONT AVE	Single Family Residence
6	XX6 WOODMONT AVE	Single Family Residence
7	XX7 WOODMONT AVE	Single Family Residence

Figure 3. Rapid Epidemiologic Assessment Survey (Generic Disaster)



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Rapid Epidemiologic Assessment Questionnaire

Title: _____

Today's Date: ____ Time: ____ Interviewer: ____ ID Number: ____

Address: ____ Block ID: ____ Household: ____

Reason for nonresponse: ____ 1=Refusal 2=House destroyed 3=No one home 4=Other

Resampled Household: ____

Was this survey answered only by the interviewer? ○ Yes ○ No

The Berkeley Public Health Department is collecting information on needs of the community since the disaster and we have selected you as a participant. We will be asking questions about your household utilities and your and other household members health needs. The information from this survey will be used to inform the city how to best serve residents in need in the next few days and weeks.

The survey will take about 5 minutes to complete and is completely anonymous, hundreds of residents will be doing the survey and we will put all the answers together. We will make every effort to ensure that the information you give us is kept confidential. You have a right to refuse to answer this survey or any questions that you do not want to answer.

1. How much damage was there from the disaster to this residence? ○ None ○ Damaged/habitable ○ Damaged/uninhabitable/repairable ○ Damaged/uninhabitable/unrepairable
2. How many people lived in this residence before the disaster? ____
3. How many people slept here last night? ____
4. If none, where did you stay? ○ Shelter ○ Special Needs Shelter ○ Hotel/Motel ○ Neighbor's ○ Other
5. How many were children less than 2 years old? ____
6. Are there any pregnant women? ____
7. How many were 65 years or older? ____

This set of questions asks you about the current status of your household utilities.

8. Do you have running water? ○ Yes ○ No
9. What is your primary source of drinking water? ○ Well ○ Bottled ○ Public ○ None
10. Are you getting electricity from the power company? ○ Yes ○ No
11. Have you used a generator since the disaster? ○ Yes ○ No
12. If yes, where is it located? ○ Indoor ○ Garage/shed ○ Outside ○ Carport ○ Other
13. Do you have a working CO detector or alarm? ○ Yes ○ No
14. Does your indoor toilet work? ○ Yes ○ No
15. If no, do you have access to a working toilet? ○ Yes ○ No
16. Do you have a working telephone (cell or regular)? ○ Yes ○ No
17. Do you have access to working motorized transportation? ○ Yes ○ No
18. Do you have a working radio? ○ Yes ○ No
19. Do you have access to news? ○ Yes ○ No
20. Are you having difficulty with trash disposal? ○ Yes ○ No

Figure 3. Rapid Epidemiologic Assessment Survey (continued)

21. Has anyone in your household been injured because of the disaster? ○ Yes ○ No

22. If yes, were they able to get the care they needed? ○ Yes ○ No

23. Has anyone in your household been ill (other than injury) since the disaster? ○ Yes ○ No

24. If yes, were they able to get the care they needed? ○ Yes ○ No

25. Does anyone in your household now require medical care? ○ Yes ○ No

26. Does anyone in your household have an illness? If Yes, what type:

Diarrheal? ○ Yes ○ No | Respiratory? ○ Yes ○ No

Rash? ○ Yes ○ No | Chronic? ○ Yes ○ No | Emotional? ○ Yes ○ No

27. Are the effects of the disaster preventing anyone in this residence from obtaining needed medication? ○ Yes ○ No

28. Do you have access to enough needed medication for everyone in this residence for the next 3 days? ○ Yes ○ No

29. Do you have access to enough food for everyone in this residence for the next 3 days? ○ Yes ○ No

30. Are emotional concerns, thinking, or memory problems preventing you from taking care of yourself or people depending on you? ○ Yes ○ No

31. Have any of the social support networks (e.g. group memberships, church activities, regular social activities) that you had before the disaster been interrupted by the disaster? ○ Yes ○ No

32. Do you have any pets living at your residence? ○ Yes ○ No

33. If Yes, how many of each type of animal do you have? (Interviewer reads types)
Birds: ____ Cats: ____ Dogs: ____
Livestock: ____ Rodents: ____ Other: ____

34. Do you need any supplies for your animals?

Food ○ Yes ○ No | Medications ○ Yes ○ No | Crate ○ Yes ○ No | Leash ○ Yes ○ No

35. In the past 48 hours have you received disaster relief such as food, water, ice, or shelter from disaster relief stations? ○ Yes ○ No

36. If no, why? ○ Didn't need relief ○ Couldn't get there ○ Didn't know about them ○ Other

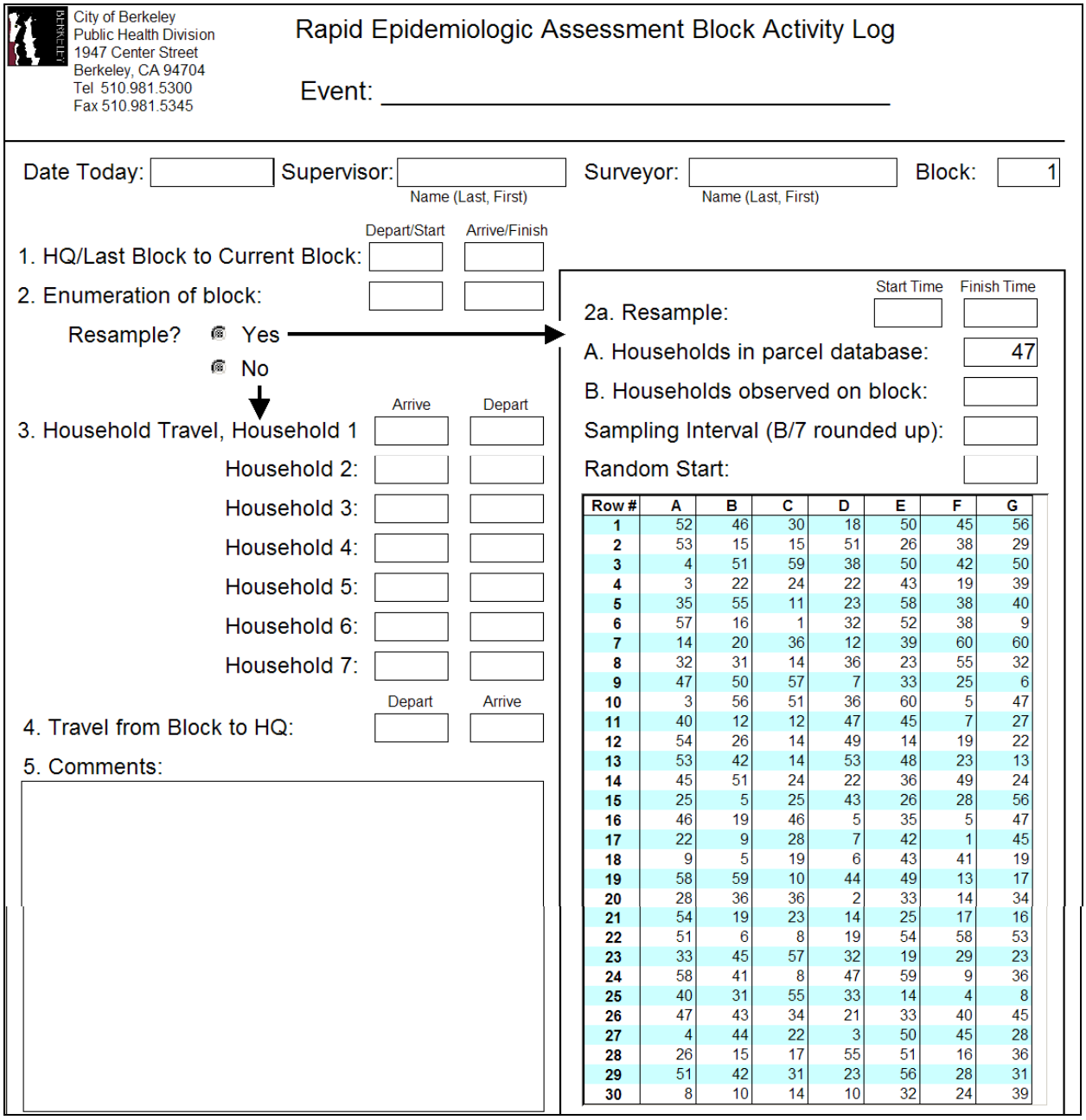
37. What is your greatest need at the moment? ○ Food ○ Water ○ Electricity ○ Medical care ○ Medications ○ Transportation ○ Other

38. If other: 5

39. Comments:

Thank you for your participation!

Figure 4. Rapid Epidemiologic Assessment Block Activity Log



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Rapid Epidemiologic Assessment Block Activity Log

Event: _____

Date Today: | Supervisor: (Name (Last, First)) | Surveyor: (Name (Last, First)) | Block: 1

	Depart/Start	Arrive/Finish
1. HQ/Last Block to Current Block:		
2. Enumeration of block:		

Resample? ◉ Yes → ○ No

	Arrive	Depart
3. Household Travel, Household 1		
Household 2:		
Household 3:		
Household 4:		
Household 5:		
Household 6:		
Household 7:		

	Depart	Arrive
4. Travel from Block to HQ:		

5. Comments:

	Start Time	Finish Time
2a. Resample:		

A. Households in parcel database: 47

B. Households observed on block:

Sampling Interval (B/7 rounded up):

Random Start:

Row #	A	B	C	D	E	F	G
1	52	46	30	18	50	45	56
2	53	15	15	51	26	38	29
3	4	51	59	38	50	42	50
4	3	22	24	22	43	19	39
5	35	55	11	23	58	38	40
6	57	16	1	32	52	38	9
7	14	20	36	12	39	60	60
8	32	31	14	36	23	55	32
9	47	50	57	7	33	25	6
10	3	56	51	36	60	5	47
11	40	12	12	47	45	7	27
12	54	26	14	49	14	19	22
13	53	42	14	53	48	23	13
14	45	51	24	22	36	49	24
15	25	5	25	43	26	28	56
16	46	19	46	5	35	5	47
17	22	9	28	7	42	1	45
18	9	5	19	6	43	41	19
19	58	59	10	44	49	13	17
20	28	36	36	2	33	14	34
21	54	19	23	14	25	17	16
22	51	6	8	19	54	58	53
23	33	45	57	32	19	29	23
24	58	41	8	47	59	9	36
25	40	31	55	33	14	4	8
26	47	43	34	21	33	40	45
27	4	44	22	3	50	45	28
28	26	15	17	55	51	16	36
29	51	42	31	23	56	28	31
30	8	10	14	10	32	24	39

Figure 5. Schematic of Survey Organization

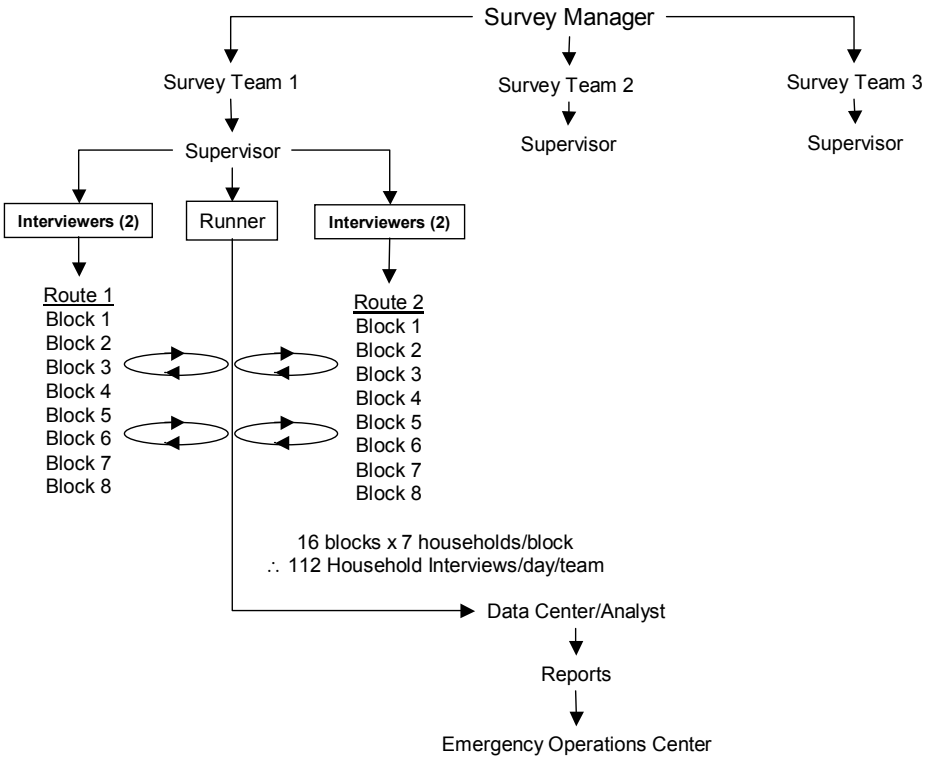

Figure 6. Four Route Scheduling of Rapid Epidemiologic Assessment, Four Routes

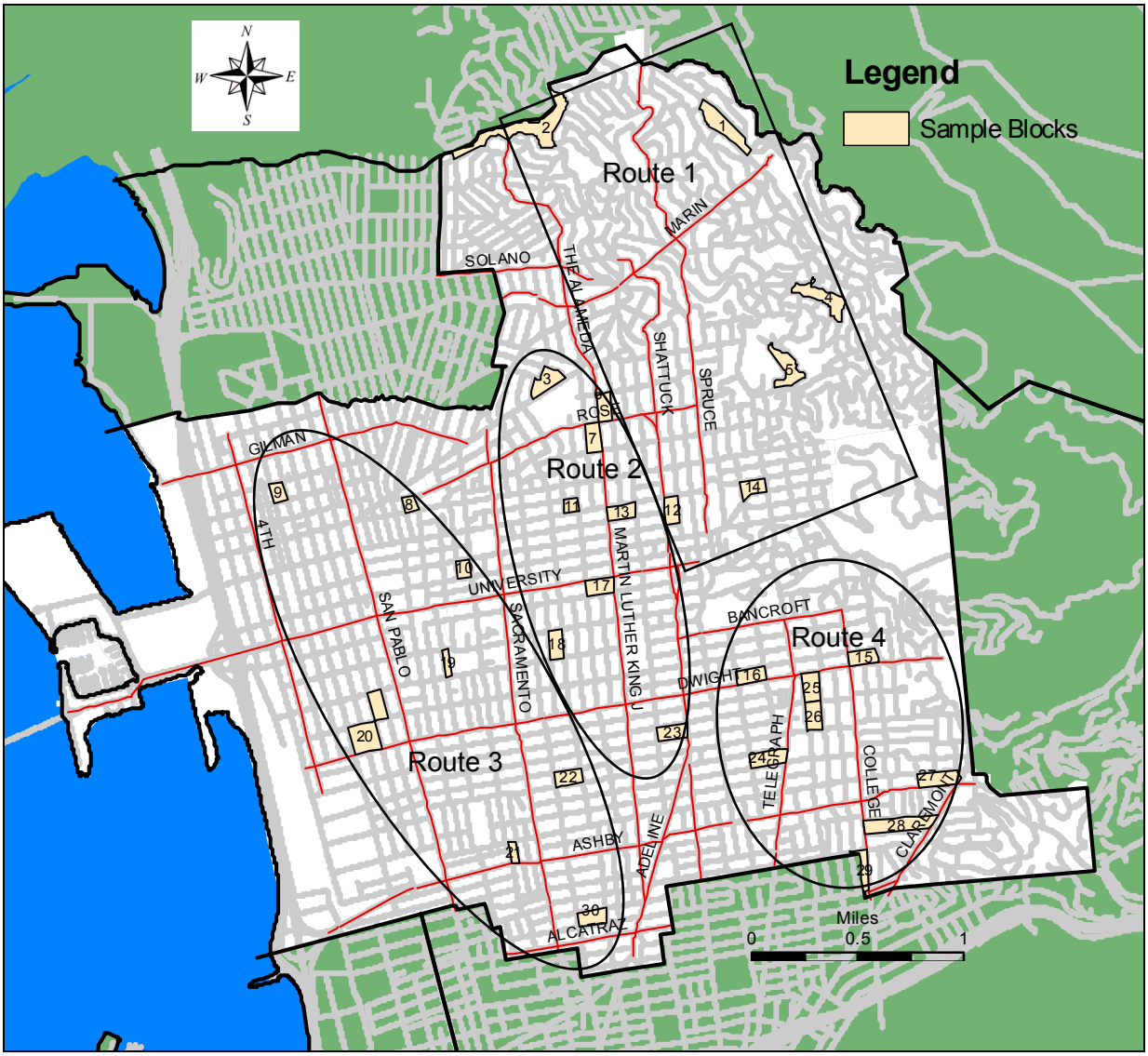

Figure 7. Rapid Epidemiologic Assessment as a Mobile Field Operation in Incident Command System

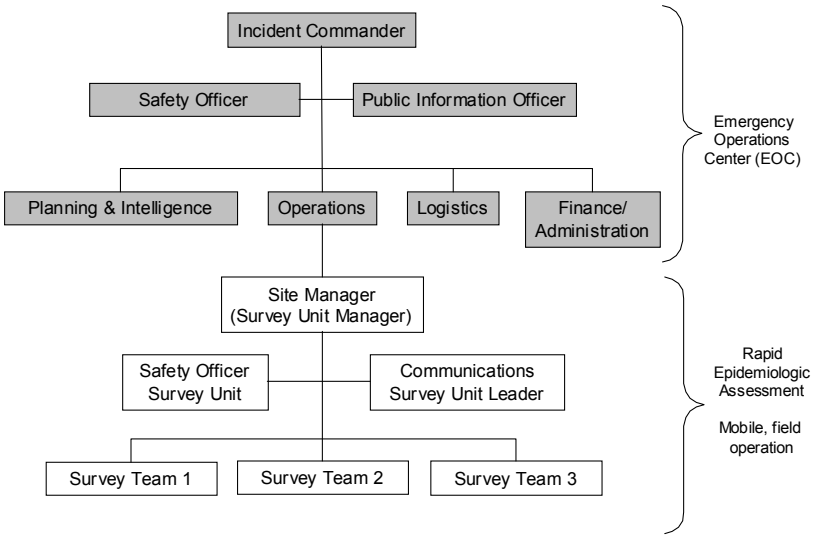

Figure 8. Time Line of Rapid Epidemiologic Assessment, Assuming 1 Day of Preparations and Full Staffing

	Day/Hour of Project					
	Day 1		Day 2		Day 3	
Activity	H8-12	H13-17	H8-12	H13-17	H8-12	H13-17
1. Identify perimeters of disaster area						
2. Select sample						
Create block maps, routes						
Create enumeration lists						
Populate database						
3. Modify questionnaire						
4. Print forms						
5. Assemble supplies						
6 Notify stakeholders						
7. Recruit survey teams						
8. Train survey teams						
9. Collect survey data						
10. Key enter surveys in database						
11. Analyze data						
12. Prepare/give EOC Presentation						