

### **Goodbye Honey Buckets Inquiry**

In four small villages in Alaska, researchers used a prospective cohort study in order to examine the health effects of having water and sewage systems piped into homes. Such infrastructure replaced hauling potable water from a common source and honey buckets and lagoons for sewage collection and treatment. Using culturally sensitive and locally approved techniques to initiate the study, recruit participants, and provide health education to all, the researchers collected data from electronic medical records (EMR) both 3 years before and 3 years after households received piped water and sanitation. Water abundance data were collected from household members before piping and from water meters after.

Three of the villages (B, C, and D) received adequate funding to provide modern plumbing to every home and did so, however one town (A) received enough funding to serve only half the homes, leaving half unserved. The population in every village is over 92% Alaskan Native or American Indian (AN/AI). Government funded tribal health organizations (clinics and hospitals) provide healthcare to these villagers.

In served homes, water usage increased from an average of 1.5 gallons/capita/day (g/c/d) to an average of 25.7 g/c/d. According to WHO guidelines, less than 1.32 g/c/d is cause for very high level of health concern, and less than 5.28 is considered a high level of health concern. Reuse of water for washing and bathing are common conservation methods used worldwide when water is scarce.

Three types of illness conditions were noted: respiratory and skin infections (likely related to washing) and gastrointestinal (likely related to ingestion of bad water).

Please examine some or all of the following data.

1.) Make notes about the quantitative skills used as you made sense of and drew inferences from the data.

2.) Construct an argument about the following:

Does it matter to the health of people in these villages to have piped water?

If so, for whom? Who, if anyone, is not affected? Use evidence from the data in your argument.

| <b>Table 1 Demographic Information</b> |                 |          |          |          |
|--|-----------------|----------|----------|----------|
|  | <b>All of A</b> | <b>B</b> | <b>C</b> | <b>D</b> |
| <b>community population</b>            | 621             | 346      | 243      | 187      |
| <b>% AI/AN</b>                         | 96              | 95       | 95       | 93       |
| <b>incomeUSD</b>                       | 43,700          | 40,000   | 22,917   | 49,000   |
| <b>% below poverty threshold</b>       | 24              | 28       | 44       | 15       |
| <b>% enrolled</b>                      | 65              | 86       | 63       | 96       |

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| Table 2. Visit rates (per person year) for each community by age class and disease type. Community A (self haul) shown as are rates in all homes with piped water and in homes with piped water in B,C , and D only. P<+0.5 is considered significant and are based on a generalized linear model |         |               |      |      |        |     |                                   |         |        |      |       |                               |        |  |  |
|---|---------|---------------|------|------|--------|-----|-----------------------------------|---------|--------|------|-------|-------------------------------|--------|--|--|
| Age class   | Period  | A self haul   |      |      |        | n*  | All piped in all four communities |         |        |      | n*    | All piped in B, C, and D only |        |  |  |
|   |         | No. individus | Resp | Skin | Gastro |     | Resp                              | Skin    | Gastro | Resp |       | Skin                          | Gastro |  |  |
| 10 years  | pre     | 56            | 3.42 | 0.63 | 0.14   | 235 | 3.01                              | 0.47    | 0.14   | 162  | 2.85  | 0.43                          | 0.14   |  |  |
|   | Post    | 43            | 2.88 | 0.35 | 0.07   | 164 | 2.47                              | 0.46    | 0.05   | 114  | 2.13  | 0.37                          | 0.013  |  |  |
|   | P value |               | 0.06 | 0.02 | 0.14   |     | 0.008                             | 0.83    | 0.004  |      | 0.007 | 0.04                          | 0.006  |  |  |
| 0-19 years  | pre     | 41            | 1.7  | 0.46 | 0      | 229 | 1.34                              | 0.27    | 0.02   | 164  | 1.34  | 0.24                          | 0.01   |  |  |
|   | Post    | 62            | 1.55 | 0.22 | 0.05   | 240 | 1.11                              | 0.21    | 0      | 163  | 1.16  | 0.12                          | 0.003  |  |  |
|   | P value |               | 0.86 | 0.01 | 0.66   |     | <0.0001                           | 0.01    | 0.01   |      | 0.002 | 0.005                         | 0.16   |  |  |
| 0-35 years  | pre     | 36            | 1.22 | 0.3  | 0.03   | 171 | 0.94                              | 0.29    | 0.03   | 134  | 0.89  | 0.2                           | 0.02   |  |  |
|   | Post    | 30            | 1.13 | 0.27 | 0.06   | 205 | 0.83                              | 0.24    | 0.02   | 165  | 0.77  | 0.1                           | 0.02   |  |  |
|   | P value |               | 0.78 | 0.79 | 0.47   |     | 0.08                              | 0.33    | 0.97   |      | 0.07  | 0.002                         | 0.99   |  |  |
| 5-50 years  | pre     | 33            | 0.97 | 0.38 | 0.02   | 176 | 0.92                              | 0.29    | 0.01   | 120  | 0.99  | 0.26                          | 0.01   |  |  |
|   | Post    | 42            | 1.03 | 0.4  | 0.02   | 149 | 0.83                              | 0.13    | 0.03   | 98   | 0.76  | 0.13                          | 0.02   |  |  |
|   | P value |               | 0.95 | 0.87 | 0.84   |     | 0.91                              | <0.0001 | 0.21   |      | 0.35  | 0.0007                        | 0.58   |  |  |
| 50 years  | pre     | 25            | 1.14 | 0.31 | 0.07   | 154 | 1.1                               | 0.23    | 0.04   | 120  | 1.13  | 0.17                          | 0.04   |  |  |
|   | Post    | 26            | 1.11 | 0.24 | 0.07   | 193 | 1.11                              | 0.24    | 0.05   | 145  | 1.15  | 0.14                          | 0.05   |  |  |
|   | P value |               | 0.83 | 0.23 | 0.96   |     | 0.92                              | 0.81    | 0.15   |      | 0.8   | 0.7                           | 0.18   |  |  |

| Table 3 Number, person-years of follow-up and visit rates (per person year) for each community and each of three illness classes, all age classes combined, pre and post water pipe installation. P<= 0.05 is considered significant derived from a generalized linear mixed model. |         |                                 |               |           |           |           |           |                                   |
|---|---------|---------------------------------|---------------|-----------|-----------|-----------|-----------|-----------------------------------|
|   | Period  | Statistic                       | A (self haul) | A (piped) | B         | C         | D         | All piped in all four communities |
| Infection type  |         | n-Pre(person years follow up)   | 161 (469)     | 219 (642) | 283 (820) | 152 (452) | 167 (433) | 821 (2,347)                       |
|   |         | n-Post (person years follow up) | 174 (506)     | 225 (627) | 273 (781) | 150 (365) | 153 (382) | 801 (2,155)                       |
| Respiratory   | pre     |                                 | 1.88          | 1.68      | 1.81      | 0.93      | 1.49      | 1.55                              |
|   | post    |                                 | 1.76          | 1.46      | 1.73      | 0.82      | 0.92      | 1.35                              |
|   | P value |                                 | 0.08          | 0.06      | 0.03      | 0.03      | <0.0001   | <0.0001                           |
| Skin  | pre     |                                 | 0.44          | 0.44      | 0.27      | 0.31      | 0.22      | 0.31                              |
|   | post    |                                 | 0.36          | 0.51      | 0.17      | 0.12      | 0.16      | 0.25                              |
|   | P value |                                 | 0.06          | 0.18      | 0.001     | <0.001    | 0.049     | 0.003                             |
| Gastrointestinal  | pre     |                                 | 0.06          | 0.06      | 0.06      | 0.03      | 0.03      | 0.05                              |
|   | post    |                                 | 0.06          | 0.04      | 0.02      | 0.02      | 0.04      | 0.03                              |
|   | P value |                                 | 0.8           | 0.2       | 0.0003    | 0.57      | 0.3       | 0.005                             |

Table order and titles slightly modified from original. Data were not modified.