## Visits to a general practitioner

| | |
|---|---|
| **Age Cohorts** | Younger |
| **Surveys** | Surveys 2 and 3 |
| **Derived Variable** | GP use |
| **Definition** | Number of visits to a general practitioner |
| **Source Items (Index Numbers)** | Question 1a & b (HSRV-065 & HSRV-066) |
| **Statistical form** | Categorical variable |
| **Index Numbers** | HSRV-133 & HSRV-134 |
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| **Endorsed** | 1 December 2004 |

**Background**

The frequency of consultation with a General Practitioner (GP) during the 12 months prior to surveys has been assessed with a single item in all ALSWH surveys other than the second and third surveys of the Younger cohort; these surveys included two items about GP visits.

The aim of this analysis is to use the two survey items about GP use to develop an algorithm for a single, reliable, self-report measure for GP visits which is comparable with the single item on other surveys. Health Insurance Commission (HIC) records of the actual number GP visits are used to assess the accuracy of these algorithms, using the following definitions.

*Predictive accuracy*: Percent agreement within 1 category between the actual and predicted number of GP visits.

*Under-estimate*: The percentage of observations in a cross-tabulation of actual and predicted numbers of GP visits, in which the model predicts a category for GP visits which is two or more categories less than HIC data.

*Over-estimate:* The percentage of observations in a cross-tabulation of actual and predicted numbers of GP visits in which the model predicts a category for GP visits which is two or more categories higher than HIC data.

In order to develop the algorithm it was necessary to identify the 12 month period which best aligned with survey responses to select from HIC records. The period from 1 May 1999 to 30 April 2000 most closely corresponded to return of Survey 2 and the period from 1 May 2002 to 30 April 2003 best corresponded with Survey 3. Counts of GP visits from the HIC data were aggregated into the same categories as the survey responses.

Data were available to develop the algorithm when women from the Younger cohort had consented to give access to their HIC data. For Survey 2, just over half of the women had consented (5 245/9 689; 54.1%), while less than half had consented for the calendar years 2002-2003 (3 714/9 081; 40.9%).

**Source items**

**How many times have you consulted a family doctor or another general practitioner (GP) for YOUR OWN HEALTH in the LAST 12 MONTHS for:**

a Pap tests, contraception, routine pregnancy checks

b All other reasons

| Code | Survey 2 Response | Survey 3 Response |
|---|---|---|
| 0 | None | None |
| 1 | Once | Once – Twice |
| 2 | Twice | 3-4 times |
| 3 | 3 times | 5-6 times |
| 4 | 4 times | 7-9 times |
| 5 | 5-6 times | 10-12 times |
| 6 | 7-9 times | More than 12 times |
| 7 | 10-12 times | |
| 8 | More than 12 times | |

**Developing a Method for Estimation**

The majority of women who consented to give access to their HIC data (93% and 95% respectively) answered both survey items concerning GP visits (Table 1).

**Table 1 Survey responses among Younger women giving consent to access HIC data and Survey 2 (n=5 245) and Survey 3 (n=3 714)**

| Survey items on GP use which were answered | Survey 2 | | Survey 3 | |
|---|---|---|---|---|
| | Number | Percent | Number | Percent |
| Items A and B | 4 881 | 93.1 | 3542 | 95.4 |
| Item A only | 230 | 4.4 | 118 | 3.2 |
| Item B only | 122 | 2.3 | 47 | 1.3 |
| Neither Item A or B | 12 | 0.2 | 7 | 0.2 |

Four options for creating a single, survey-based estimate of the number of GP visits were evaluated using data from Survey 2.

- Use one of the survey items as a stand-alone estimate
- Sum of responses to items A and B
- Estimate using linear regression
- Estimate separately for particular combinations of responses, using the best estimate for that combination.

1. Use one of the survey items as a stand-alone estimate

Neither survey item estimates the actual number of visits well; both tend to under-estimate GP use when compared with HIC data (Table 2). This option was rejected.

2. Sum the responses to the two survey items

For the purpose of summing Items A and B, the number of visits represented by each response category was defined as the mid-point for that category, with the value 15 (the median number of visits for women in this category in the HIC data) assigned to the response ‘More than 12 times’. A

summed score was calculated for women answering both items (n=4 881). This score tends to under-estimate low use and over-estimate higher use of GP services compared with HIC data (Table 2).This option was rejected.

**Table 2 Distribution of GP usage under various scenarios**

| Number of GP Visits | Actual from HIC Data | Estimate of GP use from: Item A only | Item B only | Sum of items A & B |
|---|---|---|---|---|
| None | 7.3 | 22.5 | 10.5 | 3.6 |
| Once | 11.7 | 31.2 | 16.0 | 7.7 |
| Twice | 13.6 | 20.2 | 18.9 | 11.8 |
| 3 times | 13.2 | 11.2 | 16.2 | 14.1 |
| 4 times | 11.6 | 6.0 | 12.3 | 13.9 |
| 5-6 times | 16.4 | 3.9 | 14.1 | 18.0 |
| 7-9 times | 13.8 | 1.4 | 5.1 | 17.2 |
| 10-12 times | 6.3 | 1.1 | 3.0 | 8.3 |
| More than 12 times | 6.1 | 2.5 | 4.0 | 5.6 |

3. Estimate using linear regression

The observed number of visits from HIC data was regressed, without an intercept term, on:

- both items for 4 881 women answering both items,
- Item A for 230 women answering only that item, and
- Item B for 122 women answering only that item.

The resulting regression equations, listed in order, were:

- GP Use = 0.52 * Item A + 0.86 * Item B (Equation 1),
- GP Use = 0.87 * Item A (Equation 2), and
- GP Use = 0.94 * Item B (Equation 3).

Equation 1 was used to estimate the number of GP visits for women completing both items. The predicted number of visits was rounded to the nearest integer and values were truncated at 8.

Because the regression coefficients of 0.94 and 0.86 for women completing only one item were both close to one, they suggest that the item completed corresponds with the total number of GP visits and that the there were no visits of the type specified in the unanswered item. So a third estimate was made using regression for women completing both items and the actual response for women completing one item only.

When compared with HIC data, none of the resulting estimates (Table 3) were considered to be sufficiently accurate.

**Table 3 Accuracy of various methods in the prediction of GP visits**

| Prediction Method and Response Pattern | Number | Predictive accuracy | Under-estimate | Over-estimate |
|---|---|---|---|---|
| Summed score | 4 881 | 64 | 24 | 12 |
| Regression Equation 1 if Items A and B are completed | 4 881 | 62 | 13 | 25 |
| Regression Equations 1, 2 & 3 if Item A or B is completed | 5233 | 61 | 13 | 26 |
| Regression Equation 1 if Items A and B are completed; and self-report if Item A or B only is completed | 5 233 | 61 | 13 | 26 |
| Separate estimates for each pattern of response | 5 245 | 62 | 20 | 18 |
| - Regression Equation 4 if there was a Non-zero responses to both items | 3 372 | 60 | 20 | 20 |
| - Self-report if only 1 item is answered | | | | |
| o answered Item A ONLY | 230 | 48 | 36 | 16 |
| o - answered Item B ONLY | 122 | 59 | 25 | 16 |
| - Sum of Items A and B if either item is zero | | | | |
| o Items A & B are both zero | 174 | 85 | 15 | n/a[1] |
| o Item A zero; Item B non-zero | 930 | 66 | 17 | 17 |
| o Item A non-zero; Item B zero | 405 | 69 | 15 | 16 |
| - Assigned to missing if no response to either item | 12 | n/a[1] | n/a[1] | n/a[1] |

[1] n/a = Not applicable

4. Estimate separately for particular combinations of responses

Various patterns in the data, based on whether items were completed as non-zero, completed as zero or not completed (missing), were evaluated separately in order to determine the most accurate estimation method.

*Non-zero responses to both items*

None of the regression models used above had included an intercept term, so the possibility of improved predictive power with an intercept was considered.

Using 3 372 responses, the resulting regression model is:

GP use = 1.84 + 0.24 * Item A + 0.57 * Item B (Equation 4)

The predictive accuracy for this model is 60%, with under-estimation in 20% of cases and over-estimating in a further 20%. Equation 4 over-estimates GP use for women reporting 7 or more visits and under-estimates visits for those reporting less than 2 visits. The standard errors for parameter estimates from Equation 4 were high, even when the model is fitted within strata for GP use (i.e. low, medium, high number of visits). Also, the model may be deemed to be over-fitted as it cannot be easily generalised to other time periods, or other samples of survey responses. There is no evidence that the under or over estimation is related to education or area of residence and so these factors were not included in the prediction model. Transformations of Items A and B (including log, power and step functions) did not improve robustness and predictive power.

*Answered only 1 item*
Regression analysis was performed separately for women who answered Item A only (n=230) and those who answered Item B only (n=122). The resulting models are:

- GP Use = 0.87 * Item A, and
- GP Use = 0.94 * Item B.

The model for Item A alone predicts GP visits with 48% accuracy, under-estimates for 36% of cases and over-estimates for 16%. The model for Item B is more accurate (59%), but under-estimates GP visits in 25% of cases.

Neither regression co-efficient was statistically significantly different from 1, suggesting that total GP visits is estimated by the non-missing item. Given the relatively low levels of predictive accuracy for the regression models, the survey responses for these 352 women were preferred to the regression estimates.

*Response of zero to both items*
The actual number of GP visits (HIC) was zero or one for 85% of the 174 women with a response of zero for both items (Table 4). In this case the best estimate of GP visits is believed to be zero.

**Table 4 Actual GP visits for 174 women who answered Zero for Items A & B**

| Actual number of GP visits (from HIC data) | Number | Percent |
|---|---|---|
| None | 112 | 64.4 |
| Once | 36 | 20.7 |
| Twice | 10 | 5.8 |
| 3-4 times | 8 | 4.6 |
| 5 or more times | 8 | 4.7 |

*Zero response to one item and a non-zero response to the other item*
The non-zero response (equivalent to the sum of the responses) was evaluated as the estimates of the total number of GP visits. For women with a non-zero response to Item A (n=405), the predictive accuracy if the item was 69%; 15% of values were under-estimated and 16% over-estimated. There appears to be increasing over-prediction with increasing values for item A, although the relationship was not strong enough to warrant any further adjustment. Predictive accuracy (66%), over-estimation (17%) and under-estimation (17%) were similar for women reporting a non-zero response for Item B (n=930).

Where either of Item A or Item B are reported as zero and the other item is non-zero, the sum of Items A and B is recommended as the best estimate the number of GP visits.

*No response to either item*
Set GP visits to missing for these 12 women.

Conclusion
The use of a method specific to each pattern of responses was determined as the most appropriate because both under- and over-estimation of GP visits is more evenly distributed than for other methods, especially in the more numerous classes of response. This was considered to be an improvement over conceptually simpler methods even though it failed to improve predictive accuracy. This approach also tends to under- rather than over-estimate GP usage, a result consistent with findings from Survey 1 comparing GP use by self-report with HIC data[1]. The method is computationally simple to execute.

**Derived Variable**
The value for a single variable estimating the number of GP visits by Younger women at Surveys 2 and 3 was based on the pattern of responses to two items. The method selected for each pattern of responses is shown below.

| **Response pattern:** | **Method for estimating GP visits** |
|---|---|
| Non-zero responses to both items: | ○ Fit a regression model with an intercept for women with both survey and HIC data;<br>○ Apply regression coefficients to responses for all women;<br>○ Categorise value derived from the regression |
| Answered only 1 item: | ○ Use the response for the non-missing item |
| Response to either item is zero: | ○ Estimate as the sum of the 2 items |
| No response to either item: | ○ Set to missing |

The number of responses falling into pattern is shown in Table 5.

**Table 5 Number of women with each response pattern at Surveys 2 & 3**

| **Response Pattern** | **Survey 2** | **Survey 3** |
|---|---|---|
| Non-zero responses to both items | 3 372 | 2366 |
| Response of zero to both items | 174 | 90 |
| Zero response to one item and a non-zero response to the other item | | |
| ○ Zero response to Item A; non-zero response to Item B | 930 | 439 |
| ○ Non-zero response to Item A; zero response to Item B | 405 | 647 |
| Answered only 1 item | | |
| ○ Answered Item A only | 230 | 118 |
| ○ Answered Item B only | 12 | 47 |
| No response to either item | 12 | 7 |

*Application of regression method for non-zero responses to both items at Survey 3*
Using 2366 responses, the resulting regression model including an intercept term was:

GP use at Survey 3 = 1.19 + 0.23 * Item A + 0.58 * Item B (Equation 5)

This is very similar to the regression equation 4 that was obtained for Survey 2, with the intercept term being smaller for the Survey 3 equation (1.19 versus 1.84). It should be noted, however, that 8 response categories were offered at Survey 2 and these were collapsed to 6 categories at Survey 3.

The predictive accuracy for this model was 79.84%, with under-estimation 10.57% of cases and over-estimating in a further 9.59%. There was no relationship between over or underestimating actual GP visits and the response to either item. Also, the model may be deemed to be over-fitted as it cannot be easily generalised to other time periods, or other samples of survey responses. However, it does give lower prediction error than the regression model fitted for Survey 2 applied to Survey 3 data. There is no evidence that the under or over estimation is related to education or area of residence and so these factors were not included in the prediction model. Transformations of Items A and B (including log, power and step functions) did not improve robustness and predictive power.

*Distribution of estimated total GP visits*

There is very little difference in the distribution of predicted total number of GP visits for women who have HIC data and for all women responding to Surveys 2 and 3 (Table 6). In all cases the majority of women (more than 60%) are estimated to have visited the GP between 3 and 6 times in the previous 12 months.

**Table 6 Estimated number of GP visits at Surveys 2 and 3; Younger Cohort**

| Estimated number of GP visits | Women with HIC data | | | All Respondents | | |
|---|---|---|---|---|---|---|
| | Number | Percent | Weighted Percent[a] | Number | Percent | Weighted Percent[a] |
| **Survey 2** | | **(n = 5 245)** | | | **(n = 9 688)** | |
| None | 186 | 3.6 | 3.4 | 345 | 3.6 | 3.5 |
| 1 | 456 | 8.7 | 8.5 | 824 | 8.5 | 8.4 |
| 2 | 376 | 7.2 | 7.1 | 697 | 7.2 | 7.0 |
| 3 | 1 305 | 24.9 | 25.0 | 2 398 | 24.8 | 24.7 |
| 4 | 1 109 | 21.2 | 21.1 | 2 055 | 21.3 | 21.2 |
| 5-6 | 1 090 | 20.8 | 21.5 | 1 986 | 20.5 | 21.1 |
| 7-9 | 361 | 6.9 | 6.9 | 701 | 7.3 | 7.2 |
| 10-12 | 230 | 4.4 | 4.4 | 436 | 4.5 | 4.6 |
| More than 12 | 120 | 2.3 | 2.2 | 227 | 2.4 | 2.3 |
| **Total** | **5 233** | **100.0** | **100.1** | **9 669** | **100.1** | **100.0** |
| *Missing* | *12* | *0.2* | *0.2* | *19* | *0.2* | *0.2* |
| **Survey 3** | | **(n-3 714)** | | | **(n= 9 081)** | |
| None | 111 | 2.99 | 3.18 | 446 | 4.93 | 4.81 |
| 1-2 | 659 | 17.78 | 17.74 | 1772 | 19.58 | 19.28 |
| 3-4 | 1358 | 36.63 | 36.66 | 3144 | 34.73 | 34.83 |
| 5-6 | 1115 | 30.08 | 29.89 | 2597 | 28.69 | 29.27 |
| 7-9 | 250 | 6.74 | 6.81 | 576 | 6.36 | 6.31 |
| 10-12 | 150 | 4.05 | 4.19 | 337 | 3.72 | 3.77 |
| More than 12 | 64 | 1.73 | 1.53 | 180 | 1.99 | 1.73 |
| **Total** | | **100.0** | **100.1** | **9 052** | **100.1** | **100.0** |
| *Missing* | *7* | | | *29* | | |

[a] weighted by area of residence

The SAS code to create categories for the number of GP visits is:

**Survey 2**

```
if Item A=. and Item B=. then y2gpuse=.;
else if Item A=. then y2gpuse=Item B ;
else if Item B=. then y2gpuse=Item A ;
else if Item A = 0 or Item B = 0 then y2gpuse = Item A + Item B;
else y2gpuse= round (1.84 + (0.24*Item A) + (0.569*Item B));
if y2gpuse>8 then y2gpuse=8 ;
```

**Survey 3**

```
if Item A=. and Item B=. then y3gpuse=.;
else if Item A=. then y3gpuse=Item B ;
else if Item B=. then y3gpuse=Item A ;
else if Item A = 0 or Item B = 0 then y3gpuse = Item A + Item B;
else y3gpuse= round (1.189 + (0.23*Item A) + (0.58*Item B));
if y3gpuse>6 then y3gpuse=6 ;
```