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### Article

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## TITLE

Methodological and economic evaluations of seven survey modes applied to pharmaceutical health service research

## ABSTRACT

**Objective:** To evaluate methodological outcomes and cost-effectiveness of seven survey modes, using a study of general public views towards pharmacy public health services.

**Methods:** A cross-sectional survey was conducted in North West England among people aged  $\geq 18$  years, using two approaches. Three interviewer-assisted modes were street, door-to-door and telephone. Four self-completion modes were single-and double-mailing to residential addresses, surveys sent to public/private business by post (postal-business), and questionnaires dropped-off at venues (drop-off). The study compared response rates, demographics and two domains ((a) actual use of and (b) willingness to use pharmacy public health services) between modes. Incremental cost-effectiveness ratios of different modes were assessed against the single-mailing.

**Key findings:** Response rate varied between 5.1% (postal-business) and 34.5% (street). Respondent age, education, employment, socioeconomic and deprivation status varied between different modes. Results for domain (a) were similar for all modes. Interviewer-assisted modes resulted in more positive views on willingness to use advisory services ( $P < 0.05$ ). The drop-off mode saved £45.92 (US\$72.55) per 1% increase in response rate compared to single mailing, while interviewer-assisted and double-mailing were more costly. At higher response rates, cost-savings by the drop-off mode diminished, but for other survey modes, additional costs decreased.

**Conclusion:** Drop-off mode is cost-effective compared to the standard single mailing, but selection bias is possible. Street surveys are also an efficient method, but may carry a higher risk of social desirability bias. Mixed-modes surveys may reach wider sectors of the population. The similarity in use of services suggests all survey modes reach members of the public relevant to pharmacy researchers.

**Key words:** cross-sectional survey, mixed-modes, community pharmacy, public health, cost-effectiveness

## INTRODUCTION

Surveys are commonly used to study the population's perceptions on health-related issues.<sup>1</sup> Postal surveys are the most frequently used method in many countries.<sup>2-5</sup> Generalization in surveys is essential to enable findings to be used for predictive purposes, but it is dependent on several factors e.g. adequate sample size and a good response rate.<sup>6</sup> A 60% response rate has generally been considered acceptable for survey research.<sup>7,8</sup> However, response rates for postal surveys of both health professionals<sup>5</sup> and the general population<sup>9</sup> have decreased in recent decades.

One potential way to improve responses is to use a mixed-modes survey. Relatively few studies have previously explored the impact of mixed-modes on survey findings and/or assessed costs associated with different approaches. Three Australian studies were found; two looking at a follow-up strategy, obtained contradictory findings regarding the cost-effectiveness of a telephone follow-up reminder.<sup>4, 10</sup> Another one comparing response rate and cost effectiveness of three survey modes (postal, internet and telephone) concluded that the postal survey was an economical method.<sup>11</sup> Remaining studies have evaluated only survey findings. One study in the US concluded that survey mode had little effect on findings of key questions.<sup>12</sup> A UK-based cross-sectional study suggested that data generated from different survey modes could be combined to maximize sample size of ethnic minority groups, but was less certain about the similarity of findings gathered by multiple modes.<sup>13</sup> None of these have investigated public views about pharmacies.

We have investigated the general public's views on pharmacy public health services in England.<sup>14</sup> As with any survey, if the findings are to be used to make recommendations about services, it is essential to maximise response rates and to ensure the diversity and relevance of the population reached by the survey. The study focused on seven pharmacy public health services relating to cardiovascular disease, the leading public health problem in the study area<sup>15</sup>; (i) health advice – stopping smoking, sensible drinking, losing weight and heart health, and (ii) health checks – checking blood pressure, cholesterol and blood sugar.

The aim of the work reported in this paper was to examine the differences in findings between survey modes within a mixed-modes survey used to gather information concurrently within a single population. In addition, we aimed to identify the most cost-effective methods of questionnaire distribution for health survey research through a cost-effectiveness analysis.

## **METHODS**

The cross sectional survey was conducted in a defined local government area of NW England with gender (53% female), age (51% age 35-64 years) and employment characteristics (56% employed) similar to regional and national statistics.<sup>15</sup> The total population in this area at the time of the survey was 283,000.<sup>16</sup>

Eligible participants were the general public aged  $\geq 18$  years. Health professionals were excluded since their expertise was outside the range of general public opinions. The same questions were used for all survey modes. A range of survey distribution modes were designed which included both self-completion and interviewer-assisted completion: street, door-to-door, telephone, postal and survey sent to public and private businesses. Online distribution was not included as only one local website owners was willing to post the online survey and, without the full co-operation of website owners, a response rate could not be calculated for this method. The minimum sample size required was 1,063, calculated based on a reported probability of the customer willingness to discuss 'healthy eating' with pharmacists of 0.32<sup>17</sup> and a standard error of 0.020. Hence, we set a total target sample size of 1,200.

### **Interviewer-assisted approaches**

A two-hour training session on interviewer-assisted approaches, facilitated by researchers experienced in using these approaches, was provided to four additional researchers prior to the fieldwork. Overall five researchers were involved in survey administration. The survey was conducted over weekdays and weekends during January to May 2011.

#### *Street survey*

Three researchers administered surveys at eight purposively selected retail centres within the area. The survey administration was split into three slots per day lasting about one hour each. A quota sampling framework was used, based on local population statistics,<sup>15</sup> to set target numbers for both gender and age groups to ensure representativeness of these demographic factors within this sub-sample. People who passed by researchers were randomly approached and invited to complete the questionnaire.

#### *Door-to-door survey*

One hundred streets containing at least 10 houses each were randomly selected from the postcode address file (PAF) for the area. Initially, all addresses in the PAF were assigned individual identification numbers, then Random.org was used to generate 20 random numbers which were used to select the postcode. For example, if the postcode 'L22 5PQ' was chosen, all streets located within the area 'L22 5' were included and five streets from each area were then randomly selected as target streets for conducting the door-to-door survey. Researchers visited each household on each of the selected streets, requesting one occupant of the household complete the questionnaire.

### *Telephone survey*

Four researchers each created a list of eight hundred telephone numbers (3,200 numbers in total) by randomly selecting numbers from 200 pages of phonebooks, 4 numbers each page. Random numbers were generated by Random.org. Researchers made a single call to each number, and, if recipients agreed, carried out the survey over the telephone, following a pre-prepared script to ensure consistency of interview technique. No follow-up calls of unanswered or engaged numbers were made.

### **Self-completion approaches**

Survey packs were distributed via the self-completion approaches during April to September 2011.

### *Postal surveys*

All addresses in the PAF were assigned individual identification numbers. Random.org was used to generate random numbers which were then used to select addresses. Five hundred households received postal surveys using *double-mailing*. Survey pack distribution was followed by a postcard reminder one week later. Non-respondents were then sent a second survey pack and reminder in the following month. A further 500 randomly selected households were sent survey packs, followed by one postcard reminder, but not a second survey, providing a *single-mailing* comparison.

### *Survey sent to public and private businesses*

Two methods were developed which aimed to reach the public through public or private business, defined as any place in which some type of service was provided to the public. A list of 377 businesses/companies was obtained from a website listing local businesses. For the first, *postal-business*, invitation packs were distributed, asking whether the business managers would be willing to pass the survey packs on to their colleagues and employees. If they agreed to do so, the researcher then contacted them to arrange delivery of survey packs. For the second, *drop-off*, the researcher visited in person and dropped-off questionnaires, plus freepost envelope, at public organizations which agreed to allow distribution. Seven leisure centres and thirteen libraries were contacted, all of which agreed to do this, and each was provided with 20 questionnaire packs which were left at an agreed focal point.

### **Ethics**

Ethical approval for all modes was received from Liverpool John Moores University (Ref: 09/PBS/005). All data obtained were anonymous and consent was given verbally (researcher-assisted completion) or implied through return of completed questionnaires (self-completion).

### **Outcomes**

#### *Survey response rate*

Response rates were calculated by using the number of completed questionnaires divided by approachable participants (defined as any person who was contacted to complete the survey face-to-face, on the doorstep or by telephone) for the interviewer-assisted methods, or deliverable survey packs for the self-completion approach.<sup>18</sup>

#### *Demographics*

Demographic variables included were: gender, age, ethnicity, educational background, working status, socioeconomic status (SES) and deprivation level (measure of the socioeconomic deprivation experienced by a neighborhood). To assign SES to respondents, they were asked about occupations. These were then classed into three categories; high (managerial/professional occupations), middle (skilled manual/administrative occupations) and low (un-skilled/manual occupations).<sup>19</sup> Respondents were asked for a postcode, which was then used to assign a deprivation score to respondents, based on that assigned to the postcode area as reported by the local council.<sup>20</sup> Deprivation was classified into three levels; most, moderate and least deprived. The

questionnaire explained how postcode would be used and respondents had the right not to disclose their postcode information.

#### *Key findings*

Key findings were divided into two domains; (a) actual pharmacy use and (b) reported willingness to use pharmacy public health services. Actual pharmacy use included the stated frequency of pharmacy visits in the last six months, which was dichotomised as infrequent (less than once per month) and frequent user (at least once every month). Respondents' experience of services was measured using yes/no options and analysed in three ways; experiences of an individual service, any health advice and any health check. Willingness to use services was dichotomised to positive (yes or maybe would use a service) or negative view (would not use a service), which was also examined for individual services, willingness to seek health advice and willingness to use health checks.

#### **Data analysis**

Binary logistic regression was used to identify what types of people responded to the different survey modes. The regression model was adjusted by age, education, work status, SES and deprivation level, excluding all missing data. The postal-business mode was removed from this analysis due to the small number of respondents. Key findings were also compared among all seven survey modes and also between overall interviewer-assisted and self-completion approaches using Chi-square ( $\chi^2$ ). A priori level of statistical significance was set at  $P \leq 0.05$ .

#### **Economic evaluation**

Economic evaluation was conducted from the perspective of researcher. Items and quantities of resources used (Table 1) for each survey mode were recorded, starting from the commencement of survey preparation until reaching the target or termination of the survey. All resources used for both returned questionnaires and non-respondents were captured.

#### *Unit cost analysis*

The operating cost of survey implementation was computed for each survey mode, using the cost elements shown in Table 1. The total cost was calculated by adding all relevant expenses. Dividing the total cost by the number of completed questionnaires yielded unit cost for each survey mode. Implementation period and man-hours were also recorded.

#### *Cost-effectiveness analysis*

Cost-effectiveness analysis (CEA) was used to compare the incremental cost and the incremental effectiveness ratio (ICER) of alternative survey modes to single mailing, being a commonly used technique<sup>2</sup>, as a benchmark mode. Data were analysed at base case scenario using the actual circumstances. All directly incurred costs were used to calculate total operational costs and response rate was used as the key indicator of effectiveness. The ICER was computed using the formula below, where x refers to the survey mode;

$$ICER_x = \frac{\text{Total cost of survey technique}_x - \text{Total cost of survey technique}_{\text{Single mailing}}}{(\text{Percentage of response rate}_x - \text{Percentage of response rate}_{\text{Single mailing}})/100}$$

#### *Sensitivity analysis*

A sensitivity analysis was performed by increasing the proportion of completed questionnaires, ranging from 10% to 100% in a similar way to that used by Breen *et al.*<sup>4</sup> The recalculated total operational cost was then based on the new simulated rate.

## **RESULTS**

### **Response rate**

During January to October 2011, using all modes, approaches were made to 4,988 potential participants. Of these, 3,596 were available and willing to be approached and 908 completed the questionnaires. (Table 2) The street survey had the highest response rate with about one third (34.5%) of approachable participants agreeing to take part, followed by door-to-door, telephone and drop-off respectively. The door-to-door survey encountered a high rate of unoccupied homes and refusals (54.9%). The double-, single-mailing and postal-business obtained a poor response rate, totalling approximately 20% response from deliverable postal surveys.

### **Demographic characteristics**

All survey modes obtained similar representation proportionately in terms of gender, and ethnicity, but significant differences were found between modes in age, education, working status, SES and deprivation level. (Table 3) Street survey was significantly more successful in obtaining responses from younger respondents. Both street and door-to-door survey were successful in obtaining responses from people living in moderate to less deprived areas. Unemployed respondents were less likely to complete the survey via telephone. People aged  $\geq 35$  years and those who had completed college education were more likely to respond to the double-mailing, while higher response rates were obtained from employed people to the single mailing. The drop-off mode was successful in reaching people with university degree and of higher SES.

### **Actual pharmacy use**

As shown in Table 4, all survey modes obtained similar proportions of all types of pharmacy users. Most survey modes obtained low proportions of respondents (0.5-18.8%) who had experienced individual services. Significantly more street and double-mailing survey respondents (26.5% and 28.6%) had experienced at least one health advisory service, while participants using other survey modes reported lower levels of use (8.9-19.6%). In contrast, the proportion of respondents who had experienced health check services was similar across all survey modes (11.2-18.2%), and experience of services showed no significant differences between interviewer-assisted and self-completion survey approaches.

### **Willingness to use pharmacy public health services**

Table 5 illustrates the percentage of positive views showing a willingness to use pharmacy public health services. Statistically significant differences were found in respondents' willingness to use pharmacy services between survey modes, except for blood pressure and blood sugar checks. Respondents who completed the survey by telephone were more likely to report willingness to use advice for sensible drinking and heart health, while door-to-door respondents most likely to report willingness to use smoking cessation, weight management and cholesterol check. Overall willingness to use health advice services was found to be significantly different among the six survey modes, with a higher proportion of telephone survey respondents showing willingness to use at least one health advice service. ( $P=0.003$ ) As was found with service experiences, the proportion of respondents willing to use at least one health check service was similar regardless of survey mode or approach.

### **Cost-effectiveness of survey modes**

#### *Unit cost analysis*

Drop-off mode had the least unit cost per completed survey compared with other modes, but its implementation period was the longest. (Table 2) The unit costs involved in interviewer-assisted completion were relatively higher than those for the drop-off mode but much lower than those for the postal surveys. The postal-business was the most expensive mode and also achieved a very low response.

#### *Cost-effectiveness analysis*

The single-mailing survey, used as a benchmark, had a total cost of £717.48 (\$1,133.62.97) and a response rate of 16.7%, as shown in Table 3. The incremental cost and incremental effectiveness of all survey modes against the single mailing is presented in a cost-effectiveness plane. (Figure 1) The double-mailing survey and all

interviewer-assisted approaches fell into Quadrant B, as while all obtained a higher response rate, they accrued higher operating costs. The drop-off mode was the only one falling in Quadrant C, having a lower cost and higher response rate. Postal-business had a lower response rate than the single-mailing (data fell in Quadrant D), therefore it was not considered to be cost-effective.

From the ICER, the base case scenario shows that the drop-off mode (Quadrant C) saved £45.92 (US\$72.55) per 1% increase in response rate. Street, telephone, door-to-door and double-mailing mode (Quadrant B) have additional costs over the single-mailing; £19.78 (US\$31.25), £49.25 (US\$71.82), £49.73 (US\$78.57), and £144.66 (US\$228.56) per 1% increase in response rate respectively.

### *Sensitivity analysis*

The simulation derived by increasing response rates in 10% increments affected not only the cost of survey packs but also other cost elements such as labour, calling charges and travel. As shown in Figure 2, estimated ICERs for differing response rates showed that at higher response rates, cost-savings by using the drop-off mode diminished. Additional costs decreased considerably for the double-mailing with increasing response rates, but increased slightly for the other survey modes.

## **DISCUSSION**

This study is the first attempt in health service research to compare a wide range of survey modes used among the general public, concurrently obtaining views from the same population. Previous studies have compared the efficiency of survey modes,<sup>2,4,10</sup> however none of these compared more than three modes simultaneously.

Interviewer-assisted approaches (street, door-to-door, telephone) obtained higher response rates than self-completion approaches, similar to previous reports.<sup>2,8,9</sup> Although an ideal target is a response rate of 60%,<sup>7,8</sup> in reality medical surveys frequently yield lower responses.<sup>2,8,21</sup> Response rates to lifestyle surveys have been recently declining, with even 60% being difficult to achieve, resulting in non-responder bias.<sup>22</sup> Hence there is a real need to maximise diversity among the population surveyed. In this study, response rates ranged from 5% (postal-business) to 35% (street), hence non-responder bias is still of concern. Other postal surveys on similar topics, pharmacy weight management services and advice about sensible alcohol drinking, conducted in 2012 and 2013, reported response rates of 20.6%<sup>23</sup> and 26.6%,<sup>24</sup> respectively. Our mixed-modes study received higher response rates from both women and people not in work than reported in one previous study,<sup>23</sup> both groups which have high usage of pharmacies.<sup>25,26</sup>

The different survey modes reached people with slightly different in demographic attributes, in terms of age, education, working status, SES and deprivation level. The street survey was most successful in reaching younger aged adults, perhaps because of the advantage of quota sampling. The telephone survey was less likely to obtain views from unemployed people, which may be related to reliance on mobile phones in this population, as was found in the US and Australia.<sup>27,28</sup> The door-to-door survey obtained fewer responses from people living in more deprived areas, possibly because the surveys were conducted during the day, but higher response rates in this population were obtained through self-completion approaches. Postal-business and drop-off modes are potentially limited by the willingness of business managers acting as gatekeepers to permit questionnaire distribution from their premises. Overall, our findings indicate that combining distribution modes may enable surveys to reach a wider demographic.

There were similarities in actual use of pharmacy public health services between survey modes, suggesting that data using different modes could be comparable. In addition all survey modes were able to reach members of the public who both use pharmacies and have capacity to benefit from pharmacy services, thus are relevant to pharmacy researchers. This concurs with previous work in the US which also concluded that survey mode had little effect on key findings.<sup>12</sup> Our findings also support previous UK work suggesting combining data generated from different survey modes to maximize diversity.<sup>13</sup> Experiences of using pharmacy services were similar to the

levels of use found in a Scottish postal survey where 15% of respondents had used a pharmacy for weight management support, 3% for health checks and 11% for stopping smoking assistance.<sup>23</sup> A higher proportion of respondents approached through interviewer-assisted modes reported willingness to seek health advice compared to self-completion modes, whilst self-reported experiences of using all services and willingness to use health check services showed no differences dependent on survey mode. This may indicate a degree of social desirability bias, which is recognised as a possible problem with interviewer-assisted surveys.<sup>1, 2, 21</sup>

Evidence of the cost-effectiveness of various survey modes is lacking, but is much needed, given falling response rates. Two studies have been identified which attempted to compare costs of survey methods. These had contrasting results concerning telephone reminders for postal surveys, one showing these were a cost-effective method of improving response rates<sup>12</sup> and one the converse.<sup>4</sup> The other one evaluated response rate and cost-effectiveness of three survey modes and reported the postal survey as the most cost-effective mode.<sup>11</sup> The present work is the first published study to perform a CEA comparing the entire operational costs of multiple survey modes, using response rate as the measure of effectiveness. Our data show that among self-completion approaches, the postal-business mode was inefficient due to very low responses, drop-off mode had the lowest unit cost of £2.51 (US\$3.97) per completed questionnaire while double- and single- mailing modes, were more costly. The costs of conducting street-, door-to-door- and telephone surveys ranged from £5 to £8 (US\$7.90- US\$12.64) per completed questionnaire, which was higher than drop-off mode but less than postal surveys, again due to the poor response rates of the latter. Drop-off mode was thus the most cost-effective self-completed approach and also most cost-effective overall, but its implementation period was the longest. In addition, selection bias might be of concern for this mode due to convenience sampling. However, it may merit consideration for use when long periods are allowable in survey research.

A simulated sensitivity analysis performed by varying the response rate<sup>4</sup> indicates that, while drop-off remained the most cost-effective mode, only double-mailing showed any significant decrease in cost-effectiveness with increasing response rates, with other survey modes showing very slight increases. Therefore, single mailing and all interviewer-assisted approaches appear to retain similar cost-effectiveness regardless of response rate.

### **Strengths and limitations**

Performing cost-effectiveness analysis of multiple survey modes was a unique strength of this study, which is the first reported attempt to do so. However it must be noted that the sampling frames and sampling techniques used for each survey mode were necessarily different, thus may have led to selection bias and our study did not include online distribution. Two of the self-completion approaches, double-mailing and postal-business, obtained low response rates, however we obtained sufficient overall responses from the public to enable a comparison between interviewer-assisted and self-completion approaches. The minimum sample size of 1,063 was not quite reached, although the survey did achieve ~85% of this target, mainly through pro-active interviewer-assisted approaches. Response rates for all of the self-completion approaches were lower than for interviewer-completed approaches. The generalisability of the findings is, however, still acceptable, since the standard error computed backward for the actual sample size was below 0.05.

Our sensitivity analysis focused on the major outcome of response rate and used actual costs. Cost-effectiveness may differ in different countries and settings with significant variations in costs. Moreover, response rates achieved may also vary depending on the setting, the topic and the population studied, thus, while our study presents some useful information about cost-effectiveness, the results may not be generalizable. We did not set out to investigate the effect of incentives or questionnaire length, both of which may also affect response rates<sup>2, 29</sup>, hence overall cost-effectiveness of surveys.

### **CONCLUSION**

In an age of declining response rates, future surveys should consider using mixed mode approaches, since they are most likely to deliver representative, if not generalizable, samples. Our data show that the highest response

rate for a single mode is likely to be found using street surveys. Where cost-effectiveness is a major consideration, the drop-off mode can save costs compared to other postal modes, while interviewer-assisted methods were less cost-effective. For surveys where time to completion is the most significant driver, street, door-to-door, or telephone distribution appear most useful. Social desirability bias should be of concern when interviewer-assisted methods are to be used.

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