

Enhancement of medication recall using medication pictures and lists in telephone interviews

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SUMMARY

Purpose To determine the effect of reading medication lists and providing medication pictures on recall of non-aspirin non-steroidal anti-inflammatory drugs (NANSAlDs) during telephone interviews in a case–control study.

Methods After a series of indication-specific questions, a list of all available NANSAlDs was read to study participants and a series of pictures was reviewed when available. Recall was defined as enhanced if a participant recalled NANSAlD use only after the memory aids.

Results Among the 1484 participants who reported NANSAlD use, 94 (6.3%) recalled their NANSAlD use only after the memory aids. Several groups demonstrated enhanced recall following the memory aids: men (odds ratio (OR): 1.73; 95% confidence interval (CI): 1.11, 2.69), users of non-prescription versus prescription NANSAlDs (OR 2.28; 95% CI: 1.21, 4.30), those using >2 other medications (OR 1.69; 95% CI: 1.06, 2.69), those who did not have all of their medication containers available during the interview (OR 1.58; 95% CI: 1.03, 2.42) and cases versus controls (OR 1.90; 95% CI: 1.11, 3.28).

Conclusion The reading of medication names with the availability of medication photographs enhanced recall by approximately 6%. The use of this type of memory aid may reduce recall bias in case–control studies that rely on medication recall, depending on the overall prevalence of medication use and the effect size of the drug on the outcome. Copyright © 2003 John Wiley & Sons, Ltd.

KEY WORDS — anti-inflammatory agents; non-steroidal; case–control studies; epidemiologic methods; memory

INTRODUCTION

Accurate identification of medication exposure is critical to ensuring the validity of pharmacoepidemiology studies.^{1,2} Many of these studies, particularly

case–control studies, rely on participant recall of past medication use. One strategy that is used to enhance participants' recall is to read a list of names of the medications of interest and to provide participants with photographs of the actual medications.³

Few studies have assessed the utility of this approach.^{4–7} None, to our knowledge, has systematically assessed factors associated with enhancement of recall from memory aids nor compared the effects of this approach between cases and controls in a case–control study. The aims of this study were: (1) to estimate the degree to which use of medication lists and pictures improves recall of non-aspirin non-steroidal anti-inflammatory drugs (NANSAlDs), (2) to identify factors associated with enhanced recall from these

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memory aids, and (3) to compare differences in the utility of this approach between cases and controls.

METHODS

Study population

This study was conducted as part of an ongoing case-control study designed to examine the effects of NSAIDs on the risk of acute, first myocardial infarction (MI). Cases were individuals 40 through 75 years old who were discharged with a diagnosis of acute myocardial infarction from one of 36 hospitals in a five-county region surrounding Philadelphia. Approximately four community controls with no history of MI were selected for each case using a modification of the Waksberg random digit dialing method.⁸

Only participants who reported use of one or more NSAIDs are included in this report. Cases were included only if their interviews occurred within 4 months of their MI. In order to minimize bias, controls were also included only if their interviews could be conducted within 4 months of their identification.

Data collection

All exposure data and potential predictors of enhanced recall were collected by telephone interview. All participants were sent, in advance of their interviews, a set of photographs of the most commonly used NSAIDs, including prescription and non-prescription NSAIDs, combination drugs that included NSAIDs, and photographs of the containers of non-prescription products. These sets of pictures included 21 prescription and 11 non-prescription NSAID products. We also provided an additional list of 56 brand-name NSAIDs and NSAID-containing products for which pictures were not available and a list of 24 generic drug names. During the telephone interview, participants were asked to refer to these pictures and lists. If the participant lost or did not receive the photographs, another set was sent and the interview rescheduled, unless the participant did not want to delay the interview. If, after the second mailing, the participant still did not have the photographs at the subsequent telephone call, the interview was usually conducted without sending out another set of photographs, and the names of all NSAIDs were read to the participant without reference to the pictures. A total of 153 participants (2.9%) were excluded because the medication list was not read to them nor were the pictures available during the interview. Participants were also asked to have their

medication containers in front of them, if available, during the telephone interview.

During the interview, participants were first asked to recall any medications used for symptoms commonly treated with NSAIDs during the week prior to the index date (date of MI for cases and date of interview for controls). We asked specifically about drugs to treat aches and pains, sore muscles, headaches, arthritis symptoms, gout, fever, cold or flu symptoms, and inflammation. Participants then were asked to look at the pictures and names of NSAIDs while the names were read to them and to identify any of these medications used during the week prior to the index date. If participants did not have the picture available, the entire list of NSAIDs was read to them.

Definition of 'enhanced recall' from memory aids

NSAID exposure was defined as reported use of any NSAID within the week prior to the index date. Participants were considered to have their recall of NSAID use enhanced by the memory aids (reading of the medications and looking at pictures if available) if they remembered their NSAID use only after review of the picture prompts and medication lists. Those who took more than one NSAID and who recalled at least one of them before the use of the prompts were not considered to have their recall enhanced because they would be appropriately categorized as 'NSAID users' even without the prompts. An analysis that excluded users of multiple NSAIDs yielded nearly identical results to those presented here.

Factors potentially associated with enhanced recall

Information was collected on several factors that may be related to the effectiveness of memory prompts.^{7,9-13} These included age, gender, race, insurance status, income, education, marital status, use of prescription versus non-prescription NSAIDs, the availability of medication containers at the time of the interview, number of other medications used, number of chronic medical conditions and smoking status.

Analysis

We undertook three sets of analyses to address the three specific aims of the study. First, we determined the proportion of participants with enhanced recall from the memory aids. Second, we examined the relationship between each potential predictor and

enhanced recall. Dichotomous variables were examined using odds ratios (ORs) and the chi-square statistic, and continuous variables using the independent sample *t*-test or the Wilcoxon's rank sum test if the variable was not normally distributed. In order to control for potential confounding, we performed a multi-variable logistic regression model, including all factors that were associated with enhanced recall with a $p < 0.2$.¹⁴ We also considered as a potential confounder any variable that changed the OR for any of the risk factors by 10% or more after adjustment for the potential confounder.¹⁵ Third, we compared cases and controls with respect to enhanced recall. In order to adjust for confounding, each of the other covariates was tested as possible confounders. A variable was considered to be a confounder if adjustment for that variable led to a change in the OR for recall by case-control status of at least 10%.¹⁵

We performed several additional analyses to determine possible reasons for differences in enhanced recall between cases and controls. One possible reason was a difference in availability of medication containers during the interview. The availability of medication containers differed between cases and controls because of the logistics of the study. Cases had to have their medication containers from the period prior to their MI (which occurred up to 4 months prior to the telephone interview), while controls had to have their containers from the week prior to the interview. As a result, controls were much more likely than cases to have their bottle available. Because this variable was considered to be in the causal pathway for differences in recall between cases and controls, adjustment was not made for this variable in the primary analysis. However, in a secondary analysis, we adjusted for this variable to test the causal pathway hypothesis.

It was also possible that enhancement of recall between cases and controls differed by the presence of other factors. Therefore, we examined for interactions between case-control status and the other vari-

ables of interest using the relevant product term in logistic regression analyses.

Another possible reason for differences between cases and controls was the different time from the interview to the index week (the 'recall period'). All controls were asked to recall NANSALD use within the prior week (so their recall period was, at most, 7 days) while cases were asked to recall NANSALD use from prior to their MI (so their recall period was from 20 to 122 days, median 74 days). Because there was no overlap in recall period between cases and controls, we could not examine the effects of recall period on the association between case-control status and enhanced recall (i.e. we could not adjust for recall period in the analysis of case-control status versus enhanced recall). However, we could examine recall period itself as a factor associated with enhanced recall among the cases, in whom recall period varied (unlike controls). To do this, we categorized recall period among cases into three approximately equally sized groups and compared the proportion of participants with enhanced recall, both among the case categories and with controls.

All analyses were performed using SPSS version 10.0.7 (SPSS Inc, Chicago, IL), and statistical significance was defined as a two-sided *p*-value < 0.05 .

RESULTS

Effect of memory aid on recall

A total of 1484 participants reported the use of at least one NANSALD in the index week. Of these, 94 (6.3%) recalled any NANSALD use only after use of the memory aids (Table 1). An additional 54 participants (3.6%) recalled their NANSALD use both before and after use of prompts (these were users of more than one NANSALD; Table 1). During the interview 831 (56.0%) NANSALD users had the medication pictures available, 627 (42.2%) did not, and, in 26 (1.8%), the availability of pictures was not recorded.

Table 1. Recall by memory aids*

	Number (%) (Total = 1484 NANSALD users)	95% Confidence Interval
Recalled NANSALDs after indication-specific questions	1336 (90.0)	88.4%, 91.5%
Recalled NANSALDs only after memory aids	94 (6.3)	5.1%, 7.7%
Recalled NANSALDs by both indication-specific questions and by memory aids (users of >1 NANSALD)	54 (3.6)	2.7%, 4.7%

*NANSALDs, non-aspirin non-steroidal anti-inflammatory drugs.

Factors associated with increased recall from memory aid

Table 2 displays the bivariable associations between the variables of interest and enhanced recall. Variables associated with enhanced recall from the memory aids were case status, male gender, lack of availability of medication containers, greater numbers of other medications, and non-prescription NANS AID use. Age was not associated with enhanced recall, either as a continuous variable ($p=0.71$) or as quartiles of age ($p=0.89$). Similarly, race was not associated with enhanced recall ($p=0.25$) when comparing white, black, and other races.

In multivariable analysis, case status, male gender, non-prescription NANS AIDs, and greater numbers of medications were associated with enhanced recall after the prompts (Table 3).

Effect of case-control status on recall

As shown in Tables 2 and 3, cases were significantly more likely to have their memory enhanced by the memory aids. None of the variables in Table 2 had a confounding effect on the OR for case-control status.

One reason that cases may have had better improvement in recall after the memory aid than the controls is that cases were less likely to have all of their medication containers available during the interview (39.6% cases versus 57.4% controls, $p < 0.001$). When adjusting for this difference, the effect of case-control status on enhanced recall was diminished (Table 4; OR 1.71; 95% CI 0.97, 3.01; test for heterogeneity between those with and without all medication containers available $p=0.69$).

There was a significant interaction between case-control status and age (Table 4). Cases were more likely to have enhanced recall from the memory aids relative to controls if they were older (P for interaction 0.039). The ORs for cases versus controls increased with increasing age (Table 4). This interaction was due to a greater enhancement of recall among older versus younger cases (enhancement of recall in the three increasing age groups: 3.8, 11.9 and 15.1%; p value test for trend = 0.053) but not among older versus younger controls (enhanced recall of 6.4, 5.2 and 3.8%, respectively; p value test for trend = 0.13).

Although we could not adjust for the difference in recall period in the comparison of cases versus controls, we examined the effects of recall period itself on recall (Figure 1). A higher proportion of cases had enhanced recall following the memory aids if their recall period was ≤ 90 days versus > 90 days (OR 5.07,

Table 2. Enhanced recall with memory aids*

	Percentage enhanced recall (%)	OR (95% CI)	p -value
Age (years)			
≤ 50	6.2	Ref	
> 50	6.4	1.03 (0.68, 1.57)	0.88
Case-control status			
Control	5.7	Ref	
Case	10.9	2.05 (1.23, 3.42)	0.005
Current smoker			
No	6.0	Ref	
Yes	7.6	1.31 (0.82, 2.09)	0.26
Education			
$<$ High school	6.4	Ref	
\geq High school	6.3	0.99 (0.65, 1.53)	0.98
Gender			
Female	5.1	Ref	
Male	8.6	1.77 (1.17, 2.69)	0.007
Income			
\leq \$50 000/year	6.5	Ref	
$>$ \$50 000/year	6.4	1.00 (0.64, 1.54)	0.98
Insurance			0.64
Private	6.2	Ref	
Medicare	7.1	1.16 (0.57, 2.37)	0.68
Medicaid	9.1	1.53 (0.46, 5.10)	0.49
None	10.0	1.69 (0.65, 4.39)	0.28
Marital status			0.82
Married	6.5	Ref	
Separated/Divorced	4.9	0.75 (0.41, 1.36)	0.35
Widowed	6.5	1.01 (0.47, 2.15)	0.99
Never married	6.6	1.02 (0.49, 2.09)	0.97
Medication containers available during interview			
All	5.3	Ref	
Not all	8.1	1.58 (1.03, 2.42)	0.037
Number of chronic medical conditions			
< 2	6.5	Ref	
≥ 2	6.5	1.00 (0.66, 1.52)	1.0
Number of other (non-NANS AID) medications			
< 3	5.2	Ref	
≥ 3	7.1	1.40 (0.90, 2.18)	0.14
Only non-prescription NANS AID use			
No	3.7	Ref	
Yes	7.0	1.97 (1.06, 3.66)	0.029
Pictures available			
No	6.9	Ref	
Yes	5.9	0.85 (0.56, 1.30)	0.46
Race			
White	6.3	Ref	
Non-white	6.1	0.95 (0.55, 1.66)	0.86

*OR, odds ratio; CI, confidence interval; NANS AIDs, non-aspirin non-steroidal anti-inflammatory drugs.

95% CI: 1.09, 23.7, $p=0.039$). Compared with controls, cases had significantly greater recall after the memory aids if the cases were interviewed within 90 days ($p=0.02$), but not > 90 days ($p=0.35$).

Table 3. Multivariable associations with enhanced recall from memory aids*

	Multivariable OR (95% CI)	<i>p</i> -value
Case-control status = case	1.90 (1.11, 3.28)	0.02
Male gender	1.73 (1.11, 2.69)	0.02
Non-prescription NSAIDs >2 other (non-NSAID) medications used	2.28 (1.21, 4.30)	0.01
	1.69 (1.06, 2.69)	0.03

*Availability of medication containers' not included because variable in causal pathway (see text). OR, odds ratio; CI, confidence interval; NSAIDs, non-aspirin non-steroidal anti-inflammatory drugs.

Table 4. Associations between case-control status and enhanced recall from memory aids*

	OR for case versus control (95% CI)	<i>p</i> -value
Unadjusted case versus control	2.05 (1.23, 3.42)	0.005
Adjusted for all variables in Table 3	1.90 (1.11, 3.28)	0.020
Adjusted for all variables in Table 3 + availability of medication containers	1.71 (0.97, 3.01)	0.062
Interaction with age (Adjusted for all variables in Table 3)		0.039 [†]
Age ≤ 50 years	0.53 (0.12, 2.30)	0.40
Age 51-60 years	2.24 (0.89, 5.64)	0.086
Age > 60 years	5.55 (1.91, 16.16)	0.002

*OR, odds ratio; CI, confidence interval.

[†]*p*-value for interaction.

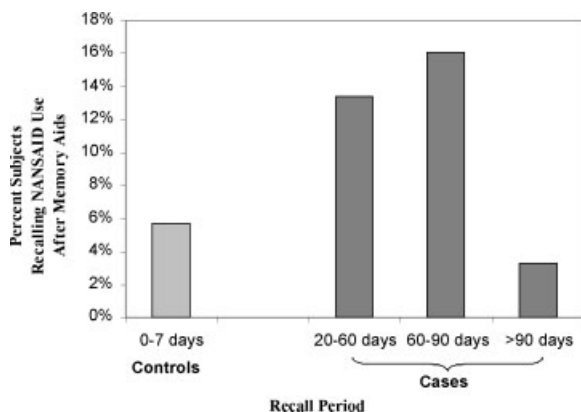


Figure 1. Percentage enhanced recall after the use of memory aids among controls (all with recall period of at most 7 days) compared with enhanced recall after the use of memory aids among cases, based on various recall periods among cases

DISCUSSION

This study demonstrates that, in conducting telephone interviews, the strategy of using memory prompts in the form of reading of specific drug names and providing pictures of medications, can result in enhanced recall of medication use by an absolute 6% among those reporting exposure compared with indication-specific prompts alone. The prompts appeared to be more effective among cases, among men, among participants taking more medications, among participants who did not have their medication containers available and amongst those using only non-prescription NSAIDs. Other factors, such as insurance status, smoking, and income did not appear to influence the effectiveness of the memory aids.

Relative benefit of memory aid

The increase in recall with the memory aids was modest in this study, with 94% of exposed participants remembering at least one of their NSAIDs without the aids. However, 6% recalled their NSAID use only after the aids and about 10% of exposed participants recalled either all or some of their NSAID use only after the memory aids. There also were subgroups that recalled an even higher proportion of NSAID use without memory aids.

Few studies have examined the effect of verbally reading medication names and showing medication pictures on recall. In a small study of pictorial aids used during a telephone interview, similar to our study, 14 women who reported using hormone replacement therapy for at least 6 months duration were asked if the availability of pictures improved their recall.⁵ Ten women reported using the pictures to assist with recall. Cottler and Robbins found an improvement of 30% in recall for psychoactive drugs after reading medication lists.⁷ In a pilot study of 532 women presenting for obstetrical or gynecological care, Mitchell *et al.* asked about medication use in the prior year using a sequence of questions.⁴ The addition of a list of named drugs led to an increase in recall compared with indication-specific questions. For aspirin and acetaminophen, 19 to 48% (average 28%) of users recalled their medication use only after hearing the specific drug names. In an analysis of a case-control study, performed in the same paper, the authors found that cases (mothers with malformed infants) reporting acetaminophen and aspirin use relied on the list of specific drug names 15 and 19% (average 16%) of the time, respectively, to recall their use of these drugs. The greater enhancement of recall

with memory aids in this prior study compared with our study could be due to differences in study design. Mitchell *et al.* asked for use of medications up to 12 months prior to the interview and participants did not have medication containers available to help with recall. We asked for recall of more recent medication use, especially among our controls, and encouraged the use of medication containers to help with recall. If our cases (who had to recall medication use up to 4 months previously) who did not have all of their medication containers available are compared with cases in the prior study, the numbers are more comparable (12% in our study versus the average of 16% in their study).

Factors associated with benefit from memory aids

Subjects who used more medications were more likely to have their recall enhanced by the use of the memory aids. Other studies have suggested that greater numbers of medications leads to worse recall,^{12,16} but none, to our knowledge, have shown that recall can be enhanced in these subjects with memory aids. Similarly, it seems intuitive that people who use non-prescription products would be more likely to forget their medication use without memory prompts compared with prescription NANSOID users. However, only one prior study of memory aids has included non-prescription medications, and did not demonstrate a difference between non-prescription drugs (aspirin or acetaminophen) and prescription-only drugs (only including drugs other than aspirin, acetaminophen, and NANSOIDS).⁴ Unlike our study, this prior study did not compare recall within a drug class.

Men were more likely than women to have better recall from the memory aids. Because most prior studies included only women, this association has not been well studied. Cottler and Robins found that men tended to have the greatest improvement in recall with prompts for some, but not all, psychoactive medications.⁷

The lack of availability of medication containers was also associated with enhanced recall from the memory aids. This suggests that the medication containers themselves may serve as a memory aid. Regardless, there was still a benefit of the medication lists and pictures among people who had their containers available.

Recall period, the time between when the exposure occurred and when it is reported by the study participants, was associated with enhanced recall among cases if the recall period was ≤ 90 days. However, if the recall period was >90 days, the memory aids had less of an effect on recall. It is likely that cases who had

to remember medication use from more than 90 days before the interview had overall worse recall^{9,10,13} and that memory aids were therefore not as useful.

Other than those factors discussed above, and case-control status (discussed below), no other factor studied modified the effectiveness of prompts. Increasing age may be associated with worse recall of medications in the absence of memory aids.¹¹⁻¹³ However, this does not mean that memory aids will work better in the elderly. For example, two studies that used memory aids did not find an effect of age on recall.^{9,10} Cottler and Robins found that younger, not older, subjects tended to have the greatest improvement in recall with prompts.⁷ Our finding in cases is consistent with this prior study, but our controls showed an opposite trend.

Cases versus controls

There are several reasons why cases may have benefited more than controls by use of the memory aids. First, cases were less likely to have their medication containers available during the interview. The diminution in the effect of case-control status on enhanced recall after adjustment for the availability of medication containers suggests that this was responsible for part of the difference between cases and controls. Second, controls were asked to remember NANSOID use from a more recent time-frame than cases. Although we could not specifically examine this possible mechanism directly, longer recall periods are associated with diminished recall.^{9,10,13} However, our analyses suggest that the benefit of memory aids may decline as the recall period is increased even further. Third, because cases had just had a potentially life-threatening event, it is possible that they did not remember their prior medication use as well as controls.^{17,18} Because the design of our case-control study prohibited altering these possible mechanisms (similar to many other case-control studies), and because differential misclassification of exposure between cases and controls can bias the results of a case-control study,¹ the use of the memory aids utilized in this study remains an important tool to reduce bias in case-control studies.

Potential limitations

There are several potential limitations to this study. First, there is no gold standard for NANSOID exposure. Therefore, we cannot tell if the memory aids prompted participants to mistakenly report NANSOIDS that they really did not take ('false positives'). If so, our results would overestimate the utility of

memory aids. However, prior studies have suggested that the use of memory aids is unlikely to lead to meaningful false positive reporting of medication use.^{4,6} In addition, if memory aids led to more false positive reports, it would be expected that cases with the longest recall period might have the greatest proportion of medications reported after the prompts. We found the opposite.

Second, although we found no effect of having pictures of medications available during telephone interviews, we cannot exclude bias as an explanation. It is possible that participants who kept the pictures that were mailed to them and who remembered to have their pictures available during the interview were different from those who did not have their pictures available in ways that were associated with medication recall. In the absence of randomization to the presence or absence of pictures, we cannot exclude an effect of including pictures along with reading of medication names. A prior randomized trial did demonstrate better recall of oral contraceptives with the use of a contraceptive calendar and photographs compared with the use of just a list of oral contraceptives (without showing pictures).⁶ However, the effect of the pictures cannot be separated from the effect of the contraceptive calendar in this study. Further, it is not clear if more oral contraceptives were depicted in the photographs than on the non-pictured lists. The photographs had pictures of 104 oral contraceptives (all but four of the drugs ever available on the market), but the number of oral contraceptives on the non-pictured list was not reported.

Third, the generalizability of these results to other medications and other recall periods is unknown. There are likely to be differences in recall for different types of medications and different outcomes.^{11,19} Therefore, investigators need to consider the type of medication under study and the disease under investigation when deciding whether or not to use this method of memory enhancement.

Finally, the actual effect of enhanced recall will depend on both the prevalence of exposure to the medication and the effect size of that medication on the outcome. For example, in our current database, the underestimation of NSAID prevalence among our cases, in the absence of memory aids, would be small (from 19.0% use with memory aids to 16.7% without aids). Depending on the ultimate effect size of NSAIDs on the odds of myocardial infarction, this could have a trivial effect on the results. However, this does not negate the increased validity in our study from the use of memory aids. Investigators will need to weigh the possible benefits of memory aids, as

quantified in our study, against the cost and logistics required to implement them.

Conclusions

In a case-control study that relied on participant recall of medication use, the strategy of reading medication names and providing medication photographs enhanced recall by about 6%. This effect was greatest among men and among participants who did not have their medication containers available during the interview, used non-prescription NSAIDs, and took more medications. Perhaps most importantly, cases, who had a longer recall period than controls and had less availability of medication containers during the interview, had greater improvement in their recall with the memory aids. Therefore, the use of this type of memory aid may reduce recall bias in case-control studies that rely on medication recall.

KEY POINTS

- Accurate medication recall is important to the validity of pharmacoepidemiology studies, especially case-control studies
- The use of memory aids can enhance recall of medications in a case-control study
- Several subgroups have the greatest enhancement of recall from memory aids
- Cases may benefit more from memory aids than controls
- Memory aids may be an important tool to minimize recall bias in pharmacoepidemiologic case-control studies

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