ORIGINAL ARTICLES

Effects of Information Framing on the Intentions of Family Physicians to Prescribe Long-Term Hormone Replacement Therapy

Jasminka Nikolajevic-Sarunac, MMedSci, David A. Henry, FRCP, Dianne L. O'Connell, PhD, Jane Robertson, MMedSci

OBJECTIVE: To determine whether the way in which information on benefits and harms of long-term hormone replacement therapy (HRT) is presented influences family physicians' intentions to prescribe this treatment.

DESIGN: Family physicians were randomized to receive information on treatment outcomes expressed in relative terms, or as the number needing to be treated (NNT) with HRT to prevent or cause an event. A control group received no information.

SETTING: Primary care.

PARTICIPANTS: Family physicians practicing in the Hunter Valley, New South Wales, Australia.

INTERVENTION: Estimates of the impact of long-term HRT on risk of coronary events, hip fractures, and breast cancer were summarized as relative (proportional) decreases or increases in risk, or as NNT.

MEASUREMENTS AND MAIN RESULTS: Intention to prescribe HRT for seven hypothetical patients was measured on Likert scales. Of 389 family physicians working in the Hunter Valley, 243 completed the baseline survey and 215 participated in the randomized trial. Baseline intention to prescribe varied across patients—it was highest in the presence of risk factors for hip fracture, but coexisting risk factors for breast cancer had a strong negative influence. Overall, a larger proportion of subjects receiving information expressed as NNT had reduced intentions, and a smaller proportion had increased intentions to prescribe HRT than those receiving the information expressed in relative terms, or the control group. However, the differences were small and only reached statistical significance for three hypothetical patients. Framing effects were minimal when the hypothetical patient had coexisting risk factors for breast cancer.

CONCLUSIONS: Information framing had some effect on family physicians' intentions to prescribe HRT, but the effects were smaller than those previously reported, and they were modified by the presence of serious potential adverse treatment effects.

In the medical literature, the results of clinical trials of preventive treatments are commonly reported in relative rather than absolute terms. For instance, the abstract of a paper by the West of Scotland Coronary Prevention Study Group on the effects of pravastatin in the primary prevention setting reports the study results only in relative terms—a 31% relative reduction in the frequency of definite coronary events with treatment.[1] This proportional reduction is equivalent to an absolute risk reduction of 2.4% over 5 years. This represents a requirement to treat 42 middle-aged men for 5 years to prevent a single coronary event. This latter expression of the result is the number needing to be treated (NNT).

Although the relative risk has been shown to be the most stable estimate of a treatment effect across a series of studies, it does not adequately convey information about the magnitude of the benefits and harms of the intervention.[2] The main disadvantage of reporting treatment effects as relative risk, or relative risk reduction when the treatment decreases risk of the event of interest, is that this statistic does not distinguish between groups of patients at different baseline risks.[3–5] Thus, a constant relative risk can translate into a range of reductions in absolute risk, depending on the baseline (untreated) probability of the outcome of interest. If participants in a trial had a 10% chance of dying, and this was halved by treatment (50% relative reduction in risk), the absolute reduction in risk would be 5%, and 20 such individuals would have to be treated to avoid 1 death. In contrast, the same relative reduction in risk in a population with a baseline mortality of 1% is equivalent to an absolute risk reduction of 0.5%, and 200 would have to be treated to avoid a death.

There is evidence to suggest that the way information is presented (information framing) can influence perceptions about the worth of a treatment.[6–12] This is most important when long-term preventive treatment is being offered to subjects at low risk of disease outcomes. Enthusiasm for prescribing appears to be higher when information on the treatment benefits is presented as relative risks

than when the same information is presented as reductions in absolute risk,[4] or as the NNT in order to prevent a harmful outcome.[5,7,8]

The management of hyperlipidemia has been the subject of most of the published studies of the effects of information framing on doctors' prescribing intentions.[4,5,8,9] In these studies, the clinical context was kept simple. There was no attempt to replicate the complexity of "real world" decision making.

In the present study, we have investigated the effect of information framing on enthusiasm for prescribing long-term hormone replacement therapy (HRT). This study differed from most published studies by asking participants to consider simultaneously the benefits and harms of therapy in response to different scenarios. We hypothesized that physicians who received information regarding the putative benefits of long-term HRT (reduced rates of hip fractures and myocardial infarction) expressed in terms of relative risks would report a stronger intention to prescribe than those who received information expressed in the form of NNT. We were interested in the extent to which framing effects varied across different clinical scenarios, particularly when physicians were asked to weigh both benefits and potential harms of treatment when making their recommendations.

METHODS

The design of this study included a baseline survey of all family physicians working in a defined geographic area. Those who responded were randomized to one of three intervention groups, and a follow-up questionnaire was posted together with some information about the benefits and harms of long-term HRT expressed in different ways.

Study Subjects

All family physicians working in the Lower Hunter area of New South Wales, Australia, were invited to participate in the study, which was approved by the Ethics Committees of The University of Newcastle and Hunter Area Health Service.

Questionnaire

We designed a questionnaire to measure physicians' demographic characteristics, as well as their current prescribing practices and intention to prescribe long-term HRT for different hypothetical patients, who had different baseline risks of the outcomes of interest. Hormone replacement therapy was defined as an estrogen preparation used alone, or in combination with a progestogen, as determined by the clinician.

The intentions of physicians to prescribe long-term therapy were investigated in seven clinical scenarios (Appendix A) describing patients at varying levels of risk for developing osteoporosis, coronary events, or breast can-

cer. Participants were not provided with numerical values for the risks of these outcomes but were left to infer these from the clinical descriptions. All of the women described in the scenarios were postmenopausal, and no mention was made of hysterectomy. Pilot data indicated that physicians were positive about the benefits of treatment in preventing osteoporotic fracture. We were interested in the impact of information framing when doctors had to consider simultaneously the benefits and harms of therapy. There is a high level of awareness of the risk of endometrial cancer with unopposed estrogen therapy and of the protective effect of progestogens. Consequently, we chose to highlight the risk of breast cancer in these scenarios and in the information-framing exercise. Our primary interest was whether the effects of framing on intention to prescribe would be lost when the spectre of breast cancer was raised. We reasoned that if we could show blunting of the framing effect in the situation in which physicians were most enthusiastic about HRT (i.e., prevention of osteoporotic fracture), then the modulating effects would be expected to extend across situations in which baseline enthusiasm for treatment was less. Figure 1 summarizes the combination of risk factors portrayed in the scenarios.
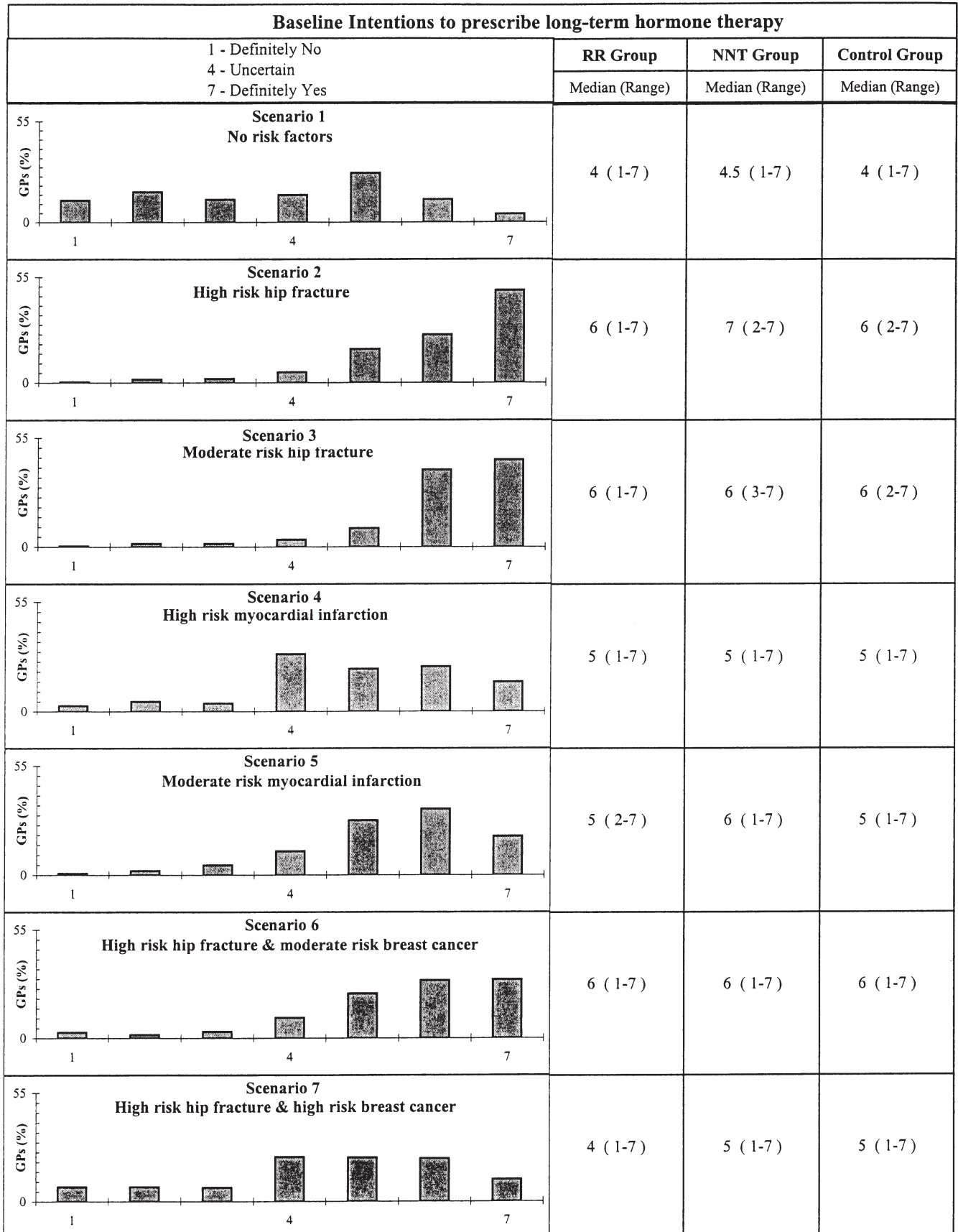
The physicians were asked to rate their intention to prescribe to the patients described in the scenarios. Responses were measured on a 7-point Likert scale ranging from "definitely no" to "definitely yes"; the midpoint of the scale allowed participants to indicate uncertainty over whether or not they would recommend long-term HRT to the patients described. The instructions to the physicians emphasized that none of the patients described in the clinical scenarios had preference for or against HRT, and that all would comply with their decision.

Baseline Survey

Copies of the questionnaire, as well as a cover letter with a brief explanation of the design and purpose of the study, were sent to all family physicians working in the Lower Hunter area. They were told that respondents would receive a summary of the best evidence on the long-term benefits of HRT in prevention of hip fracture and coronary events and on the risk of developing breast cancer, but they were not told that they would receive the information in one of two formats (expressed in terms of relative risk or NNT), derived from the same data sources, or that they might be in the control group, in which case they would receive information at the end of the study.

Information Sources

In the absence of randomized trials with clinical outcomes of interest, we relied on observational studies to provide estimates of the relation between estrogen use and the risk of hip fractures, myocardial infarction, and breast cancer.[13–17] In the case of hip fracture, we found the estimates

Baseline Intentions to prescribe long-term hormone therapy			
1 - Definitely No 4 - Uncertain 7 - Definitely Yes	**RR Group** Median (Range)	**NNT Group** Median (Range)	**Control Group** Median (Range)
Scenario 1 No risk factors	4 (1-7)	4.5 (1-7)	4 (1-7)
Scenario 2 High risk hip fracture	6 (1-7)	7 (2-7)	6 (2-7)
Scenario 3 Moderate risk hip fracture	6 (1-7)	6 (3-7)	6 (2-7)
Scenario 4 High risk myocardial infarction	5 (1-7)	5 (1-7)	5 (1-7)
Scenario 5 Moderate risk myocardial infarction	5 (2-7)	6 (1-7)	5 (1-7)
Scenario 6 High risk hip fracture & moderate risk breast cancer	6 (1-7)	6.5 (1-7)	6 (1-7)
Scenario 7 High risk hip fracture & high risk breast cancer	4 (1-7)	5 (1-7)	5 (1-7)

FIGURE 1. Family physicians' baseline intentions to prescribe long-term hormone replacement therapy for each clinical scenario in the intervention and control groups. RR indicates relative risk; NNT, number needing to be treated.

of estrogen effect from case-control and cohort studies to be different, with nonoverlapping confidence intervals. Accordingly, separate pooled estimates *within* the two study types were derived using a fixed effects model and presented to participants as a range of values representing possible reductions in the risk of hip fracture that might be expected with estrogen therapy.[18] For the sake of consistency, the data on myocardial infarction and breast cancer were treated the same way.

The data suggested that treatment with HRT might result in a relative decrease of between 39% and 69% in the incidence of myocardial infarction, a relative decrease of between 15% and 43% in incidence of hip fracture, and a relative increase of between 9% and 25% in the incidence of breast cancer compared with not using HRT. This work was completed before the publication of an individual patient data meta-analysis of breast cancer and HRT.[19] However, our estimates were in good agreement with those reported (a relative increase of 9% in breast cancer with "ever use" of HRT from prospective studies, and 15% or 27% relative increases in case-control studies with population or hospital controls respectively).[19] This study was completed before the recent publication of the HERS trial, which has raised doubts about the benefit of medium-term HRT in terms of reduced risk of coronary events.[20]

Estimates of relative risk from the published literature were translated into absolute differences and expressed as NNT (the inverse of the absolute difference) by applying them to age-specific population incidence rates for myocardial infarction, hip fractures, and breast cancer for New South Wales. A time frame of 10 years was used, and two ages of commencement of this therapy (50 and 60 years of age) were considered.

Intervention and Follow-up

Subjects who returned the first questionnaire were allocated randomly to three groups. The unit of randomization was the practice, rather than the individual physician. Within strata defined by practice size, block randomization was used to assign each practice to an intervention or control group.

One group (the relative risk group) received information on the long-term effects of HRT expressed in terms of relative risk decreases or increases in risk of hip fracture, myocardial infarction, and breast cancer (Information Sheet 1 in Appendix B). The second group received information, presented as the NNT for 10 years (for women of 50 and 60 years of age) in order to prevent one hip fracture or myocardial infarction, or cause one more case of breast cancer (Information Sheet 2 in Appendix B). The third group received no material and served as control subjects. These subjects received copies of the information after the study was completed.

The information sheets were sent to the intervention groups approximately 4 weeks after the baseline questionnaires were returned. A second identical questionnaire was sent to participants to be completed after the information sheet had been read. The control group received only the two identical questionnaires spaced by approximately 4 weeks.

Statistical Analysis

The analyses were performed with SAS (Cary, NC) and STATA (College Station, TX) software. Analysis of possible differences in physicians' demographic and practice characteristics between the three randomized groups were tested using the χ^2 test for categorical variables and the Kruskal-Wallis Test for comparison of medians in the case of continuous variables. In addition, the Mann-Whitney *U* Test was used to analyze differences between those who did and those who did not respond to follow-up after randomization.

The changes in intentions to prescribe HRT to patients described in the seven hypothetical clinical scenarios before and after the intervention were assessed for individual physicians as a change in ratings between baseline and follow-up. Subjects were classified as becoming less likely to prescribe, becoming more likely to prescribe HRT than previously, or showing no change. Proportions of physicians in each of the three change categories were compared across the three groups using a χ^2 test and polytomous logistic regression. The results of the polytomous logistic regression were identical to those from binary logistic regressions taking each category of "change" relative to that of "no change". The effects of clustering were checked using the binary logistic regressions with practice as the cluster variable (Stata Statistical Software Release 5.0, Stata Corp., College Station, Tex, 1997). Because the majority of practices had only one or two physicians participating (average practice size was 1.5), the results of the analyses with and without clustering taken into account were almost identical. For simplicity, the results of the analysis that ignores clustering are presented.

RESULTS

The initial mailing included all 398 family physicians working in the Lower Hunter area. Of these, 243 returned the baseline questionnaire and were randomized into three groups. Two hundred fifteen (88%) of these completed the intervention phase of the study. There were no significant differences between respondents and nonrespondents in the intervention phase (data not displayed). The characteristics of subjects in the three study groups were similar (Table 1).

Baseline Intentions to Prescribe Hormone Replacement Therapy

There were striking differences in stated intention to prescribe hormone therapy to the women described in the

Table 1. Demographic Characteristics of Family Physicians at Entry to the Trial by Intervention Group*

Characteristic	RR Group (n = 81)		NNT Group (n = 82)		Control Group (n = 80)		p Value
	n	%	n	%	n	%	
Male gender	51	63	51	62	49	61	.98
Qualification							
FRACGP[†]	10	12	19	23	14	18	.20
Dip Obstet/Gynecol	13	16	2	24	16	20	.42
Employment status							
Full-time	64	79	67	82	69	88	.56
Part-time[‡]	17	21	15	18	9	12	
Practice type							
Solo	28	35	22	27	27	35	.45
Group (2+)	52	65	60	73	51	65	
	Median	IQR	Median	IQR	Median	IQR	
Years since graduation	20.5	13–27	17	12–25	17	12–25	.25
Years in general practice	14	8–20	12	8–19	12	7–18	.57
Patients per week	150	100–180	133	90–160	125	100–160	.40
Female patients aged 45–65 years per week	30	18–50	30	17–50	27	20–40	.37

Numbers vary as some variables have missing data. RR indicates relative risk; NNT, number needing to be treated; IQR, Interquartile range, 25th to 75th percentile.

[†] *Fellow of the Royal Australian College of General Practitioners.*

[‡] *Less than 20 hours per week.*

seven hypothetical scenarios (see Fig. 1). There was ambivalence toward prescribing to women described as having no risk factor for developing hip fracture or myocardial infarction. Intentions to prescribe were highest for women described as being at moderate or high risk of hip fracture. There was less (but still considerable) enthusiasm for prescribing to women described as being at moderate or high risk of myocardial infarction. The coexistence of risk factors for breast cancer had a negative effect on intentions to prescribe HRT to women at moderate or high risk of developing hip fracture.

Effects of Information Framing on Intentions to Prescribe Hormone Replacement Therapy

The baseline intentions to prescribe HRT to the patients described in the scenarios were similar across the three groups (see Fig. 1).

In six of seven scenarios, there was a trend for both control subjects and the relative risk group to become more likely to prescribe HRT during the study (Table 2). For each of the seven clinical scenarios, comparison between the three study groups showed that the physicians who received the information as NNT had the highest proportion reporting themselves as "less likely", and the lowest proportion reporting themselves as "more likely", to prescribe hormone therapy (Table 2). However, the overall effects were small, and in four scenarios these differences did not reach statistical significance. The smallest effect of information framing was seen in the two scenarios that required physicians to consider both the benefits of HRT and the potential harm, in the form of an increased risk of

breast cancer. The *p* values were similar from the χ^2 test (reported in Table 2), the polytomous logistic regression, and the binary logistic regressions with and without clustering taken into account (data not shown).

Pairwise comparisons revealed differences between the scenarios. For cases at moderate or high risk of hip fracture (scenarios 2 and 3), a larger proportion of the NNT group relative to control subjects became less likely, with correspondingly smaller proportions becoming more likely, to prescribe HRT. For scenario 2, a larger proportion of the relative risk group showed no change in prescribing intentions. When the scenario described a woman at high risk of myocardial infarction, a significantly smaller proportion of the NNT group became more likely to prescribe relative to the control group.

DISCUSSION

This study confirms previous findings that physicians view interventions in a more positive way when information on their benefits is presented in relative rather than in absolute terms. However, the overall effect of information framing was smaller than has been observed in other studies,[6,7,9,10] and was inconsistent across different clinical scenarios.

The study differs in a number of respects from previous work. First, we included a control group who received no information but were asked to respond to the scenarios on two occasions. This group tended to increase their intention to prescribe during the study, as did the group who received the information framed as change in relative risk. The change in intention to prescribe in the control

Table 2. Changes in Intention to Prescribe Long-Term Hormone Replacement Therapy
in the Intervention and Control Groups

Scenario	Group*	Change in Intentions to Prescribe, %			p Value[†]
		Less Likely	No Change	More Likely	
1. No risk factors	Control (*n* = 74)	22	38	40	.16
	RR (*n* = 70)	26	37	37	
	NNT (*n* = 71)	40	34	26	
2. High risk of hip fracture	Control	19	38	43	.002
	RR	7[‡]	61	32[‡]	
	NNT	24	56	20[‡]	
3. Moderate risk of hip fracture	Control	14	56	30	.02
	RR	17	50	33	
	NNT	33[‡]	51	16	
4. High risk of myocardial infarction	Control	30	27	42	.02
	RR	21	24	54	
	NNT	36	39	26[‡]	
5. Moderate risk of myocardial infarction	Control	28	31	42	.08
	RR	14	39	46	
	NNT	32	38	30	
6. High risk of hip fracture, moderate risk of breast cancer	Control	25	34	41	.37
	RR	23	39	38	
	NNT	30	44	26	
7. High risk of hip fracture, high risk of breast cancer	Control	32	34	34	.45
	RR	35	36	29	
	NNT	46	29	26	

RR indicates relative risk; NNT, number needing to be treated.
[†]*Values from χ² test.*
[‡]*Cell is statistically significantly (p < .05) different from that of control group.*

group may be an effect of involvement in the study or may be due to other activities focusing on use of HRT that were occurring over the study period. This clearly illustrates the need for a control group. For scenarios describing women at risk of myocardial infarction, there were no differences between the control and relative risk groups, and the majority of the relative risk group did not change their prescribing intentions for scenarios describing risk of hip fracture. This possibly indicates a conditioning effect of repeated exposure to claims regarding the benefits of HRT for hip fracture being expressed in relative terms. Most coverage of the issue in the lay and medical press in Australia seems to have taken this form. In contrast, physicians may have been less aware of the evidence of a claimed beneficial effect of estrogens on the cardiovascular system, as their baseline intention to treat was less than for prevention of osteoporosis. This may explain the increased intention to prescribe to the women described as being at high risk of myocardial infarction after exposure to the information expressed in relative terms. In contrast, the doctors who received the estimates framed as NNT displayed lower enthusiasm for prescribing than the control group across all scenarios, and these differences were statistically significant for the scenarios describing women at moderate or high risk of hip fracture.

Another difference between this and most other studies was that we asked participants to consider simultaneously the benefits and potential harms of therapy when making a decision to prescribe. With the two scenarios that described women at moderate to high risk of developing breast cancer, the impact of information framing was small and could have occurred by chance. It was noticeable that intention to prescribe to women at high risk of breast cancer (scenarios 6 and 7) increased in only small proportions of respondents—the majority becoming less likely to prescribe, or not changing their intentions. This suggests that doctors are "risk averse" when they are asked to consider the adverse consequences of their actions, and in such situations the way the information is framed may have little impact.

We have recently completed a systematic review of the literature on the importance of framing in relative rather than absolute terms.[21] The design of many of the studies has been suboptimal. All have involved some element of within-subject comparison. Consequently, the response to one information frame may be conditioned by recent exposure to the other frame. It is uncertain what effect this will have had, but our opinion is that it may have exaggerated responses and may have led to an overestimate of the true impact of information framing. The lack of control groups who received no intervention is another concern. In our trial, we measured changes in intention scores within a prospective parallel group design. The pattern of change in the control group was similar to that in the relative risk group in several of the scenarios. Previous studies have not determined the baseline intention to prescribe. Although

they were able to conclude that the rating of effectiveness, or likelihood of prescribing, was greater when information was presented in relative rather than in absolute terms, it is unclear whether this was because of an increase in intention in one group, a reduction in the other, or a combination of these trends. The present study suggests that the main effect is a reduction in intention when information is presented in absolute terms and baseline event rates are low.

Criticisms can be made of the wording used to present information in this and other studies. Specifically, the word "relative" has been used inconsistently.[6,8–12] In pilot testing our information package, we found confusion regarding the meaning of the term "relative" in the context of the study and dropped it. We preferred alternative wording that implied a comparison of the risk in the treated group with a nontreated group (see Appendix B). Some participants may have concluded that the relative risk reduction quoted in the information package was a large absolute reduction in risk, and such a misinterpretation may have affected other studies of information framing.[6,8–12]

Information-framing studies have often failed to control for time preference, and this is also a criticism of the present study.[7–10,12] The tendency has been to mention the duration of therapy that is necessary to achieve the absolute benefit, but not to mention it when describing the benefits in relative terms. Consequently, participants may have concluded that the relative benefit was immediate, while the absolute benefit was deferred. These factors could contribute to the negative impact of absolute risk presentations.

In conclusion, the way information is framed has an impact on intention to prescribe long-term HRT. However, the magnitude of the effects of information framing appears to be less than that reported in previous studies. In part, this may be a consequence of the design of some of these studies, but it is also likely to be due to the more complex clinical situations that we presented to the participants in this study. In particular, the effects of information framing on the use of preventive therapies may be small when doctors are asked to contemplate the harmful effects of their interventions.

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APPENDIX A

Clinical Scenarios Used to Assess Intention to Prescribe Hormone Replacement Therapy

Imagine a Caucasian woman comes to you requesting advice on HRT. She does not have a preference either for or against HRT and would comply with your decision. Will you recommend HRT in the following circumstances?

1. Fifty-five-year-old, asymptomatic woman who lives an active life, a nonsmoker, with no significant medical conditions or significant family history of medical conditions.
2. Sixty-five-year-old, slim woman who lives an active life, a smoker, who has a personal history of osteoporotic vertebral fracture and no other medical conditions or family history of medical conditions.
3. Fifty-five-year-old, slim asymptomatic woman who lives an active life, a nonsmoker, who had an early menopause, with a family history of osteoporotic fracture and no other significant medical conditions.
4. Sixty-five-year-old, obese woman who lives an inactive life, who has a personal history of coronary heart disease (myocardial infarction) and no other significant medical conditions or family history of medical conditions.
5. Fifty-five-year-old, obese woman who lives an active life, former smoker (stopped 1 year ago), who has high serum cholesterol level, a strong family history of coronary heart disease, but no personal history of coronary events and no other significant medical conditions.
6. Sixty-five-year-old woman who has had two osteoporotic vertebral fractures, who lives an inactive life, a smoker, who has a personal history of benign breast disease and no other significant medical conditions or family history of medical conditions.
7. Fifty-five-year-old woman who has had two osteoporotic vertebral fractures, who lives an active life, a nonsmoker, who has a strong family history of breast cancer (sister had breast cancer at age 45) and no other significant medical conditions.

APPENDIX B

Information Sheets

Information Sheet 1 (RR)

Estimates from the epidemiologic studies suggest that for postmenopausal women who are in good health, long-term treatment would produce the following results:
1. Treatment with HRT might result in a *decrease* of between 39% and 69% in the incidence of myocardial infarction compared with nonuse of HRT,
2. Treatment with HRT might result in a *decrease* of between 15% and 43% in the incidence of hip fracture compared with nonuse of HRT, and
3. Treatment with HRT might result in an *increase* of between 9% and 25% in the incidence of breast cancer compared with nonuse of HRT.

Information Sheet 2 (NNT)

Estimates from the epidemiologic studies suggest that:

For *50-year-old* postmenopausal women who are in good health:
1. Between 106 and 187 such women would have to be treated with HRT for 10 years to *prevent* 1 myocardial infarction,
2. Between 488 and 1,428 such women would have to be treated with HRT for 10 years to *prevent* 1 hip fracture, and if
3. Between 174 and 552 such women were treated with HRT for 10 years, it might *cause* 1 additional case of breast cancer.

For *60-year-old* postmenopausal women who are in good health:
1. Between 27 and 49 such women would have to be treated with HRT for 10 years to *prevent* 1 myocardial infarction,
2. Between 160 and 458 such women would have to be treated with HRT for 10 years to *prevent* 1 hip fracture, and if
3. Between 155 and 432 such women were treated with HRT for 10 years it might *cause* 1 additional case of breast cancer.