Original Research

Presentation of Evidence in Continuing Medical Education Programs: A Mixed Methods Study

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Introduction: *Clinical trial data can be presented in ways that exaggerate treatment effectiveness. Physicians consider therapy more effective, and may be more likely to make inappropriate practice changes, when data are presented in relative terms such as relative risk reduction rather than in absolute terms such as absolute risk reduction and number needed to treat. Our purpose was to determine (1) how frequently continuing medical education (CME) speakers present research data in relative terms compared to absolute terms; (2) how knowledgeable CME speakers and learners are about these terms; and (3) how CME learners want these terms presented.*

Methods: *Analysis of videotapes and PowerPoint slides of 26 CME presentations, questionnaire survey of CME speakers and learners, and focus groups with learners.*

Results: *Speakers presented data more frequently in relative than absolute terms, but most frequently in general terms such as frequencies, percentages, graphs, and P-values with no data. Of 1367 PowerPoint slides, 269 presented research data, and of these, 225 (84%) presented data in general terms, 50 (19%) in relative terms and 19 (7%) in absolute terms. CME speakers understood relative and absolute terms better than learners. Approximately 25–35% of speakers and 45–65% of learners could not correctly calculate relative risk reduction, absolute risk reduction, and number needed to treat. Learners wished to have these terms presented in CME programs in a consistent and easily understood format and requested a brief review of them at the beginning of CME programs.*

Discussion: *Presentation of research data in most CME programs is inadequate to allow learners to make fully informed therapeutic decisions. Speakers and learners need professional development to improve their presentation and understanding of research data.*

Key Words: *research utilization, statistical literacy, evidence-based medicine, knowledge translation, optimal prescribing, continuing medical education*

Introduction

Reporting and interpreting data from clinical trials is essential for findings to be put into practice. However, data can be presented in different ways that may convey different estimates of the efficacy of a therapy. For instance, studies have found that family physicians and specialists consider therapy more effective, and may be more likely to make inappropriate practice changes, when data are presented in relative terms such as relative risk reduction rather than in absolute terms such as absolute risk reduction and number needed to treat (NNT).[1–5] The authors of these papers and the National Institutes of Health[6] suggest that no one measure provides the information necessary for physicians to make an informed decision about results of clinical trials. They suggest that data be presented in absolute and relative terms. Another consideration is that none of the studies investigated the effect of presenting 95% confidence intervals for data, a statistic that provides an estimate of the precision of results.

Physicians' understanding of relative and absolute terms appears to be less than optimal. For example, about 30% of English[7] and Australian[8] family physicians (FPs) reported they understood the terms absolute risk, relative risk, and NNT. Only about 12% understood confidence intervals and odds ratios. Notably, almost all who did not understand the

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terms expressed interest in learning more about them. In a study of Canadian specialists, 35% correctly defined absolute risk reduction, 25% understood relative risk reduction, and 12.5% understood odds ratio.[9]

Our purpose was to relate the above findings to continuing medical education (CME) conferences. Our research questions were: (1) How is research data presented in CME conferences? (2) How well do learners who attend CME programs and speakers who teach in them understand relative and absolute terms? (3) What are learners' preferences about presentation of research data in CME programs?

Methods

We used quantitative and qualitative methods, including (1) analysis of speakers' presentations using a rating tool developed by the researchers; (2) a questionnaire using items from McColl et al[7] to assess speaker and learner understanding of research terms (see Appendix); and (3) focus groups with conference learners to understand their preferences about the presentation of research data in CME programs.

Setting

We collected data from two CME therapeutics conferences organized by academic CME departments, one from the University of Ottawa and one from Dalhousie University in Halifax, Nova Scotia. The 3-day conferences were attended by more than 400 learners and involved more than 50 plenary presentations. Research ethics boards from each site approved the project.

Instruments/Analysis

Question 1: How Is Research Data Presented in CME Conferences?

Before each conference, we mailed all plenary speakers ($n = 55$) a letter asking permission to videotape their presentation for a research study. The letter explained that we would disclose the purpose of the study after each conference because we wished speakers to present as they normally do. Fifty-three (96%) of speakers agreed to have their presentation videotaped. After each conference, we informed all speakers that the purpose of the study was to analyze the presentation of research data in CME presentations. We then used SPSS 15.0 to randomly select presentations for analysis and asked selected speakers for consent to analyze their presentations. We intended to analyze 15 presentations from each site. However, at one site, only 11 presentations were recorded properly. We analyzed all 11 from this site and 15 randomly selected from the other site.

The rating tool was created in Microsoft Excel and automatically summed the slides in each category. It went through several iterations based on a pilot study of PowerPoint slides from eight presentations. The research team had several meetings to refine the tool and agree on how to rate slides. The rating tool is available from the lead author.

For each presentation, 2 researchers independently analyzed the PowerPoint slides for counts of data in *relative* terms (odds ratios, hazard ratios, relative risk, relative risk reduction), *absolute* terms (absolute risk reduction or increase, number needed to treat or harm) or *general* terms (frequencies, percentages, graphs, only P-values, prevalence, events per 1000 person-years). Speaker identity was removed from the title slide before rating. If slides presented quantitative data but did not provide a reference, we did not count this as research data. Slides not directly relevant to the presentation were excluded (title slides, cartoons, and non-relevant graphics). After viewing the PowerPoint slides, the same two researchers analyzed videotapes of the presentations to observe if speakers presented content orally that was not apparent on the slides. It was not possible to remove speaker identification from the video recordings. Discrepancies in ratings were resolved by the 2 researchers, and outstanding discrepancies were resolved by the research team. Slide counts were expressed as frequencies.

Question 2: How Well Do Learners and Speakers Understand Relative and Absolute Terms?

All CME speakers received the *Statistical Comprehension Questionnaire* by mail after the conferences. Learners received the questionnaire in their registration packages at the conference and were asked to return it to the registration desk. The questionnaire assessed perceived understanding of statistical terms using items from McColl et al[7] and the ability to calculate relative risk reduction, absolute risk reduction, and numbers needed to treat using a simple example developed by the research team. Results were expressed as frequencies and percentages.

Question 3: What Are Learners' Preferences About Presentation of Research Data?

We conducted a 1.5-hour focus group with learners at each conference ($n = 9, 5$). To illustrate the difference between relative and absolute terms, we presented them with results of the ASCOT[10] primary prevention trial using various research terms, which showed that over 3.3 years, atorvastatin led to a reduction of nonfatal myocardial infarction and death from coronary heart disease of 36% (relative risk reduction), 1.1% (absolute risk reduction) with an NNT of 94 (95% confidence interval 60 to 215).We also pointed out that at the end of 3.3 years, 97% of patients who did not take atorvastatin remained event-free while 98.1% of those taking atorvastatin remained event-free, and we illustrated this with a Cates plot.[11] We then asked them to describe their interpretation of each result and their likelihood of prescribing the medication as a result

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of the research term presented. We also asked them to give us their perspectives on the current presentation of research data at CME events and to describe their preferences about the type and format of research data in CME presentations. The focus group discussions were audio recorded and transcribed. Two members of the research team (MA, TM) independently analyzed the transcripts using thematic analysis to identify key themes in learners' preferences about how research data should be presented.[12] Data were managed using Atlas Ti 6.0. The researchers met to review prominent themes and patterns that emerged from the data and to agree upon the terms used to describe the key themes. Transcripts were reviewed using the agreed-upon coding to recode themes and ensure that relevant qualitative comments were grouped under the correct theme(s).

Results

Question 1: How Is Research Data Presented in CME Conferences?

Analysis of presentations ($n = 26$) revealed that most speakers do not support therapeutic recommendations with research data in either relative or absolute terms (TABLE 1). Of the 1367 PowerPoint slides, 269 presented research data. Of these 269 slides, 225 (84%) presented data in general terms, 50 (19%) presented data in relative terms and 19 (7%) presented data in absolute terms. Twenty-four slides (9%) presented 95% confidence intervals. Of the 26 presentations, 13 showed any data in relative terms, 6 showed any data in absolute terms, and 12 showed 95% confidence intervals. Analysis of videotapes indicated that speakers seldom mentioned absolute and relative values that weren't included in their slides.

Question 2: How Well Do Learners and Speakers Understand Relative and Absolute Terms?

The response rates for the questionnaire were 29% for learners (121/417) and 33% for speakers (20/61). Most learners were FPs (94%, 109/116), followed by specialists (3%, 4/116) and residents (3%, 3/116). Learners were 51% male and 49% female, and well-experienced, with an average of 18.3 years of practice (SD 11.1). Twenty-eight percent had completed an EBM course or workshop in the last 10 years, and the most common sources of EBM training were postgraduate and CME. Almost all speakers were specialists (95%, 19/20) with one family physician as the exception. There were more male speakers (70%, 14/20) than female (30%, 6/20), and speakers had similar career experience as learners, with an average of 18.0 years in practice (SD. 10.6). Similarly, most speakers did not report EBM training in the past 10 years (70%, 14/20).

TABLE 1. Numbers of Slides Making Therapeutic Recommendations and Presenting Research Data in General, Relative, and Absolute Terms, and with 95% Confidence Intervals. Listed in Descending Order of Absolute Terms

Slides rated	Therapeutic recommendations	General terms[a]	Relative terms[b]	Absolute terms[c]	95% CI
131	23	18	10	7	1
68	3	12	5	4	5
39	2	11	2	3	3
49	6	12	4	3	1
32	7	10	3	1	2
69	22	24	5	1	1
59	4	8	4	0	3
56	20	19	6	0	2
111	14	27	4	0	2
72	22	10	1	0	2
26	7	5	3	0	1
37	10	1	1	0	1
29	3	8	2	0	0
29	4	9	0	0	0
49	14	0	0	0	0
45	10	15	0	0	0
37	5	1	0	0	0
21	7	4	0	0	0
49	16	2	0	0	0
102	13	7	0	0	0
56	15	9	0	0	0
47	17	0	0	0	0
32	11	6	0	0	0
50	12	2	0	0	0
21	1	1	0	0	0
51	6	4	0	0	0
1367	**274**	**225**	**50**	**19**	**24**

[a]general terms = percentages, graphs, P-values only, prevalence, events per 1000 person-years.
[b]relative terms = odds ratio, hazard ratio, relative risk, relative risk reduction.
[c]absolute terms = absolute risk reduction or increase, number needed to treat or harm.

Topics included in presentations (presented separately from TABLE 1 to maintain anonymity of speakers):

- TIAs and non-disabling stroke
- Common myths in family medicine
- Depression and SSRIs
- Hyperlipidemia
- Sexually transmitted infections
- Exacerbations of COPD

DOI: 10.1002/chp

- Complementary medicine
- Office management of heart failure
- Osteoporosis
- Hypertension
- Bleeding disorders
- Pediatric asthma
- Inflammatory bowel disease
- Thyroid disorders
- Early rheumatoid arthritis
- Chronic kidney disease
- Tick disease
- Dysmenorrhea
- Dermatology
- Allergy, asthma, anaphylaxis
- Nutrition
- Attention deficit hyperactivity disorder
- Pediatric diabetes
- Same sex health issues
- Prostate cancer
- Atrial fibrillation, heart failure, stent thrombosis

Speakers had a better understanding of research terms than learners (TABLE 2). For both groups, perceived understanding was greatest for NNT. Speakers outperformed learners on all calculation problems, although 25–35% of speakers were unable to correctly answer problems on NNT, absolute risk reduction, and relative risk reduction (45–62% of learners were unable to correctly answer these problems). In a question about how much evidence speakers should use to support treatment recommendations, both groups felt that research data should be presented (95% and 94%, respectively; see FIGURE 1).

Question 3: What Are Learners' Preferences About Presentation of Research Data?

Learners' reactions to the presentation of the ASCOT trial data showed the impact of framing on the interpretation of research. For example, learners said that relative risk reduction was impressive, and were less enthusiastic about prescribing the drug as the absolute risk terms were presented. As the facilitators presented NNT and Cates plots, the participants began talking about nondrug-related therapy to prevent nonfatal myocardial infarction (MI). They were particularly impressed with the visual presentation of data using Cates plots (ie, happy faces).

> I'm thinking that it gets at learning styles, and we are probably much more impressed by one of these results in a slightly different way, and it's making me realize that there are some speakers presenting the same data in these different ways, and even that last graphic (smiling faces) was sort of interesting, I responded to that, in a different way. [Participant A8]

Learners provided many suggestions about how CME speakers should present data when making treatment recommendations. They said they would like speakers to use variety of research terms, with the most preferred terms including numbers needed to treat, "obverse" of the absolute risk reduction (ie, the likelihood of survival instead of death) and confidence intervals. Some participants described the importance of additional information such as cost and patient compliance issues. Some learners felt that a more thorough presentation of research data would be helpful for newer and controversial areas of medicine, and during drug-sponsored events. They also described the need for speakers to balance the presentation of research data with the key messages of the presentation.

> I feel a lot of what we do will probably always be supported by anecdotal evidence and things that seem to work, and the most important thing for me, is that a speaker is able to articulate whether what they are telling me is based on evidence or not and when it is, they present enough of the data so that I can decide if I agree. [Participant A4]

> Yet at the same time you want to get the message across in a short period of time, and I guess it depends on what type of research is being presented, too. If they are presenting a big large trial, I think it is important to show how they did it, what the study population was like and what that means to us. I think the presentations I've gone to, the ones that are really, really good are the ones that can say how to develop it into your practice. [Participant A2]

A central theme from the focus groups was trust in CME speakers' ability to critically appraise research, although some participants from both focus groups expressed doubt about some speakers' ability to appraise the evidence before presenting it. They requested that speakers explain the statistics as they are presented.

When asked about recommendations to improve the current presentation of research in CME events, learners told us they want a short "statistics refresher" session at the start of CME conferences and a one-page handout on statistics as part of the conference registration package. Another suggestion was to develop a template so that research data is presented in a consistent format, allowing physicians to interpret it more quickly during presentations.

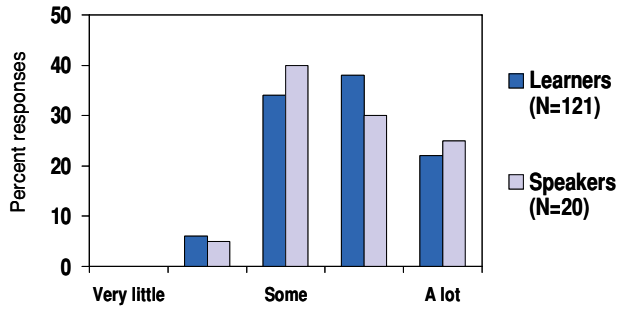

FIGURE 1. Percent Responses of Learners and Speakers to Question "How Much Emphasis Should CME Speakers Place on Presenting Research Results when Making Therapeutic Recommendations?"

Discussion

We found that in CME presentations on therapeutics, speakers are much more likely to present data in general terms

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TABLE 2. Percent of Learner ($n = 121$) and Speaker ($n = 20$) Responses to Perceived Understanding of and Ability to Calculate Research Terms

		Understand and could explain to others	Understand	Don't understand but would like to	Don't understand and it would not be helpful	Calculated correctly
RRR	Learner	40%	42%	17%	1%	36%
	Speaker	50%	35%	15%	–	68%
ARR	Learner	37%	45%	19%	–	55%
	Speaker	45%	30%	25%	–	74%
NNT	Learner	51%	40%	8%	–	45%
	Speaker	80%	15%	5%	–	79%
Odds ratio	Learner	11%	46%	40%	3%	*
	Speaker	30%	35%	15%	–	*
Hazard ratio	Learner	3%	35%	58%	4%	*
	Speaker	20%	45%	35%	–	*
Confidence intervals	Learner	27%	48%	24%	1%	*
	Speaker	65%	30%	5%	–	*

RRR = relative risk reduction.
ARR = absolute risk reduction.
NNT = number needed to treat.
*Participants were not asked to calculate these terms.

than in relative terms. They are even less likely to present data in absolute terms or with 95% confidence intervals. Of the learners who responded to the questionnaire, 35–50% understood and could calculate absolute risk reduction, relative risk reduction, and NNT. Focus group participants recognized the importance of presenting research data completely and the need for learners to receive refreshers on understanding statistics at CME events. They also suggested that speakers present these statistics in a consistent, easy-to-understand format so they could more easily assimilate evidence-based findings.

CME speakers' understanding of research terms was better than learners' understanding of these terms, with 50–85% understanding and being able to calculate them. Information from the American Academy of Family Physicians indicates that using EBM sources for presentations adds an average of 5–6 hours of extra preparation time.[13,14] However, this did not include time to calculate statistics such as NNT that might not be readily available.

Our study is limited to large conferences in two Canadian cities, so it may not be generalizable to other settings. We analyzed presentations involving therapy only and did not review presentations involving diagnosis because the statistical measures of diagnostic tests (sensitivity, specificity, positive and negative predictive values) are even more complex than those involving therapy. The findings of learners' and speakers' understanding of terms may be an overestimation, since it is possible that the respondents who were most familiar with these terms responded to the questionnaire. Young et al found that respondents overestimate their knowledge ofstatistical terms, which agrees with our finding that respondents' self-reported understanding generally exceeded their ability to calculate the statistics.[15] The results should also be viewed with caution since the response rates were low (∼30%). It is noteworthy that almost all respondents who did not understand research terms felt that it would be helpful for them to do so, supporting other findings of physicians' positive attitudes toward EBM and awareness of the importance of understanding EBM principles.[7,8,15–17]

To our knowledge, this is the first study to objectively evaluate the use of research data to support treatment recommendations in CME presentations. While EBM is being taught in medical schools and considered essential for optimal practice, it is troubling that practicing FPs are receiving accredited CME that for the most part does not present research data in a way that allows them to make informed therapeutic decisions. The American Academy of Family Physicians has designated CME that uses evidence from approved evidence-based sources as worthy of double credits[13] but does not specify how the evidence should be presented. Since there is some indication that the way evidence is presented affects the likelihood of physicians changing their prescribing,[1–5] it is important that CME programs present evidence completely as recommended by the National Institutes of Health.[6] Such a change will require addressing the needs of learners and faculty.

A logical next research step is to replicate the study in other educational formats and venues, including CME programs in other provinces, specialist CME programs, and undergraduate and postgraduate teaching, and in other

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health care professional education such as nursing and pharmacy. If our findings are confirmed, we make the following recommendations.

- Journal editors should require that authors present data in relative and absolute terms so they can be easily incorporated into educational programs.
- CME providers should stipulate that speakers present data in relative and absolute terms and work with faculty development programs to educate speakers about the meaning of basic statistical terms and how to include them in their teaching at all levels.
- Similarly, CME providers should educate learners about these statistical terms and how to use these terms when interpreting treatment recommendations for their patients.
- Presentation of research data in relative and absolute terms should be a requirement for accredited CME. This would require auditing of presentations by individuals skilled in recognizing and interpreting these terms—a considerable investment in human resources, but one that would promote the culture of evidence-based practice at all levels.
- CME providers should work together to develop tools and templates so that speakers and learners can easily present and interpret data in relative and absolute terms.

Based on our findings, we are trying to make changes to our own CME programs. We have developed a short statistics refresher that we have presented at the beginning of large conferences. Working with faculty and learners, we have developed PowerPoint templates for presenting research findings in absolute and relative terms in a consistent manner. Finally, we have developed an Excel spreadsheet to help faculty calculate these terms if they are not provided in original publications. To extend our work to other health professions, we are collaborating with our Department of Continuing Pharmacy Education to provide faculty development workshops to promote the use of these tools (available online at http://cme.medicine.dal.ca/EBM.htm).

We recognize that simply changing the way that relative and absolute information is presented will not guarantee that it will be applied or change patient outcomes. The application of new information and optimizing practice is complex and requires consideration of clinician experience, patient preferences, and organizational factors. However, despite the complexity of optimizing practice, we believe that presenting treatment outcomes in relative and absolute terms in a consistent format will make research findings more accessible to learners at all stages of the educational curriculum.

APPENDIX STATISTICAL COMPREHENSION QUESTIONNAIRE

Please indicate: ☐ Male ☐ Female **Years in practice? (approx.)** _____yrs.

Your profession: ☐ Family physician—Member/Certificant of CFPC? ☐ Yes ☐ No

☐ Specialist (please specify): _____

☐ Other (please specify): _____

INSTRUCTIONS: **The information required to calculate Qs 1–3 is provided below.**
Please do not guess. If you are not sure, indicate "I don't know".

A randomized control trial examined the effect of a drug for lowering LDL cholesterol in patients with coronary heart disease. The outcome was myocardial infarction.

- 1000 patients received the **drug**. 60 (6%) had an MI.
- 1000 patients received **placebo**. 80 (8%) had an MI.

1. What is the number needed to treat (NNT) to prevent 1 myocardial infarction?

_____patients ☐ I don't know

2. What is the absolute risk reduction (ARR) for myocardial infarction?

_____% ☐ I don't know

3. What is the relative risk reduction (RRR) for myocardial infarction?

_____% ☐ I don't know

4. The odds ratio and hazard ratio are both relative measures of the effect of a therapy.

☐ True ☐ False ☐ I don't know

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RATE YOUR FAMILIARITY with research terms (a)–(f) in the table below:

	Understand and could explain to others	Some understanding	Don't understand but would like to	Don't understand and it would not be helpful for me to understand
a. Relative risk reduction	☐	☐	☐	☐
b. Odds ratio	☐	☐	☐	☐
c. Hazard ratio	☐	☐	☐	☐
d. Absolute risk reduction	☐	☐	☐	☐
e. Number needed to treat	☐	☐	☐	☐
f. Confidence intervals	☐	☐	☐	☐

Have you completed an evidence-based medicine course/workshop in the last 10 years? ☐ Yes ☐ No

If yes, please indicate where: (check all that apply) ☐ Undergraduate ☐ Postgraduate ☐ CME ☐ Other (specify):_____

How much emphasis should CME speakers place on presenting research results when making therapeutic recommendations?

Very little----------Some----------A lot

1	2	3	4	5
☐	☐	☐	☐	☐

Comments:

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