Successful Scientific Writing

Paul Z. Siegel, M.D., M.P.H.

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The ABSTRACT

Components of an abstract

- **Major purpose of study**
- **Basic procedures**
- **Main findings**
- **Principal conclusions**

List Medical Subject Headings (MeSH) key words under the abstract.

Important:
Emphasize what is new and useful.

Reliability of Information on Chronic Disease Risk Factors Collected in the Missouri Behavioral Risk Factor Surveillance System – Abstract (initial draft - 183 words)

The Behavioral Risk Factor Surveillance System (BRFSS) is widely used by state health agencies to measure the prevalence of chronic disease risk factors. Despite the widespread use of BRFSS, few studies exist on the reliability and validity of BRFSS-collected data. To assess the reliability of the Missouri BRFSS, a test-retest study was conducted. The authors conducted telephone reinterviews for 222 respondents of completed BRFSS interviews from March and April 1993. The second interview was completed between six and 30 days of the first interview. Agreement was high for sociodemographic variables (kappa values from 0.85 to 1.00). Reliability of information on chronic conditions and risk factors was also high, with kappa values from 0.82 for hypertension to 1.00 for current smoking status. Regarding cancer screening practices, reliability was lower for knowledge of the prostate-specific antigen test (kappa = 0.21) than for women's cancer screening practices (i.e., the mammogram and Pap smear). Questions on attitudes toward environmental tobacco smoke showed lower reliability than did questions on individual actions to reduce exposure to environmental tobacco smoke. These findings demonstrate the overall flexibility and utility of the BRFSS.

Reliability of Information on Chronic Disease Risk Factors Collected in the Missouri Behavioral Risk Factor Surveillance System

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The Behavioral Risk Factor Surveillance System (BRFSS) is widely used by state health agencies to measure the prevalence of chronic disease risk factors. We completed a test-retest study to assess the reliability of the Missouri Behavioral Risk Factor Surveillance System. We conducted telephone reinterviews for 222 respondents of completed Behavioral Risk Factor Surveillance System interviews from March and April 1993. The second interview was completed between 6 and 30 days after the first interview. Agreement was high for sociodemographic variables (kappa values from 0.85 to 1.00). Reliability of information on chronic conditions and risk factors was also high, with kappa values from 0.82 for hypertension to 1.00 for current smoking status. Regarding cancer screening practices, reliability was lower for knowledge of the prostate-specific antigen test ($\kappa = 0.21$) than for women's cancer screening practices (that is, the mammogram and Papanicolaou smear). Questions on attitudes towards environmental tobacco smoke showed lower reliability than did questions on individual actions to reduce exposure to environmental tobacco smoke. (Epidemiology 1994;5:545-549)

Keywords: behavior, chronic diseases, diabetes mellitus, hypertension, reproducibility of results, risk factors, smoking, surveillance, tobacco smoke pollution, data collection.

Chronic diseases such as coronary heart disease, cancer, stroke, diabetes mellitus, chronic obstructive pulmonary disease, and chronic liver disease account for over 70% of all annual deaths in the United States.[1] A substantial portion of the chronic disease burden is related to modifiable risk factors such as cigarette smoking, hypertension, and obesity.[2-5] Control of chronic diseases and their antecedents, as well as chronic disease surveillance, are priorities of the nation, as reflected in *Healthy People 2000: National Health Promotion and Disease Prevention Objectives*.[6]

The Behavioral Risk Factor Surveillance System is the world's largest health surveillance system. Developed in 1981 by the Centers for Disease Control and Prevention (CDC), it is the only state-specific surveillance system available to monitor the patterns and prevalence of chronic disease risk factors.

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The purpose of the Behavioral Risk Factor Surveillance System was to provide a flexible, state health agency-based surveillance system to assist in planning, implementing, and evaluating health promotion and disease prevention programs.[7-9] The number of participating states (including the District of Columbia) has ranged from 26 in 1986 to 50 in 1993. Despite importance and widespread use of the Behavioral Risk Factor Surveillance System, few studies[10-12] have assessed the accuracy of data collected through this system.

To contribute additional information on the accuracy of these telephone survey data, we recently conducted a test-retest study of the Missouri Behavioral Risk Factor Surveillance System.

Methods

Data Collection

We will briefly review the Behavioral Risk Factor Surveillance System methods which have been discussed in detail elsewhere.[7.8.13] Using Random digit dialing,[14] a random sample is selected from Missouri's no institutionalized adult population (age $\geq$ 18 years) who have telephones. The computer-assisted Missouri Behavioral Risk Factor Surveillance System is administered by trained interviewers during a 2-week period of each month. Each month, 126 interviews are conducted, for a total of 1,512 annual interviews. Among eligible respondents (that is, non-business phone extensions, working numbers), the response rate was 66% for the baseline survey during the study period.

The current reliability study was conducted for completed Behavioral Risk Factor Surveillance System interviews from March and April 1993. During this period, reliability interviews were conducted for 222 of 252 respondents (88%). The second interview was completed between 6 and 30 days after the first interview.

SURVEY INSTRUMENT

The Behavioral Risk Factor Surveillance System instrument consists of three parts: (1) a core of questions asked by all participating states; (2) standardized modules developed by CDC, added at the state's discretion; and (3) special questions developed within the state. For the reliability study, questions were utilized from all three categories. When possible, Behavioral Risk Factor Surveillance System questions were adopted based on the national surveys such as the National Health and Nutrition Examination Surveys and the National Health Interview Surveys. [13] Table 1 presents selected questions used in the Missouri Behavioral Risk Factor Surveillance System. The full Missouri Behavioral Risk Factor Surveillance System instrument used during the study period consisted of 133 questions. The instrument of the reliability study consisted of 37 of these 133 questions. (A copy of the questionnaire is available from the first author.)

ANALYSIS

For dichotomous variables, we used Cohen's kappa statistic (κ).[16-19] As a reference, kappa values greater than 0.75 represent excellent agreement, those less than 0.40 show poor agreement, and values in the middle range represent fair to good agreement.[17] We calculated Pearson correlation coefficients (r) for continuous variables (for example, age) and Spearman rank correlation coefficients (r) for ordinal variables (for example, education level).[20] When analyzing cancer screening results, we determined denominators by applying current cancer early detection guidelines.[21]

Results

Our sample was generally representative of the overall Missouri population,[22] although it slightly underrepresented younger persons, males, and blacks (Table 2). Reliability for sociodemographic variables was generally high (Table 3). Kappa values ranged from 0.85 for employment status to 1.00 for gender. Correlation values ranged from 0.92 for education level to 0.98 for age.

Estimates of the reliability of information on chronic conditions and risk factors are presented in Table 4. Kappa values varied from 0.82 for hypertension to 1.00 for current smoking status.

TABLE 1. Selected Questions* Used in the Behavioral Risk Factor Surveillance System, Missouri, 1993

Category and Question
Chronic conditions and risk factors
Have you ever been told by a doctor, nurse, or other health professional that you have high blood pressure? †
Have you ever been told by a doctor that you have diabetes? †
Have you smoked at least 100 cigarettes in your life? †
Do you smoke cigarettes now? †
Cancer screening practices
Have you ever had a mammogram? †
Have you ever had a Pap smear? †
Have you ever heard about the PSA blood test? ‡
Have you ever had a PSA blood test? ‡

* Questions pertaining to environmental tobacco smoke attitudes and exposure are presented elsewhere.[15]
† Question developed by CDC.
‡ Question developed by the Missouri Department of Health.

TABLE 2. Respondent Characteristics* by Sociodemographic Grouping, Missouri, 1993

Characteristic	Number	%
Age (years)		
18 – 34	66	29.7
35 – 54	74	33.3
≥ 55	81	36.5
Unknown/refused	1	0.5
Gender		
Female	135	60.8
Male	87	39.2
Race		
White	206	92.8
Black	13	5.9
Other	3	1.3
Education level		
Less than high school graduate	25	11.3
High school or technical school graduate	155	69.8
College graduate	42	18.9
Income level ($)		
< 15,000	74	33.3
15,000 to < 35,000	63	28.4
≥ 35,000	58	26.1
Unknown/refused	27	12.2

* Based on the original interview.

TABLE 3. Estimate of Reliability of Sociodemographic Variables* Collected in the Behavioral Risk Factor Surveillance System, Missouri, 1993

Characteristic	Agreement (%)	Kappa or *r*
Age	98	0.98 †
Gender	100	1.00 ‡
Race	99	0.97 ‡
Education level ‖	93	0.92 §
Income level	79	0.97 §
Employment status	91	0.85 ‡

* Based on 222 interviews.
† Pearson correlation coefficient.
‡ Kappa value.
§ Spearman rank correlation coefficient.
‖ Household income.

Values of *r* ranged from 0.85 for smoking intensity to 0.99 for reported age of diabetes onset. We noted fairly wide variation in the reliability of information on cancer screening practices (Table 4). Data on whether respondents had heard of the prostate-specific antigen (PSA) test showed low reliability ($\kappa = 0.21$). Reliability tended to be higher for women's cancer screening practices (that is, the mammogram and Papanicolaou smear). Intermediate reliability was noted for the digital rectal examination ($\kappa = 0.59$). Wide variation was also seen in the utilization of cancer screening practices. For example, 95% of adult women had received a Papanicolaou smear, whereas only 40% of men (age 50 years and older) reported that they had received a prostate-specific antigen test.

We assessed the reliability of questions on attitudes and actions to reduce exposure to environmental tobacco smoke (Table 4). Questions on attitudes toward environmental tobacco smoke (that is, harmfulness of tobacco smoke to nonsmokers and environmental tobacco smoke limitations in public places) showed lower reliability (kappa values of 0.51 and 0.47, respectively) than did three questions on actions to reduce exposure to tobacco smoke. Questions on environmental tobacco smoke-related actions ascertained whether respondents had asked someone not to smoke in their presence ($\kappa = 0.72$), had asked to be seated in a nonsmoking section of a restaurant ($\kappa = 0.82$), or had discussed the reduction of smoking in the workplace ($\kappa = 0.62$).

We also compared reliability based on a second interview 6 days following the original interview with that based on a second interview 7 – 20 days following the first interview. These analyses showed no clear pattern in reliability across these time intervals.

Discussion

The only published study with which to compare our results is the New York City-based study of a triethnic population.[10] Our findings generally agree with those of the New York study. For example, in the study by Shea *et al*,[10] reliability was high for sociodemographic variables. In items comparable between our study and the New York study (for example, chronic conditions and risk factors), our estimates of reliability were slightly higher. The New York study also included comparisons among whites, blacks, and Hispanics, whereas our study lacked sufficient samples of various racial/ethnic groups for each comparison. Unlike the New York research, our study included reliability estimates for various cancer screening practices and environmental tobacco smoke exposure variables. Our response rate for the second interview (88%) was higher than the New York rate (56%).

Our study relied on computer-assisted telephone interview (CATI) techniques. Computer-assisted technology has advantages and disadvantages over paper-and-pencil surveys, some of which may affect reliability estimates. Among the advantages of computer-assisted telephone interview techniques are that: (1) an opportunity for data entry errors is eliminated, because responses are entered directly into the computer; (2) with a menu-driven computer-assisted telephone interview system, the interview proceeds more smoothly and rapidly because the computer selects the appropriate skip pattern; and (3) responses that are not within acceptable parameters are identified immediately, thereby eliminating some potential data entry errors. The major disadvantage of a computer-assisted telephone interview system is the lack of paper copies of interviews to verify responses and to search for inconsistencies.

A weakness of our study is that it can only measure reliability, rather than validity. In two published studies that have attempted to measure validity, [11,12] substantial agreement was shown for most cardiovascular risk factors between Behavioral Risk Factor Surveillance System-collected data and physiologic/in-person interview data. Another limitation of the Behavioral Risk Factor Surveillance System is its reliance on telephone surveys. This surveillance system oversamples older white middle class women and undersamples minorities and other hard-to-reach populations who may have limited phone coverage. This sampling pattern may result in underestimation of risk factor prevalence.[9,23]

Major strengths of the Behavioral Risk Factor Surveillance System are that it allows states to develop and add survey questions on emerging health issues,

TABLE 4. **Estimate of Reliability of Information on Chronic Conditions, Risk Factors, Cancer Screening Practices, and Attitudes and Actions toward Environmental Tobacco Smoke Collected in the Behavioral Risk Factor Surveillance System, Missouri, 1993**

Condition/Risk Factor/Practice	Number of Respondents	Prevalence (%)	Agreement (%)	Kappa Or *r*
Condition of risk factor				
Ever told hypertension	221	24	93	0.82 †
Ever told diabetic	222	7	98	0.86 †
Age told diabetic	12		92	0.99 ‡
Body mass index (kg/m^2)	216	25.3		0.96 ‡
Ever-smoker	222	50	97	0.94 †
Current smoker	108	25	100	1.00 †
Average cigarettes/day	55		86	0.85 §
Cancer screening practice ‖				
Ever had mammogram	81	75	95	0.87 †
Had mammogram in past year	39	59	90	0.79 †
Ever had Pap smear	135	95	96	0.68 †
Had Pap smear in last year	123	63	89	0.76 †
Ever heard of PSA ¶ test	43	63	63	0.21 †
Ever had PSA test	22	40	82	0.60 †
Ever had digital rectal exam	55	71	82	0.59 †
Attitude/action toward ETS				
ETS is harmful to nonsmokers' health	222	81	86	0.51 †
Smoking should be limited in public places	222	92	91	0.47 †
Asked someone not to smoke in presence	222	35	87	0.72 †
Asked to be seated in nonsmoking section of restaurant	222	69	92	0.82 †
Discussed the reduction of workplace smoking	222	26#	73	0.62 †

* Based on the original interview
† Kappa value.
‡ Pearson correlation coefficient.
§ Spearman rank correlation coefficient.
‖ Denominators for cancer screening practices. Ever had mammogram: women age 40 years and older; Had mammogram in past year: women age 50 years and older; Pap smear: women age 18 years and older; PSA test: men age 50 years and older; Ever had digital rectal exam: women and men age 40 years and older.[21]
¶ Prostate-specific antigen.
# Excludes subjects who answered "don't know," refused to answer, already had a smoke-free workplace, or were unemployed or retired.

and it can be adapted for surveys of special populations.[24] No clear pattern in reliability was shown based on whether Behavioral Risk Factor Surveillance System questions were developed at CDC *vs* those developed in Missouri. For questions developed in Missouri, reliability was relatively high for question on actions to reduce environmental tobacco smoke exposure, yet fairly low for knowledge of the prostate-specific antigen test. The low reliability for the prostate-specific antigen knowledge may be related to the infrequent use of this test until recently, rather than the properties of the question itself. In addition, since the prostate-specific antigen test may be part of a routine blood test, some men may be unaware that the test was performed. Our results indicate that reliability may be higher for variables (for example, smoking status) and lower for knowledge and attitudinal variables (for example, that environmental tobacco smoke is harmful to nonsmokers' health).

Acknowledgements

We are grateful to supervisors and surveyors from Manpower, Inc., who conducted data collection, and in particular to Carol McClanahan, Jane Heath, and Anna Klick, who supervised data collection. We also thank Linda Webb and Donald Sharp, Centers for Disease Control and Prevention, for assistance in this project and for helpful comments on the manuscript.

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PASSIVE VOICE

(the ‘agent’ of the action is omitted).

"James Watson was awarded the Nobel Prize for discovering the molecular structure of DNA."

vs.

"The Nobel Committee awarded James Watson the Nobel Prize for discovering the molecular structure of DNA."

Passive Voice

Advantages

- avoids unnecessary words when the "who" or "what" performing the action is unimportant or obvious.
- can help avoid monotonous repetition (especially in Methods section)
- useful for policy statements (diffuses the locus of responsibility)

Disadvantages

- Creates confusion/ambiguity when the agent of action **is** important or otherwise unclear.
- This confusion is compounded when the passive voice is used in long sentences.

STRUCTURED ABSTRACT

Handheld Cellular Telephone Use And Risk of Brain Cancer

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Context A relative paucity of data exists on the possible health effects of using cellular phones.

Objective To test the hypothesis that using handheld cellular telephones is related to the risk of primary brain cancer.

Design and Setting Case-control study conducted in 5 US academic medical centers between 1994 and 1998 using a structured questionnaire.

Patients A total of 469 men and women aged 18 to 80 years with primary brain cancer and 422 matched controls without brain cancer.

Main Outcome Measure Risk of brain cancer compared by use of handheld cellular telephones, in hours per month and years of use.

Results The median monthly hours of use were 2.5 for cases and 2.2 for controls. Compared with patients who never used handheld cellular telephones, the multivariate odds ratio (OR) associated with regular past or current use was 0.85 (95% confidence interval [CI], 0.6-1.2). The OR for infrequent users (<0.72 h/mo) was 1.0 (95% CI, 0.5-2.0) and for frequent users (>10.1 h/mo) was 0.7 (95% CI, 0.3-1.4). The mean duration of use was 2.8 years for cases and 2.7 years for controls; no association with brain cancer was observed according to duration of use (P=.54). In cases, cerebral tumors occurred more frequently on the same side of the head where cellular telephones had been used (26 vs 15 cases; P=.06), but in cases with temporal lobe cancer a greater proportion of tumors occurred in the contralateral than ipsilateral side (9 vs 5 cases; P=.33). The OR was less than 1.0 for all histologic categories of brain cancer except for uncommon neuroepitheliomatous cancers (OR, 2.1; 95% CI, 0.9-4.7).

Conclusions Our data suggest that use of handheld cellular telephones is not associated with risk of brain cancer, but further studies are needed to account for longer induction periods, especially for slow-growing tumors with neuronal features.

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REDUCING MORTALITY FROM COLORECTAL CANCER BY SCREENING FOR FECAL OCCULT BLOOD

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Abstract *Background.* Although tests for occult blood in the feces are widely used to screen for colorectal cancers, there is no conclusive evidence that they reduce mortality from this cause. We evaluated a fecal occult-blood test in a randomized trail and documented its effectiveness.

Methods. We randomly assigned 46,551 participants 50 to 80 years of age to screening for colorectal cancer once a year, to screening every two years, or to a control group. Participants who were screened submitted six guaiac-impregnated paper slides with two smears from each of three consecutive stools. About 83 percent of the slides were rehydrated. Participants who tested positive underwent a diagnostic evaluation that included colonoscopy. Vital status was ascertained for all participants over 13 years of follow-up. A committee determined causes of death. A single pathologist determined the stage of cancer for each tissue specimen. Differences in mortality from colorectal cancer, the primary study end point, were monitored with the sequential log-rank statistic.

Results. The 13-year cumulative mortality per 1000 from colorectal cancer was 5.88 in the annually screened group (95 percent confidence interval, 4.61 to 7.15), 8.33 in the biennially screened group (95 percent confidence interval, 6.82 to 9.84), and 8.383 in the control group (95 percent confidence interval, 7.26 to 10.40). The rate in the annually screened group, but not in the biennially screened group, was significantly lower than in the control group. Reduced mortality in the annually screened group was accompanied by improved survival in those with colorectal cancer and a shift to detection at an earlier stage of cancer.

Conclusions. Annual fecal occult-blood testing with rehydration of the samples decreased the 13-year cumulative mortality from colorectal cancer by 33 percent. (N Engl J Med 1993;328:1365-71.)

Reliability of Information on Chronic Disease Risk Factors Collected in the Missouri Behavioral Risk Factor Surveillance System

The Behavioral Risk Factor Surveillance System (BRFSS), a population-based telephone survey of health-related behaviors among adults ages 18 and older, is used by nearly all state health agencies to measure the prevalence of chronic disease risk factors. Despite widespread use, the reliability of BRFSS-collected data is not well described. To assess the reliability of the Missouri BRFSS, interviews from 222 of 252 respondents (response rate = 88%) who completed the survey during March and April, 1993, were repeated 6-30 days after the original interview. Reliability was highest for sociodemographic variables, chronic conditions and risk factors (kappa > 0.82), lower for cancer screening practices (kappa = 0.59-0.87), and lowest for knowledge about prostate-specific antigen testing (kappa = 0.21). Reliability of questions about attitudes toward environmental tobacco smoke (kappa = 0.47-0.51) was lower than for questions about individual actions to reduce environmental tobacco smoke (kappa = 0.62-0.82). We conclude that the reliability of most BRFSS questions is high. New, more reliable, questions to measure knowledge of prostate-specific antigen testing need to be developed.

(165 words)

Screening research papers by reading abstracts

Please get the abstract right, because we may use it alone to assess your paper.

The BMJ receives approaching 8000 manuscripts each year and accepts only about 7% of them. Editors reject about 60-70% of original articles without external review. When a paper is clearly unsuitable for the *BMJ* just one editor can make the decision to reject it. When the decision is less clear other editors are involved.

The low acceptance rate makes the *BMJ* a big rejection machine and leaves many of our customers dissatisfied. But triaging papers at an early stage allows us to spend as much time and effort as possible on the peer review, commissioning, and editing of material that we think will be relevant, useful, and important to our readers, material that we want to publish. Furthermore, rejecting unsuitable papers quickly allows the authors to submit their work to another journal. That delay may be as little as a few hours. Daily duty editors make initial decisions within 24 hours of submission of research papers and can reject manuscripts, send them for eternal review, or pass them to colleagues for a further opinion almost instantly using our online manuscript processing system (submit.bmj.com).

How do *BMJ* editors make decisions about research papers? During initial screening, the first editor makes judgments about originality, importance, and relevance. The ideal paper, given that the *BMJ* is a general medical journal with an international readership, would be useful to as many readers as possible around the world and appeal to a broad medical readership. Its findings would be directly relevant to patient care or to healthcare policy that would affect patients. The research question would be one that really needed answering, and the findings would be credible and would add enough to existing evidence, rather than simply comprising another small brick in the wall of knowledge. The authors would have used the right research design to answer the question, and any weaknesses in the design would be outweighed by important strengths. Our focus is on the research question and then the methods used. We do not decide the paper's fate on whether the findings are positive or negative.

A couple of years ago it became clear that several *BMJ* editors were making at least preliminary decisions on submitted research papers by reading only the abstracts, and we decided to test whether this was valid. We conducted an experiment to see if editors at the *BMJ* could make decisions about research papers based on reading only the abstracts, and to compare how each initial decision differed from the final one after reading the whole submission.[1] Only original research papers containing a structured abstract were included in the study. Medical editors acting as first readers of *BMJ* submissions had to read the abstract of each manuscript allocated to them and read no other material related to the submission.

Editors recorded the time taken to read each abstract and either their decision (immediate rejection, send to external peer reviewer, need for further in house consultation) or their inability to make a decision based on the abstract alone. Having made a decision based on the abstract, editors then read the whole manuscript and recorded on a separate form the time taken to do this and their decision based on reading the whole submission. The papers then continued through the rest of the process as normal, and the *BMJ* researchers followed them up and recorded the outcomes.

For about two thirds of submissions seen during the study, editors were able to make decisions based on reading only abstracts. They went on to make similar decisions when they read the corresponding whole submissions. For all papers that editors thought should be rejected after reading the abstract, the final decision after full processing was still rejection. The *BMJ* researchers concluded that it would be valid for editors to reject a submission after reading only the abstract if they were confident about that decision, and that when they felt they needed to read a full submission to make a decision, they should do so.[1]

Our estimate is that an initial decision is made on the abstract alone in 15-25% of papers. In a further 30-40% of papers editors look at the full paper for one or two specific points, which usually concern the paper's originality or methods. The remaining papers are read more fully before an initial decision is made. This is not as radical as it might sound: it is routine, for example, for conference panels to screen submissions by assessing abstracts. The 30-40% of papers that we send to external peer reviewers are read more fully by editors, and by reviewers and—if they survive external peer review—in painstaking detail by several people at our editorial advisory (or hanging) committees.

If you intend to submit an original research paper to the *BMJ* please ensure that its structured abstract is as complete, accurate, and clear as possible—but not unnecessarily long—and has been approved by all authors (see our full advice on writing structured abstracts at http://bmj.bmjjournals.com/advice/sections.shtml). All too often abstracts are poorly written, incomplete, misleading, and plain wrong.[2 3] And, anecdotally, we know that the abstract is often the last piece written and is left to the least experienced author to produce.

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