Course VIII-2, 2019

Basic statistical tests and more

Aya Goto

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Fukushima Medical University

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What you can learn in this session

- Choosing an appropriate test
- Ways of tabulation
- Analyzing numbers using OpenEpi
- Analyzing text using KH Coder

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J. Seizon *and Life Sci.* Vol. 27-2, 2017, 3

Health literacy as a driving force for improving access to health care: recovery after the nuclear power plant accident in Fukushima

Aya Goto, Alden Y Lai, Kimiko Ueda, Rima E Rudd

The Fukushima nuclear accident induced in people the fear of unknown health effects of radiation contamination due to confusing and often contradicting health risk messages. We developed and implemented a health literacy training workshop among local public health nurses and nursery school teachers, who are key players of community health and maternal and child health. The aim of this study is to assess the training's impact in a one-year follow up. We conducted a mail survey among participating 65 nurses and 45 teachers.

Over half of respondents in both groups continued to use learned skills one year after the workshop, which was associated with higher confidence and interest in receiving further training.

The skills gained in improving text readability and assessing readers' understanding were well applied, but skills related to relaying numeric information and paraphrasing professional terms were difficult to acquire. Currently, we are planning to upgrade and continue the workshop by focusing more on numeric information and paraphrasing of professional terms. We will continue to scale-up our health literacy initiative as a part of and beyond the disaster restorations activities in an aim to establish a health literate health system in Fukushima.

Table 1. Participants' workshop evaluation and self-evaluation of achievements toward training objectives

Statements	N (%) of 4 and 5[a]		
	Total (N = 57)	Nurses (N = 31)	Teachers (N = 26)
Workshop evaluation			
I applied learned skills in practice.	35 (61)	21 (68)	14 (54)

35/57 = 61% (95 Confidence Interval:)

Table 2. Association of application of learned health literacy skills with workshop evaluation and self-evaluation

Statements	N (%) of 4 and 5[a]		
	Non-users (N = 22)	Users[b] (N = 35)	P value[c]
Workshop evaluation			
I gained confidence in assessing and revising written materials.	2 (9)	13 (38)	0.02
I want to attend further training.	9 (41)	30 (86)	<0.001

2	13
20	22

( ) test

P value= ( )

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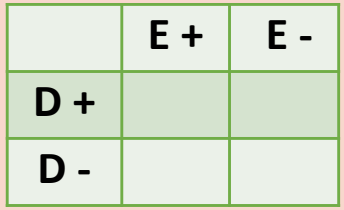
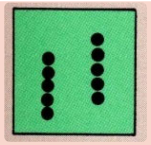
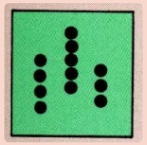
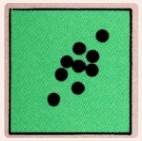
Basic statistical tests

Data type	Parametric	Non-parametric
Contingency table 		Large sample Chi-square test Small sample Fisher's exact test
Comparison of means		
(2 groups, independent) 	T-test	Mann-Whitney U test
(2 groups, paired)	Paired t-test	Wilcoxon signed rank test
(≥3 groups, independent) 	ANOVA	Kruskal-Wallis test
Association of two continuous variables 		
(Correlation)	Pearson's correlation	Spearman's correlation
(Regression)	Linear regression	Median regression

❖Analysis of contingency table

Relationship of residential region and hypertension

	City A	City B
HP positive	20	80
HP negative	40	60

❖Comparison of means

Relationship of residential region and blood pressure

	City A	City B
max BP (mean)	160	140

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- Paired

  Before-after study

  Matched case-control

	Before treatment N=100	After treatment N=100
max BP (mean)	160	140

- Un-paired (independent)

	Placebo N=100	Drug A N=100
max BP (mean)	160	140

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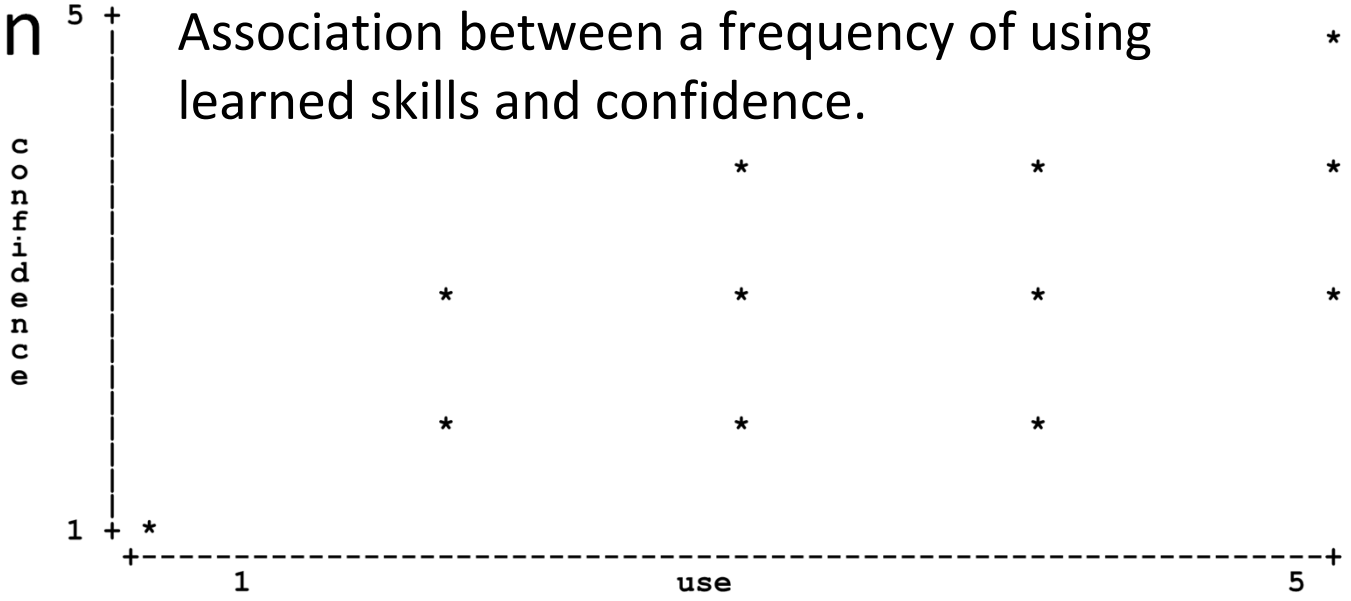
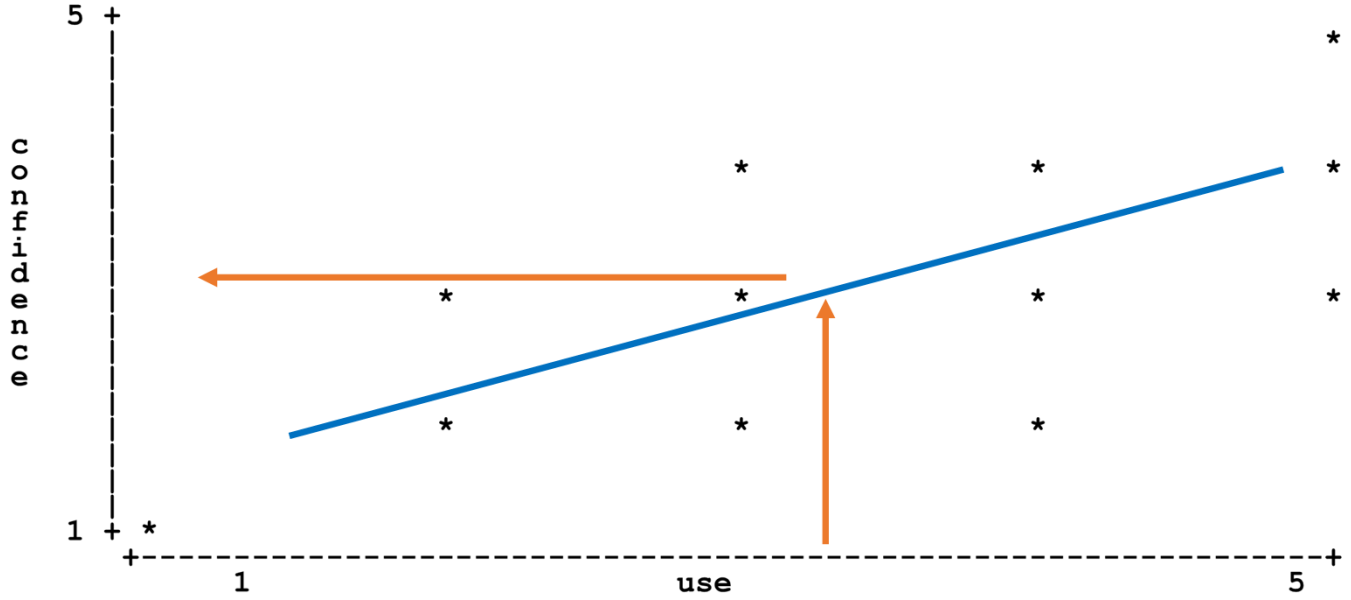
Correlation

Association between a frequency of using learned skills and confidence.



Regression



❖ Parametric

Data type: Continuous

Sample size: Large

Distribution (graph): Bell shape

❖ Non-parametric

Data type: Categorical

Sample size: Small (<30)

Distribution (graph): With outliers

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Group A	Group B
120	105
80	130
90	145
110	125
95	115
Mean ⟺	Mean

t-test

Group A	Group B	Rank A	Rank B
120	105	7	4
80	130	1	9
90	145	2	10
110	125	5	8
95	115	3	6

U-test

Independent

PARA

NON-PARA

Paired

Group A	Group B	A-B
120	105	15
80	130	-50
90	145	-55
110	125	-15
95	115	-20
	0 ⟺	Mean

Paired t-test

Group A	Group B	A-B	Rank A-B
120	105	15	1
80	130	-50	-4
90	145	-55	-5
110	125	-15	-2
95	115	-20	-3

Signed rank-sum test

Tabulation

10 year follow-up study of health behavior and mortality

```
tabulate sm outcome, row chi
```

sm	outcome alive	dead	Total
current smoker	61	85	146
	41.78	58.22	100.00
ex-smoker	74	67	141
	52.48	47.52	100.00
non smoker	268	136	404
	66.34	33.66	100.00
Total	403	288	691
	58.32	41.68	100.00

Pearson chi2(2) = 29.0882 Pr = 0.000

Mortality is significantly different among three groups.

You can not say:

Mortality is significantly higher for current smoker.

Contraceptive Methods	STD +	STD -
Condom		
OC		
IUD		
.		
.		
.		

dep	conf 0	1	Total
0	9	2	11
1	2	2	4
2	0	3	3
Total	11	7	18

Maternal confidence and
Two-item depression score
(0-2; ≥1 = depression tendency)

Simplifying a big table

Categorical data

1. Descriptive analysis only
2. Re-categorize into major categories
3. Re-categorize into one item of interest and others

Continuous data

1. Descriptive analysis only
2. Re-categorize into two by using
   1) a standard cut-off value
   2) mean or median or quantile value

Quick analysis using OpenEpi

http://www.openepi.com

Useful when…

1. You want to calculate 95%CI of a proportion.
2. You have a filled contingency table and want to perform a statistical test.
3. You know mean (SD) of your data and want to perform a statistical test.
4. You want to calculate a sample size.

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Expand All | Collapse

- Home
- Info and Help
- Language/Options/Settings
- Calculator
- Counts
  - Std.Mort.Ratio
  - Proportion
  - Two by Two Table
  - Dose-Response
  - R by C Table
  - Matched Case Control
  - Screening
- Person Time
  - 1 Rate
  - Compare 2 Rates
- Continuous Variables
  - Mean CI
  - Median/%ile CI
  - t test
  - ANOVA
- Sample Size
  - Proportion
  - Unmatched CC
  - Cohort/RCT
  - Mean Difference
- Power
- Random numbers

OpenEpi Open Source Epidemiologi

Now in English, French, Spanish, Italian, ar

Version 3.03a Updated 2015/05/04 ***Try it in a S***

OpenEpi provid
studies, stratifie
analysis, sample
and other evalua
other useful site

OpenEpi is free
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The programs h
translated. Some of the components from other sources hav

Proportion

Expand All | Collapse

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  - Compare 2 Rates
- Continuous Variables

Start | Enter | Results | Examples | Help

Clear | Settings | Conf. level=95% | Calculate

Simple Proportion

Sample	Numerator	10	
	Denominator	100	
Multiply results by		100	eg, 100 for %
Population size		1000000	if large,leave as 1000000
Compare to %		50.0	for optional statistics

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Start | Enter | Results | Examples | Help

95% Confidence Limits for Proportion 10/100
Multiplier=100
Large population size or sample with replacement.

	Lower CL	Per 100	Upper CL
Proportion as Percent		10	
Mid-P Exact	5.193		17.1
Fisher Exact(Clopper-Pearson)	4.9		17.62
Wald (Normal Approx.)	4.12		15.88
Modified Wald(Agresti-Coull)	5.349		17.61
Score(Wilson)*	5.523		17.44
Score with Continuity Correction (Fleiss Quadratic)	5.163		18.04

*LookFirst items: Editor's choice of items to examine first.

One-Sample Test for Binomial Proportion, Normal-Theory Method
Does proportion 0.1 differ from 0.5?
z-value = -8
Two-sided p-value=<0.0000001

Results from OpenEpi, Version 3, open source calculator--Proportion
Print from the browser with ctrl-P
or select text to copy and paste to other programs.

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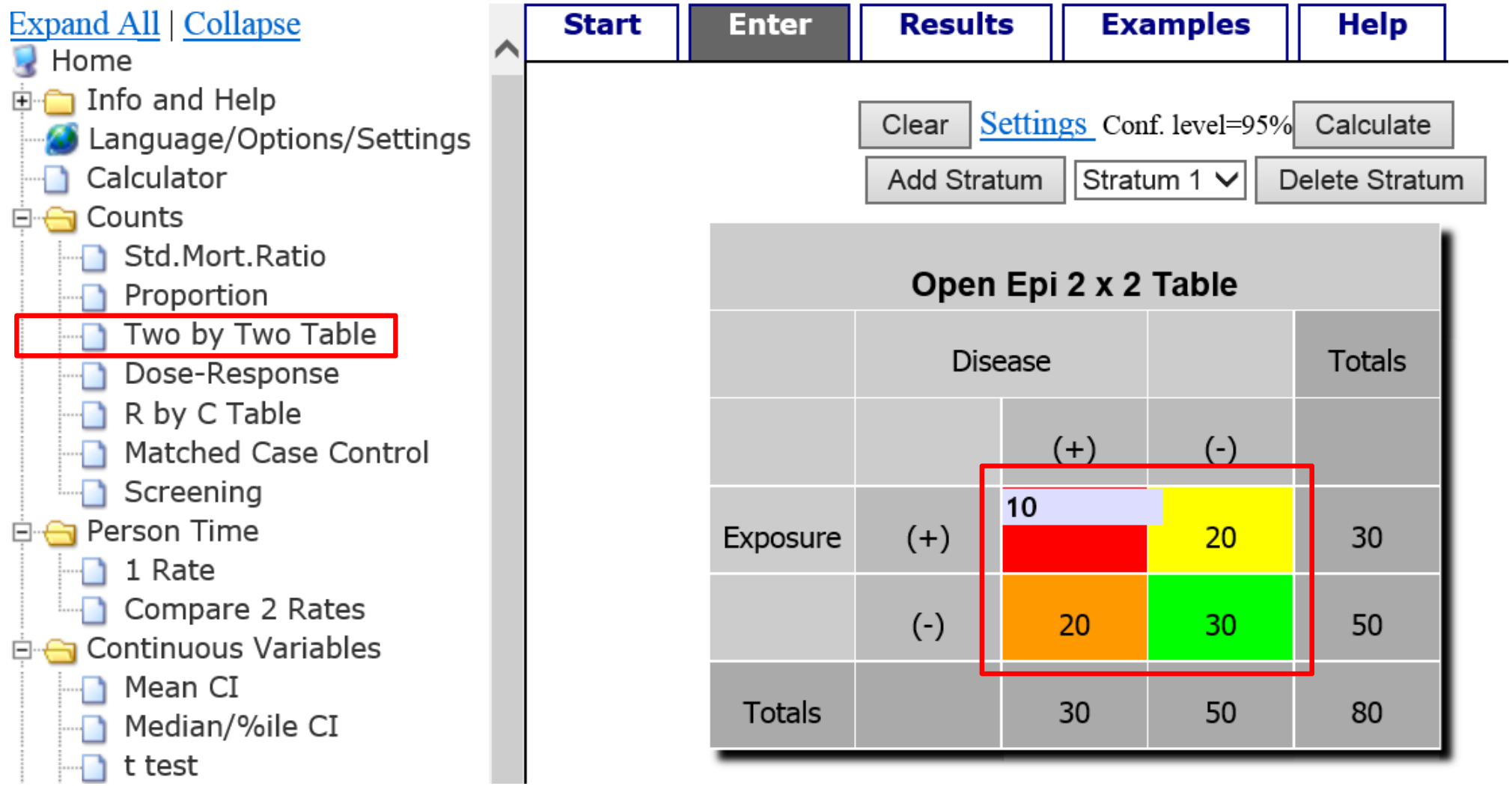
Two by Two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t test
Start
Enter
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Examples
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Clear
Settings
Conf. level=95%
Calculate
Add Stratum
Stratum 1
Delete Stratum
Open Epi 2 x 2 Table
Disease
Totals
(+)
(-)
Exposure
(+)
10
20
30
(-)
20
30
50
Totals
30
50
80

Start | Enter | Results | Examples | Help

2 x 2 Table Statistics

Single Table Analysis

		Disease (+)	Disease (-)
Exposure	(+)	10	2030
	(-)	20	3050
		30	5080

Chi Square and Exact Measures of Association

Test	Value	p-value(1-tail)	p-value(2-tail)
Uncorrected chi square	0.3556	0.2755	0.5510
Yates corrected chi square	0.128	0.3603	0.7205
Mantel-Haenszel chi square	0.3511	0.2767	0.5535
Fisher exact		0.3621(P)	0.7243
Mid-P exact		0.2823(P)	0.5647

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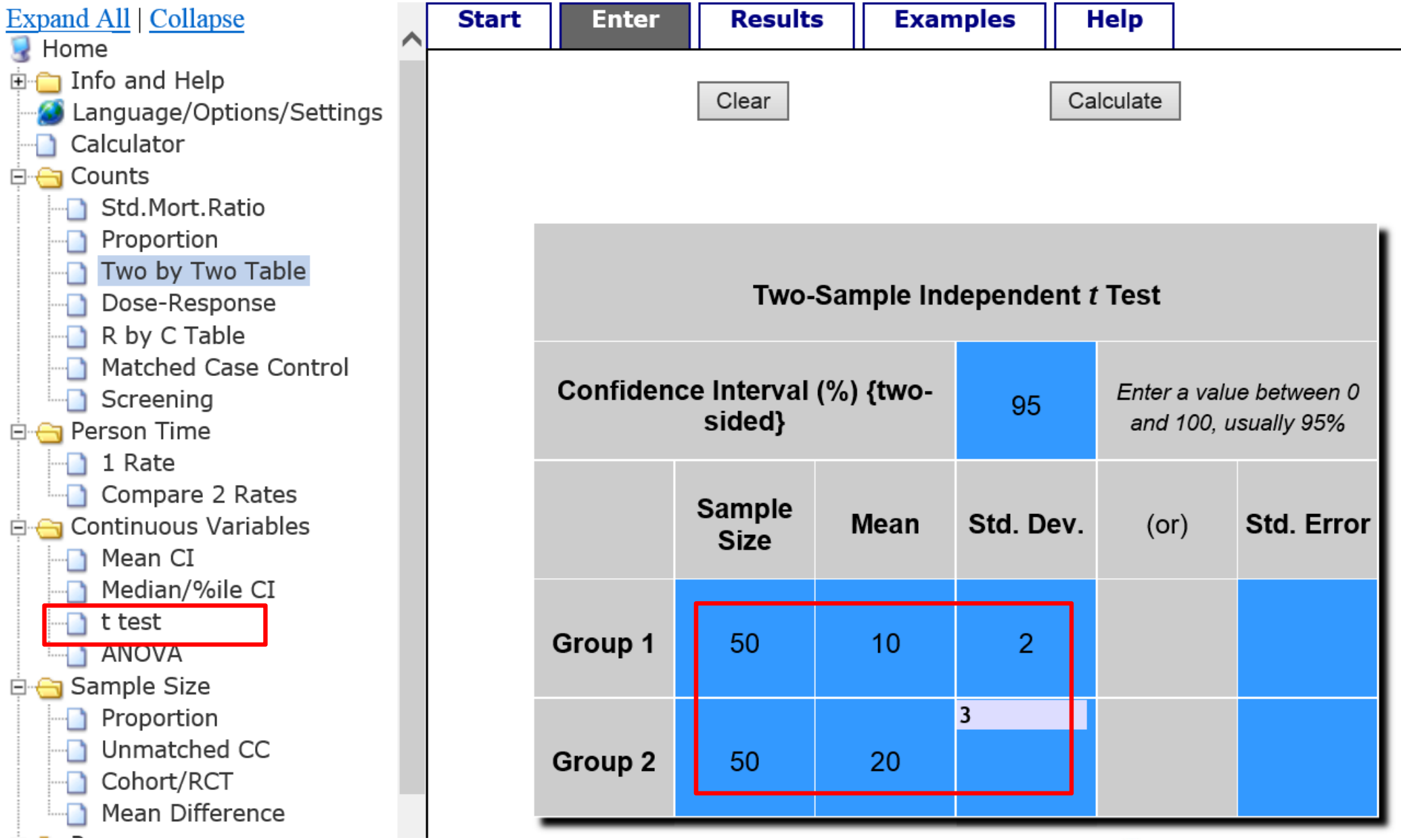
T test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Help
Clear
Calculate
Two-Sample Independent t Test
Confidence Interval (%) {two-sided}
95
Enter a value between 0 and 100, usually 95%
Sample Size
Mean
Std. Dev.
(or)
Std. Error
Group 1
50
10
2
Group 2
50
20
3

Start | Enter | Results | Examples | Help

Two-Sample Independent *t* Test

Input Data

Two-sided confidence interval 95%

	Sample size	Mean	Std. Dev.	Std. Error
Group-1	50	10	2	
Group-2	50	12	3	

Result	*t* statistics	*df*	p-value[1]	Mean
Equal variance	-3.92232	98	0.0001628	
Unequal variance	-3.92232	85	0.0001772	

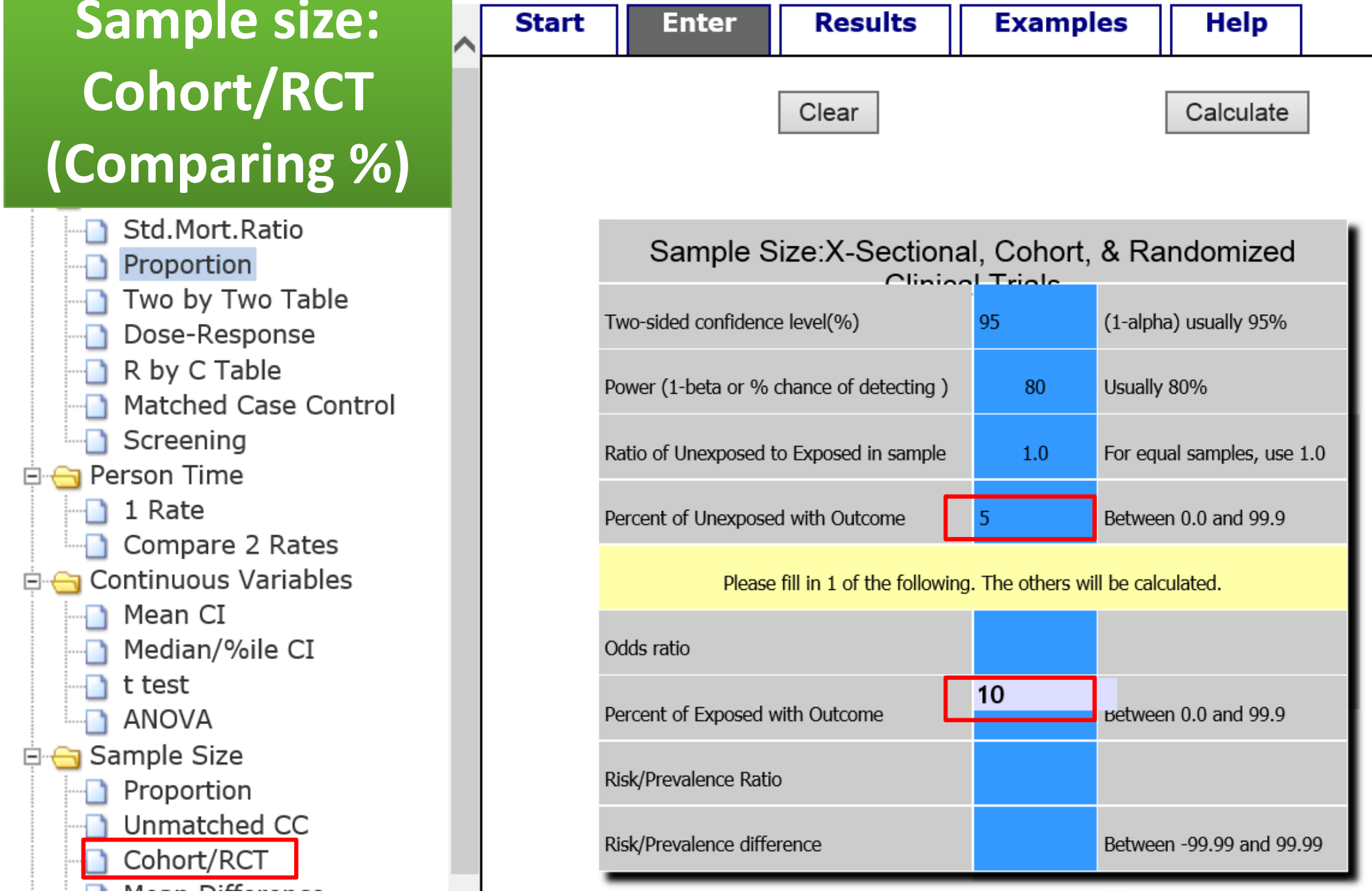
If this p value is 0.05 or higher, select the equal variance p value. If under 0.05, select the unequal variance p value.

	F statistics	*df*(numerator,denominator)	p-value[1]
Test for equality of variance[2]	2.25	49,49	0.005325

[1] p-value (two-tailed)

[2] Hartley's *f* test for equality of variance

Sample size: Cohort/RCT (Comparing %)



Start | Enter | Results | Examples | Help

Sample Size:X-Sectional, Cohort, & Randomized Clinical Trials

Two-sided significance level(1-alpha):	95
Power(1-beta, % chance of detecting):	80
Ratio of sample size, Unexposed/Exposed:	1
Percent of Unexposed with Outcome:	5
Percent of Exposed with Outcome:	10
Odds Ratio:	2.1
Risk/Prevalence Ratio:	2
Risk/Prevalence difference:	5

	Kelsey	Fleiss	Fleiss with CC
Sample Size - Exposed	437	436	475
Sample Size-Nonexposed	437	436	475
Total sample size:	874	872	950

Sample size: Mean Difference

- Counts
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Start | Enter | Results | Examples | Help

Clear | Calculate

Sample Size For Comparing Two Means

Confidence Interval % (two-sided)		95		*Enter a value between 0 and 100, usually 95%*
Power		80		*Enter a value between 0 and 100, usually 80%*
Ratio of sample size (Group 2/Group 1)		1		
	Group 1		**Group 2**	Enter means OR difference on next line
Mean	10	and	12	**or Difference**
Std. Dev.	3		4	*Enter Std. Deviation OR Variance of each group*
Variance				

Start | Enter | Results | Examples | Help

Sample Size For Comparing Two Means

Input Data

Confidence Interval (2-sided)	95%
Power	80%
Ratio of sample size (Group 2/Group 1)	1

	Group 1	Group 2	Difference*
Mean	10	12	-2
Standard deviation	3	4	
Variance	9	16	

Sample size of Group 1	50
Sample size of Group 2	50
Total sample size	100

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IAEA - Hiroshima University Consultancy Meeting

Science, Technology and Society Perspectives on Nuclear Science, Radiation and Human Health – The International Perspective

Health literacy promotion in Fukushima after the nuclear accident:

A case of responding to health care professionals' needs through the development of a health literacy toolkit

Aya Goto

Center for Integrated Science and Humanities

Fukushima Medical University

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Fukushima nuclear accident

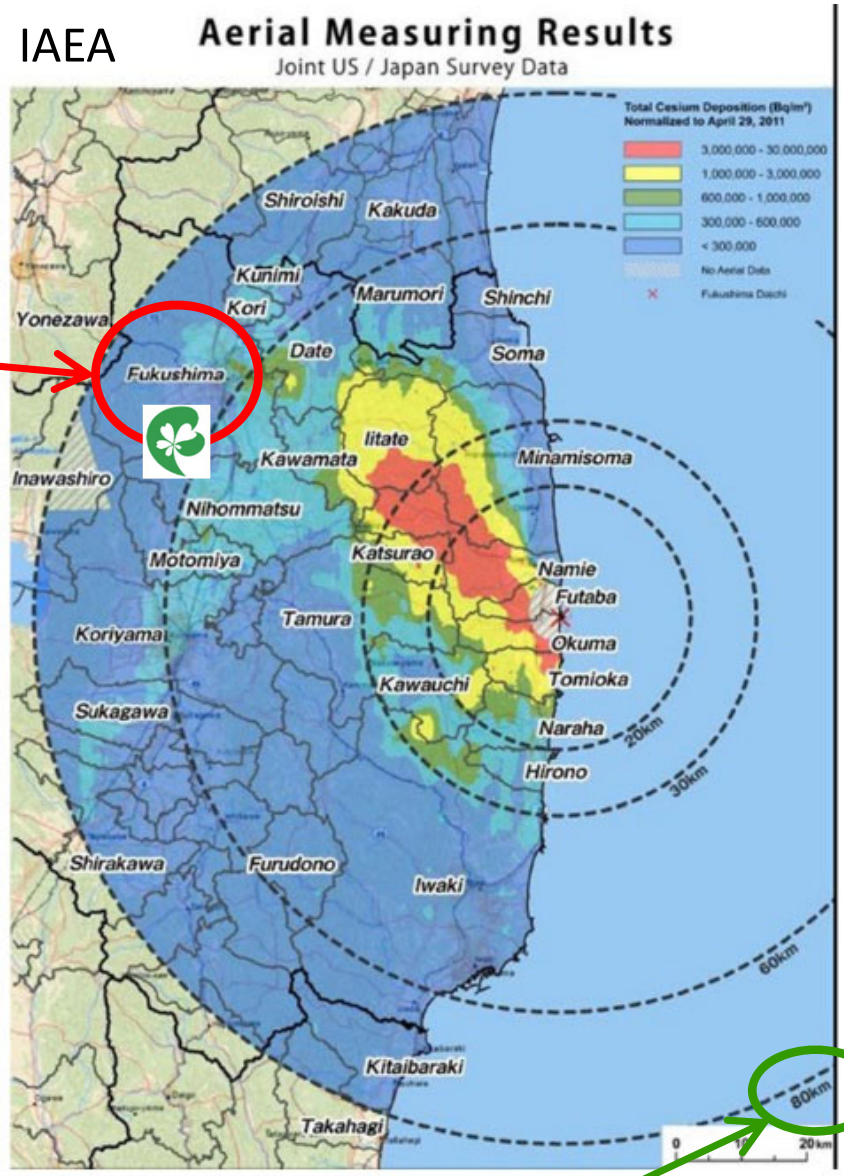
Fukushima City

15% decline in under 5-yo pop. in 2 years

Depression and decline in maternal confidence among Fukushima mothers

BMC Psychiatry. 2015; 15: 59.

J Commun Healthc. 2014; 7: 106-116.



50 miles: US Recommended Evacuation Zone

Fear of unknown health effects of radiation contamination due to confusing and often contradicting health risk messages with difficult scientific data

Picture: Leaflets about radiation placed in the lobby of a health center in Fukushima City.

Community health workers

Government

Fukushima Nuclear Accident Independent Investigation Commission

"Information for residents to make informed decisions"

How do we respond to parents' concerns ?

Public health nurses

(gate keepers of community health)

Nursery school teachers

(key players of maternal and child health)

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Health literacy

- "The cognitive and social skills which determine the motivation and ability of individuals to gain access to understand and use information in ways which promote and maintain good health" WHO, 1998

http://www.hsph.harvard.edu/healthliteracy/overview/

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Health literacy training

Table 2 Content of the health literacy training program in Fukushima City

First session	Second session	Follow-up survey
1. Ice-breaking activity 2. Lecture • General background of health literacy • Instructions to use material assessment tools 3. Exercise • Assessment of an assigned written health material 4. Training evaluation 5. Homework • Assessment of materials that participants themselves developed	1. Review quiz 2. Lecture Techniques to improve; • Text • Graphics • Risk presentation 3. Exercise • Revision of their own materials that they had assessed as homework 4. Training evaluation 5. Homework • Apply learned knowledge and skills in practice	1. Review of one-month application 2. Training evaluation 3. Distribute additional information leaflet about tips to apply health literacy in practice

- Goto A, et al. Japan Medical Association Journal. 2014; 57: 146-53.
- Rudd RE. Assessing health materials: Eliminating barriers – increasing access. 2010. http://www.hsph.harvard.edu/healthliteracy/

Training evaluation

- Workshop evaluation surveys among participants
- 65 nurses and 45 teachers who attended workshops in 2013-2014
- At the end of each session, 1 month (nurses only) and 1 year after the second session.
- Evaluation items
  - Application, confidence gain and interest in further training.
  - 12 specific training goals: 4 items each on knowledge, material assessment and development
  - Opinions on applications and barriers of learned skills in daily practices

Japan Medical Association Journal. 2015; 58: 1-9.
Journal of Seizon and Life Sciences. 2017; 27: 192-207.

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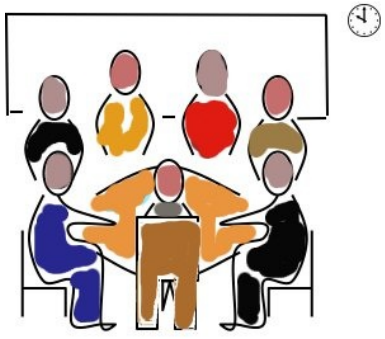

Assignments

1. Calculate 95% confidence interval of a proportion of users. “**Proportion**”
2. Select and perform an appropriate statistical test for an association between learned skills use and building confidence. “**Two by Two**” or “**t test**”?
3. How do you interpret the results for further improvement of the workshop?

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And more…

Please fill in a questionnaire to reflect upon your clinical experiences.

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Working toward Patient-centered Care

How many years have you been working as a physician?	( ) years
Gender	1. M 2. F
Do you provide health service to clients/patients daily? Note. If not, no need to answer questions below.	1. Yes 2. No
Did you attend our previous courses?	1. Once 2. Multiple 3. Never (= This is the first time)

Please think back about the last patient you have seen, and describe the situation in detail.
(Eg. A patient you have communicated just before coming to class.)

2 What do you think the patient wanted to say the most?

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