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El pensamiento estadístico, una introducción al análisis e interpretación de datos en investigación

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Asesoría Estadística para
Investigación



Contenido

- Introducción a la Estadística aplicada a la investigación
- ¿Qué es el pensamiento estadístico?
- Etapas del pensamiento estadístico
- Elementos necesarios para aplicar el pensamiento estadístico
- Estadística: Aplicación, plan de recolección de datos, plan de tabulación y plan de análisis

¿Solo yo tengo dudas en estadística?



M. Ricky Ramadhian | 4.94
Lampung University

What do you consider a good standard deviation?



Sailesh Palikhe | 16.51
University of Toyama

What is the difference between " $\text{mean} \pm \text{SD}$ " and " $\text{mean} \pm \text{SE}$ "?



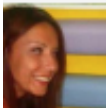
Sinead Lambe | 16.65
University of Bath

Is there a minimum number per group necessary for an ANOVA?



Bindu Chethala
Abu Dhabi International school

Which test can I use, One-way or two-way ANOVA?



Marija Topuzovska Latkovikj | 10.41
Ss. Cyril and Methodius University

Which statistical tests do you apply for small samples (less than 30 sampling units)?



Lyd LII
The Open University (UK)

How to interpret Cramer's C results?



Maren Catherina Podszun | 15.29
National Institutes of Health

What is the best way to do statistical analysis with a small n?



Redempta Mutisya | 1.27
Kenyatta University

How can I calculate the sample size in a pre-post test design?



Arnab Datta | 22.26
National Heart, Lung, and Blood Institute

What is the best way to determine outliers in data that is normally distributed ?



Shahar Frenkel | 34.56
Hadassah Medical Center

How do I compare several groups over time?

Aunque a veces estemos “perdidos”...



Buraq Abdulkareem  0.70

The University of Manchester

Can I use chi-square for two samples coming from the same distribution group, but with different mean and standard deviation?

Hello everybody,

I don't have much experience in statistics. Can I use chi-square for two samples coming from the same distribution group, but with different mean and standard deviation?

Thanks,

Buraq

¿Por ayuda o por terquedad?



Deleted · University of Alberta

Hi All

Thanks for the responses! very helpful ideas. Unfortunately the study has already been completed and I have data that I need to analyze, so I can't make any changes to study design.

I could consider interrater reliability as a measure for sure. That's very helpful thanks.

Anyone have any specific recommendations to the bolded stats tests above?

Thanks

PS



May 19, 2015 · Flag



Jochen Wilhelm · 1207.42 · 393.89 · Justus-Liebig-Universität Gießen

For a post-mortem analysis?

Publicaciones que parecen absurdas

88

For the classroom

New evidence for the Theory of the Stork

Thomas Höfer^a, Hildegard Przyrembel^b and Silvia Verleger^c

^aFederal Institute for Risk Assessment, Berlin, ^bOffice of the National Breast Feeding Committee at BfR, Berlin, and ^cIndependent Midwife, Berlin, Germany

Summary

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Berlin, Germany.
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thomas.hoefer@bfr.bund.de

Data from Berlin (Germany) show a significant correlation between the increase in the stork population around the city and the increase in deliveries outside city hospitals (out-of-hospital deliveries). However, there is no correlation between deliveries in hospital buildings (clinical deliveries) and the stork population. The decline in the number of pairs of storks in the German state of Lower Saxony between 1970 and 1985 correlated with the decrease of deliveries in that area. The nearly constant number of deliveries from 1985 to 1995 was associated with an unchanged stork population (no statistical significance). However, the relevance of the stork for the birth rate in that part of Germany remains unclear, because the number of out-of-hospital deliveries in this area is not well documented. A lack of statistical information on out-of-hospital deliveries in general is a severe handicap for further proof for the Theory of the Stork.

© Blackwell Publishing Ltd. *Paediatric and Perinatal Epidemiology* 2004, **18**, 88–92

Publicaciones que son chanzas o “bromas”

Hazardous journeys

Parachute use to prevent death and major trauma related to gravitational challenge: systematic review of randomised controlled trials

Gordon C S Smith, Jill P Pell

Contributors: GCSS had the original idea. JPP tried to talk him out of it. JPP did the first literature search but GCSS lost it. GCSS drafted the manuscript but JPP deleted all the best jokes. GCSS is the guarantor, and JPP says it serves him right.

Funding: None.

Competing interests: None declared.

Ethical approval: Not required.

- 1 Belmont PJ Jr, Taylor KF, Mason KT, Shawen SB, Polly DW Jr, Klemme WR. Incidence, epidemiology, and occupational outcomes of thoracolumbar fractures among US Army aviators. *J Trauma* 2001;50:855-61.
- 2 Bricknell MC, Craig SC. Military parachuting injuries: a literature review. *Occup Med (Lond)* 1999;49:17-26.

Publicaciones falsas

98 **vol. XVIII** **no. 6 (2013)** **METALURGIA INTERNATIONAL**

EVALUATION OF TRANSFORMATIVE HERMENEUTIC HEURISTICS FOR PROCESSING RANDOM DATA

Dragan Z DUIRIĆ¹, Boris DELILBAŠIĆ¹, Stevica RADISIĆ²

¹University of Belgrade, Serbia, ²Health Center "Stari Grad", Serbia

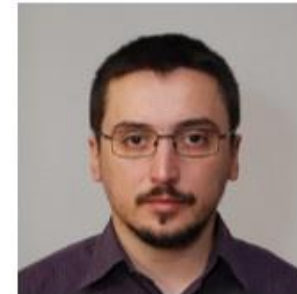
Key word: data mining, randomness studies, hermeneutic heuristics , EU support



**Prof. PhD
Dragan Z. DUIRIĆ**



**Prof. PhD
Boris DELILBAŠIĆ**



**Doctoral student
Stevica RADISIĆ**

[10] R. Garcia, M Perez-Gomez, X. J. Harris, and R. Jeremy. "On completeness methods in transductive system theory". Transactions of the Chinese Mathematical Society, 22 pp.83-107, April 1992.

[11] T. Dzimidzic, B. Sagdiyev, A. S. Hole. "The epistemologies of the dice, a practical considerations." Technical Report 4603/4343, Institute of Science, Art and Management, 2008.

[12] E. Gupta, Q. Wilson, and M. Jackson. "Some niteness results for combinatorially elliptic scalars". Proceedings of the Polish Mathematical Society, 20 pp.1408-1443, January 2000.

Although lymph-node metastasis would be expected to occur via lymphatic channels, its development is also a sign of systemic metastasis. A coordinated pathway involving angiogenesis in the emergence of metastatic potential is likely,^{2,11} and the striking association of high vascular counts with node metastasis provides clinicopathological evidence for this. ER, EGFR, and c-erbB-2 are growth factor receptors while p53 is a nuclear protein involved in cell cycle regulation and apoptosis. All have been related to prognosis in or to adverse features of breast cancer. One possible coordinated mechanism would be regulated release of angiogenic factors as a consequence of activation of these receptors or deregulation of differentiation. Many new vascular growth factors have been described recently,¹² and antagonism of ones specific to endothelium might provide a new approach to the management of metastasis.

Our findings also suggest that one reason for the success of breast screening is the detection of tumours before a critical number of blood vessels has been induced. In our series, vascular counts in tumours less than 1 cm in diameter and in grade I well-differentiated tumours were in the range for normal breast tissue. If metastasis began at any size screening would not be expected to be of benefit. Vascularisation could explain the low metastasis rate found in smaller screened tumours.^{13,14} In animal models, the angiogenic activity of perimastin breast lesions has been suggested to relate to risk of malignancy.²¹

We thank Liz Clemens for typing.

REFERENCES

- Potterman J. What is the evidence that tumours are angiogenesis dependent? *J Natl Cancer Inst* 1990; 82: 4-6.
- Makarewicz V, Hart JR. Metastasis and angiogenesis. *Acta Oncol* 1990; 29: 97-103.
- Goldman E. The growth of malignant disease and the role of animals with special reference to the vascular system. *Cancer* 1906; 12: 36-40.
- Loew L, Kleinerman J, Sidel J. Quantitative relationships between tumour cells, tumour vessels, and tumour angiogenesis following tumour implantation. *Cancer* 1970; 24: 997-1000.
- Stearns JR, Crowl PK, Tashir, Singer S. Angiogenesis-deficient W/W mice exhibit a decreased rate of tumour angiogenesis. *Am J Cancer* 1988; 41: 88-92.
- Srinivasan A, Laidler P, Davies R, Hogan K, Haglan LE. The prognostic significance of tumour vascularity in intermediate-thickness (0.76-4 mm thick) skin melanomas. *Am J Pathol* 1988; 138: 419-23.
- Waisman N, Sempke JP, Welch WR, Folmann J. Tumor angiogenesis and metastasis: correlation in invasive breast carcinoma. *N Engl J Med* 1991; 324: 1-8.
- Pharis DV, Cordell JL, Mollnes K, Herzy AR, Gasser KC, Mason DY. JCD20, a new monoclonal antibody that detects vascular endothelium associated antigen on routinely processed tissue sections. *J Clin Pathol* 1990; 43: 750-57.
- Schlingemann RO, Rietveld FJR, de Wilt GW, et al. Endothelial antigen CD34 is expressed by a subset of cultured endothelial cells and on the endothelial abdominal microvasculature of the tumor stroma. *J Invest Dermatol* 1990; 95: 690-94.
- Kuusi I, Birkhoff R, Harris AL, Mason M, Gasser KC, Mason DY. Heterogeneity of vascular endothelial cells with reference to expression of vascular tumours. *J Clin Pathol* 1992; 45: 345-412.
- Albelda SM, Muller WA, Jaffe CA, Nicosia RJ. Molecular and cellular properties of PECAM-1 (CD31): a novel vascular cell-cell adhesion molecule. *J Cell Biol* 1991; 114: 1059-69.
- Gasser K, Paken C. Monoclonal use of monoclonal antibodies in histopathology. In: Gasser K, Hainrow P, eds. Recent advances in histopathology. London: Longman, 1991: 1-10.
- Herzy AR, Cordell JL, Birkhoff R, et al. CD34, EGFR receptor and c-erbB-2 expression in human breast cancer. *Oncogene* 1991; 6: 2277-84.
- Garcia JV, Gracian R, Lase DP. Activating mutation in p53 gene confers resistance to effects of a monoclonal antibody specific for the mutant form. *EMBO J* 1990; 9: 3027-34.
- Mason DY, Cordell JL, Brown M, et al. Detection of T cells in paraffin wax embedded tissue using antibodies against peptide sequences from the CD3 and CD45. *J Clin Pathol* 1989; 42: 1194-200.
- Nishihori S, Saitoh JRG, Hainrow P, Chambers P, Fardon JR, Harris AL. Normal growth factor receptor expression is essential for local response to anticancer therapy in patients with recurrent colorectal cancer. *Lancet* 1988; 1: 883-85.
- Hart JR, Saito A. Biology of tumour metastasis. *Cancer* 1992; 399: 1433-57.
- Kuusi I, Harris AL. Novel growth regulatory factors and tumour angiogenesis. *Eur J Cancer* 1991; 27: 783-84.
- Talbot L, Fagelson G, Day NE, Duffy SW, Kitchin RM. Breast cancer treatment and natural history: new insights from results of screening. *Lancet* 1992; 339: 412-14.
- Schmidt JC. Natural history of breast cancer. *Lancet* 1992; 339: 618.
- Jensen HM, Chen I, DeVault MR, Lewis AE. Angiogenesis induced by "normal" human breast tissue: a probable marker for prognosis. *Cancer* 1982; 218: 293-95.

Effect of vitamin and trace-element supplementation on immune responses and infection in elderly subjects

RANJIT KUMAR CHANDRA

Aging is associated with impaired immune responses and increased infection-related morbidity. This study assessed the effect of physiological amounts of vitamins and trace elements on immunocompetence and occurrence of infection-related illness. 96 independently living, healthy elderly individuals were randomly assigned to receive nutrient supplementation or placebo. Nutrient status and immunological variables were assessed at baseline and at 12 months, and the frequency of illness due to infection was ascertained.

Subjects in the supplement group had higher numbers of certain T-cell subsets and natural killer cells, enhanced proliferation response to mitogen,

increased interleukin-2 production, and higher antibody response and natural killer cell activity. These subjects were less likely than those in the placebo group to have illness due to infections (mean [SD] 23 [5] vs 48 [7] days per year, $p=0.002$).

Supplementation with a modest physiological amount of micronutrients improves immunity and decreases the risk of infection in old age.

Lancet 1992; 340: 1124-27.

ADDRESS: Memorial University of Newfoundland, and World Health Organization Centre for Nutritional Immunology (Prof R K Chandra, MRC). Correspondence to Prof R K Chandra, Center for Human Nutrition, School of Hygiene and Public Health, Johns Hopkins University, 615 North Wolfe Street, Baltimore, Maryland 21205, USA.

APPLIED NUTRITIONAL INVESTIGATION

Effect of Vitamin and Trace-Element Supplementation on Cognitive Function in Elderly Subjects

Ranjit Kumar Chandra, MD, FRCP, MACP

From the Memorial University of Newfoundland, St. John's, Canada; and the Privat Hospital, Gurgaon, India

OBJECTIVE: To determine whether supplementation with vitamins and trace elements in modest amounts influences cognitive function in apparently healthy, elderly subjects.

METHODS: The study was designed as a randomized, double-blind, placebo-controlled trial. Ninety-six, apparently healthy, independent men and women older than 65 y of age were recruited and randomized to receive a supplement of trace elements and vitamins or a placebo daily for 12 mo. Blood-nutrient levels were estimated at baseline and at the end of the study. The major outcome measure assessed was cognitive function consisting of immediate and long-term memory, abstract thinking, problem-solving ability, and attention.

RESULTS: Eighty-six subjects completed the 1-y trial. The supplemented group showed a significant improvement in all cognitive tests ($P < 0.001$ to 0.05) except long-term memory recall ($P > 0.1$). Those whose blood-nutrient levels were below the reference standard showed better responses on cognitive tests. There was no significant correlation between individual nutrient levels and performance on various cognitive function tests.

CONCLUSIONS: Cognitive functions improved after oral supplementation with modest amounts of vitamins and trace elements. This has considerable clinical and public health significance. We recommend that such a supplement be provided to all elderly subjects because it should significantly improve cognition and thus quality of life and the ability to perform activities of daily living. Such a nutritional approach may delay the onset of Alzheimer's disease. *Nutrition* 2001; 17:709-712. ©Elsevier Science Inc. 2001

KEY WORDS: elderly, aging, vitamins, trace elements, cognitive function, memory, Alzheimer's disease

INTRODUCTION

Aging is associated with a gradual impairment in cognitive function¹ and even mild dementia has been linked to an increase in mortality in the aged.² Also, the elderly also have a high prevalence of undernutrition.^{3,4} At least 43% of independently living elderly individuals in affluent industrialized countries of North America and Europe have been estimated to have dietary intakes and blood-nutrient levels comparable with "deficiency."

Many nutrients play a key role in the metabolism of neuronal cells and their appendages. Their deficiency may be mediated by their catalytic role in numerous enzymes, antioxidant action, and various other processes. In vivo, micronutrients potentiate the ability of immune cells to suppress the toxic effect of inclusion bodies found in brains of patients with Alzheimer's disease (R K Chandra, in preparation). Further, micronutrients may reduce the amount of amyloid material in brain biopsies of patients with Alzheimer's disease.

The study was supported by a grant from the Nutrition Research Education Foundation and the University Research Professorship Award of Memorial University of Newfoundland.

Correspondence to: Ranjit Kumar Chandra, MD, FRCP, MACP, Jawahar Child Health Centre, St. John's, NF, A1A 1B8, Canada. E-mail: rchandra@mun.ca

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A preliminary cross-sectional one-point study suggested an association between dietary intake and blood levels of vitamin C, B12, B2, or folic acid and cognitive function as judged by the Wechsler Memory Test and the Halstead-Reitan Categories Test.⁵ However, no intervention was attempted and other vitamins and none of the trace elements were studied.

Therefore, nutritional deficiencies may be a contributing factor, perhaps even a causal factor, in the decline of cognitive function in old age. The hypothesis tested in this study was that an optimum intake of all essential micronutrients in modest physiological amounts improves cognitive function in the elderly. We conducted a randomized, double-blind, placebo-controlled trial to test this hypothesis.

SUBJECTS AND METHODS

The study population and their nutritional status at baseline and at the end of the 12-mo study period were described previously.⁶

Subjects

Ninety-six, apparently healthy, independently living men and women older than 65 y volunteered to enroll for the double-blind, placebo-controlled trial. They were from the middle socioeconomic class, with an average family income of C\$48,000 per annum. None of the subjects had any chronic or serious acute illness. Specifically, none suffered from any form of psychiatric illness or dementia. None had taken any nutritional supplements in

Psychology journal bans *P* values

Test for reliability of results 'too easy to pass', say editors.

Chris Woolston

26 February 2015

A controversial statistical test has finally met its end, at least in one journal. Earlier this month, the editors of *Basic and Applied Social Psychology* (BASP) announced that the journal would no longer publish papers containing *P* values because the statistics were too often used to support lower-quality research¹.

In an editorial explaining the new policy, editor David Trafimow and associate editor Michael Marks, who are psychologists at New Mexico State University in Las Cruces, say that *P* values have become a crutch for scientists dealing with weak data. "We believe that the $p < .05$ bar is too easy to pass and sometimes serves as an excuse for lower quality research," they write.

Speaking to *Nature*, Trafimow says that he would be happy if null hypothesis testing disappeared from all published research: "If scientists are depending on a process that's blatantly invalid, we should get rid of it." He admits, however, that he does not know which statistical approach should take its place.

Búsqueda del pensamiento estadístico

Filosofía de aprendizaje y acción



El investigador reacciona,
procesa y responde a la información

Forma de pensar y razonar las
cosas que se ven a partir de los
datos



El pensamiento estadístico no es un pensamiento matemático



Trata con fenómenos biológicos o naturales

Acciones:



Tomar decisiones ante
la incertidumbre

Encontrar solución a
los problemas

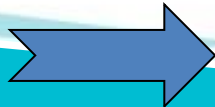


¿Cómo se estimula el pensamiento estadístico?

- Conocer las bases teóricas de los problemas de investigación.
- Planteamiento ordenado y lógico de los pasos de la investigación.
- Procesos de recolección y tabulación apropiados.
- Análisis crítico y lógico de los resultados y así poder llegar a conclusiones válidas y sustentadas de los problemas con los que se enfrentan en los procesos de investigación.

Primera etapa del pensamiento estadístico

- El investigador se plantea un problema con base en la observación de los fenómenos, se pregunta qué está sucediendo, cuáles son las relaciones de eventos que hacen que suceda y qué implicaciones tiene el hecho que suceda.
- luego procede a diseñar una investigación con la cual pretende responder sus preguntas controlando todos los factores que pueda y decide la forma en que evaluará el resultado de sus observaciones.
- Procede a realizar la medición de los fenómenos



Datos

Paso intermedio



-El análisis estadístico-

Segunda etapa del pensamiento estadístico

Interpretación de los resultados

- Sustentación
- Validez
- Congruencia
- Ética

Poner en términos claros y comprensibles los hechos observados y analizados.

Preguntas sencillas para enfocar actividades

- ¿Qué quiero saber?
- ¿Por qué quiero saberlo?
- ¿Para qué quiero saberlo? (¿Qué persigo con la investigación? ¿Cuál es mi objetivo?)
- ¿Qué voy a medir y cómo lo voy a medir?

Información

- La mayoría de los textos para el aprendizaje de la probabilidad y estadística empiezan con los datos, como si antes de tenerlos no ocurriera nada. Lo que es peor, nos (mal)enseñan a trabajar con supuestos.
- El proceso de generación de los datos es determinante en la búsqueda del conocimiento en cualquier campo.
- Todos los procesos de análisis de los datos, por sofisticados que sean, pierden valor si los datos no son fiables.

Diseño

- Variables independientes: ¿Cuántas variables independiente introduciré en el estudio? ¿Cómo las voy a determinar, controlar y especificar? ¿De qué tipo de variables se trata?
- Variables dependientes: ¿Cuántas variables voy a medir? ¿Cómo se operativizarán? ¿Qué escala de medición se utilizará?

Muestra

- Muestra representativa
- ¿Población?  Censo
- Muestreos probabilísticos y no probabilísticos

Plan de recolección de datos



Plan que el investigador propone para la recolección u obtención de la información.

Plan de tabulación

Se debe prever los cuadros que, de acuerdo con los objetivos e hipótesis, permitan la presentación de la información en forma clara y sistemática.



Crítica, corrección y codificación

Una vez recolectada la información se procede a fase de crítica, corrección y codificación de la misma, esto permite clasificar la información como: correcta, incorrecta pero corregible o inservible.

Así también, nos da la pauta para establecer si se puede re-muestrear o repetir algún proceso.

Análisis de la información

El análisis de la información se efectúa con los datos obtenidos. El tipo de análisis o métodos estadísticos a aplicar depende de las variables, los objetivos e hipótesis de la investigación.

Se recomienda el uso de paquetes de computación con facilidades estadísticas (Excel) o paquetes especializados (R, SPSS, STATA, etc.).



Estadística



- Se ocupa de fenómenos colectivos, de grandes grupos o conjuntos de datos.
- Aplicable a diferentes campos de la ciencia, investigaciones y eventos que requieren de análisis e interpretación.
- Establece márgenes de variabilidad.
- Se basa en la probabilidad.
- Permite estimación de eventos o fenómenos con cierto grado de exactitud y precisión.

Análisis estadístico

El análisis estadístico tiene dos funciones:

- Organizar y describir datos que han sido recolectados.
- Proporcionar conclusiones o inferencias acerca de las poblaciones, usando datos a partir de muestras.



Resultados

Estos son los productos del análisis de los datos. Normalmente resumen los datos recolectados y el tratamiento estadístico aplicado.

Los resultados se pueden describir utilizando tablas y gráficas debidamente numeradas y tituladas.

Consideraciones finales

1. Uso de conocimientos no estadísticos del problema

Dependiendo de las variables y grado de conocimiento que se tenga de ellas, es posible establecer explicaciones de las relaciones entre las variables y las respuestas.

2. Mantener el diseño y análisis tan simple como sea posible

No exagerar en el uso de técnicas estadísticas complejas y sofisticadas.

“Si el diseño se estropea grandemente por ineptitud, no es posible que incluso la estadística más compleja y elegante salve la situación”
(Douglas C. Montgomery).

3. Tener siempre presente la diferencia entre significación estadística y significación práctica

La interpretación del análisis requiere de no solo conocimiento estadístico, sino del hecho de poder establecer que lo estadístico es compatible con lo práctico.

La estadística sustenta, pero no fundamenta.

Taller

Desarrolle un tema de investigación y de este:

- Haga una breve descripción del problema
- Escriba las preguntas de investigación (general y específicas)
- Plantee los objetivos (general y específicos)