PRUEBAS DE HIPÓTESIS PARAMÉTRICAS PARA LA COMPARACIÓN DE MEDIAS

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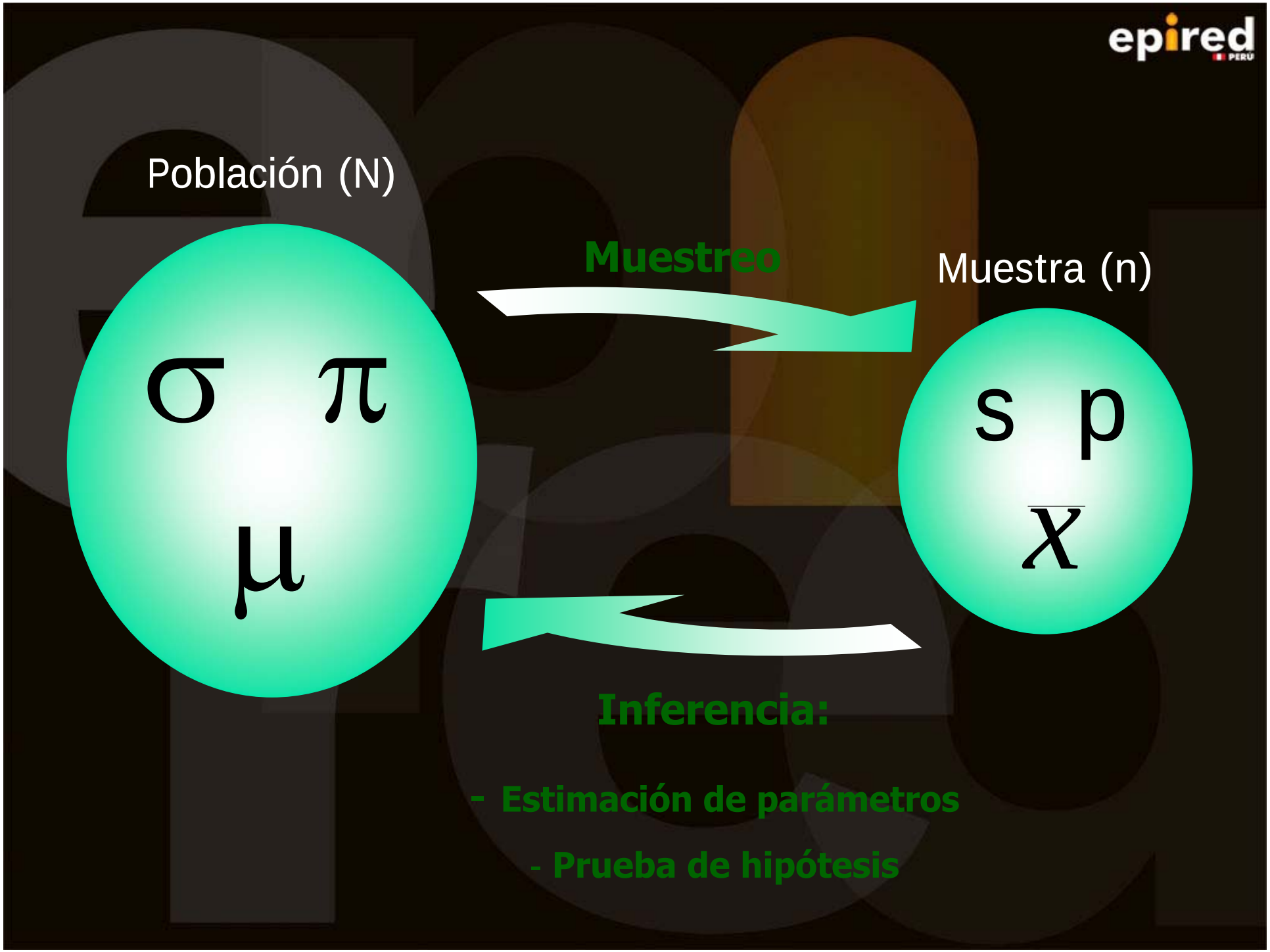
Prueba de Hipótesis

- En muchas situaciones el investigador tiene alguna idea o conjetura sobre el comportamiento de una o varias variables.
- El diseño y planeamiento de la investigación debe permitir probar la veracidad de sus ideas sobre la población en estudio, en base a los datos de una muestra.
- La idea o conjetura es una **hipótesis** y el procedimiento de toma de decisión sobre la hipótesis se conoce como **prueba de hipótesis**.

Hipótesis Estadística

- Es una proposición sobre los parámetros de una o más poblaciones. Más formalmente, una hipótesis estadística es una proposición sobre la distribución de probabilidad de una variable aleatoria.
- Siempre son proposiciones sobre la población, no sobre la muestra.
- Son conjeturas que se hacen antes de empezar el muestreo.


epired
PERU
Población (N)
σ π
μ
Muestreo
Muestra (n)
s p
$\bar{x}$
Inferencia:
- Estimación de parámetros
- Prueba de hipótesis

Hipótesis Nula y Alternativa

- Hipótesis nula: Suposición que se hace sobre el valor del parámetro de la población antes de empezar el muestreo (situación actual). Se representa con el símbolo H_0.

- Hipótesis alternativa: Conclusión que se acepta cuando los datos no apoyan la hipótesis nula. Se representa simbólicamente como H_1.

Hipótesis Nula y Alternativa

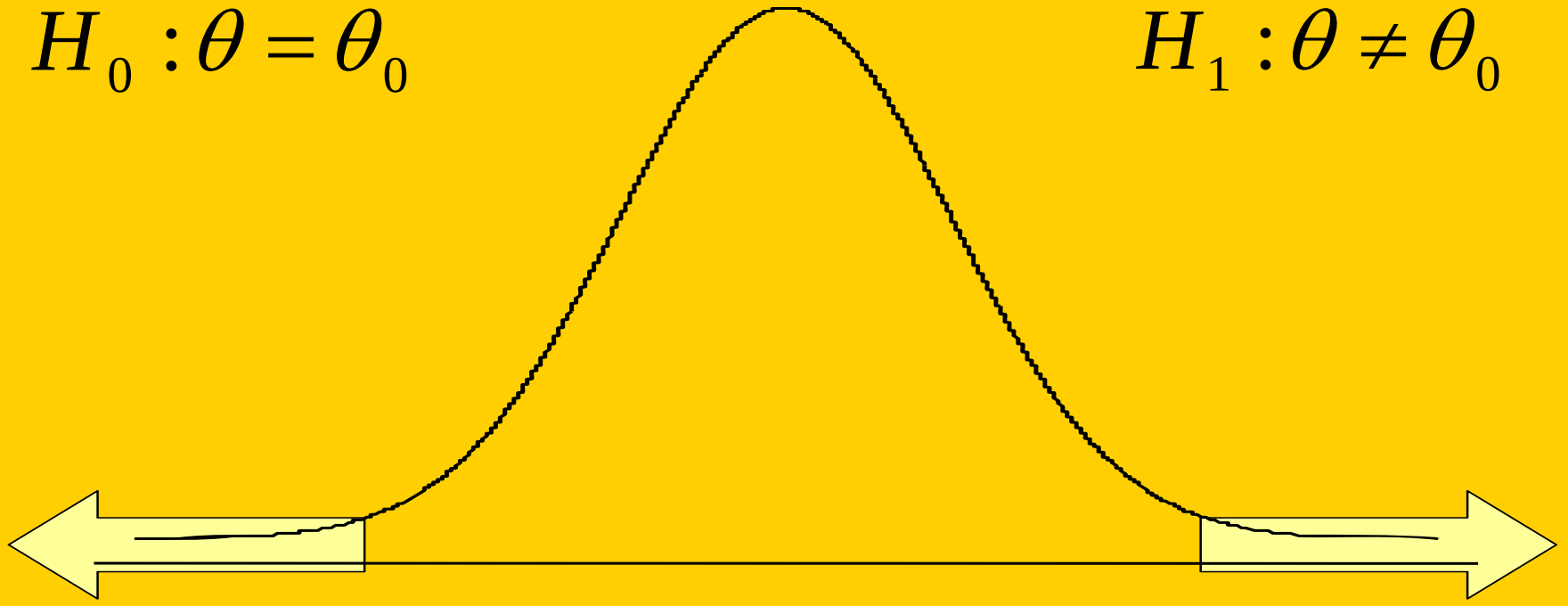
- La hipótesis nula debe contener una proposición de igualdad, ya sea $=$, $\geq$ ó $\leq$.
- La hipótesis alternativa es expresada como la opuesta a la hipótesis nula.
- En la terminología de prueba, se habla de probar una hipótesis nula contra una alternativa, en el supuesto tentativo de que la hipótesis nula es cierta.

Tipos de prueba identificados por la formulación H_0 y H_1

Prueba bilateral.

$H_0 : \theta = \theta_0$

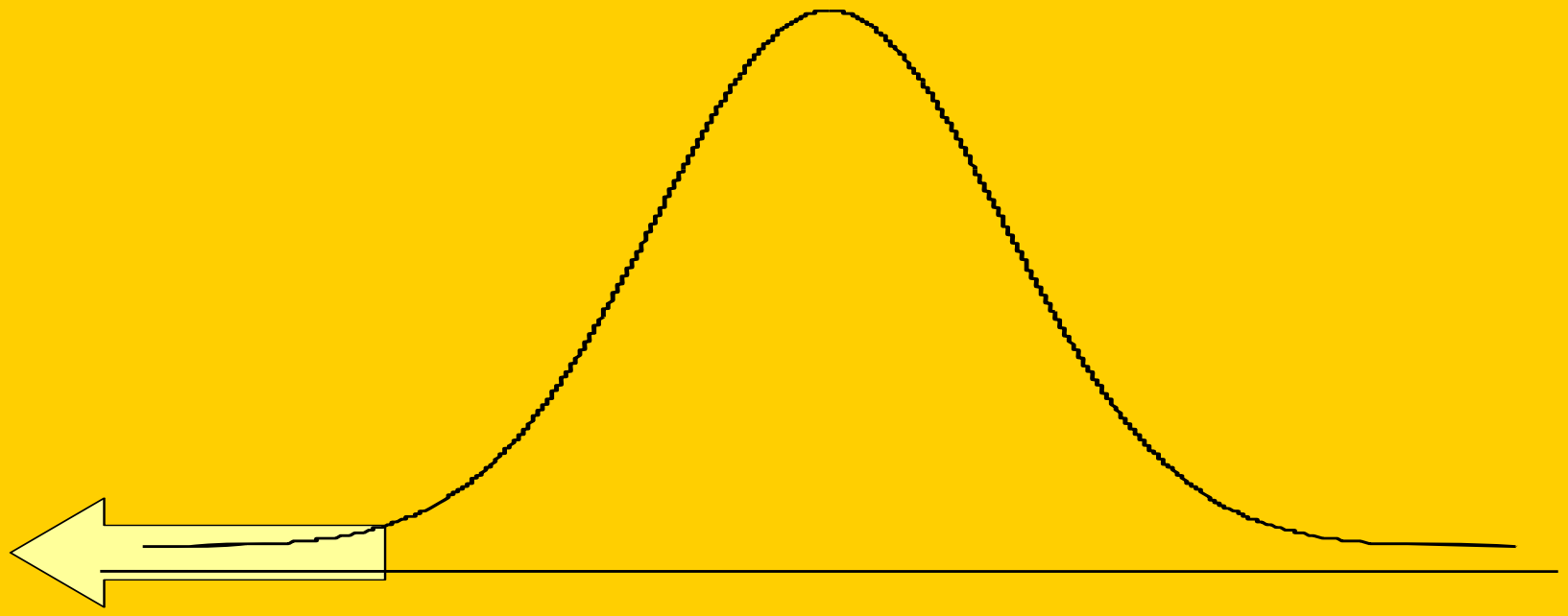
$H_1 : \theta \neq \theta_0$



Tipos de prueba identificados por la formulación H_0 y H_1

Prueba unilateral de cola inferior.

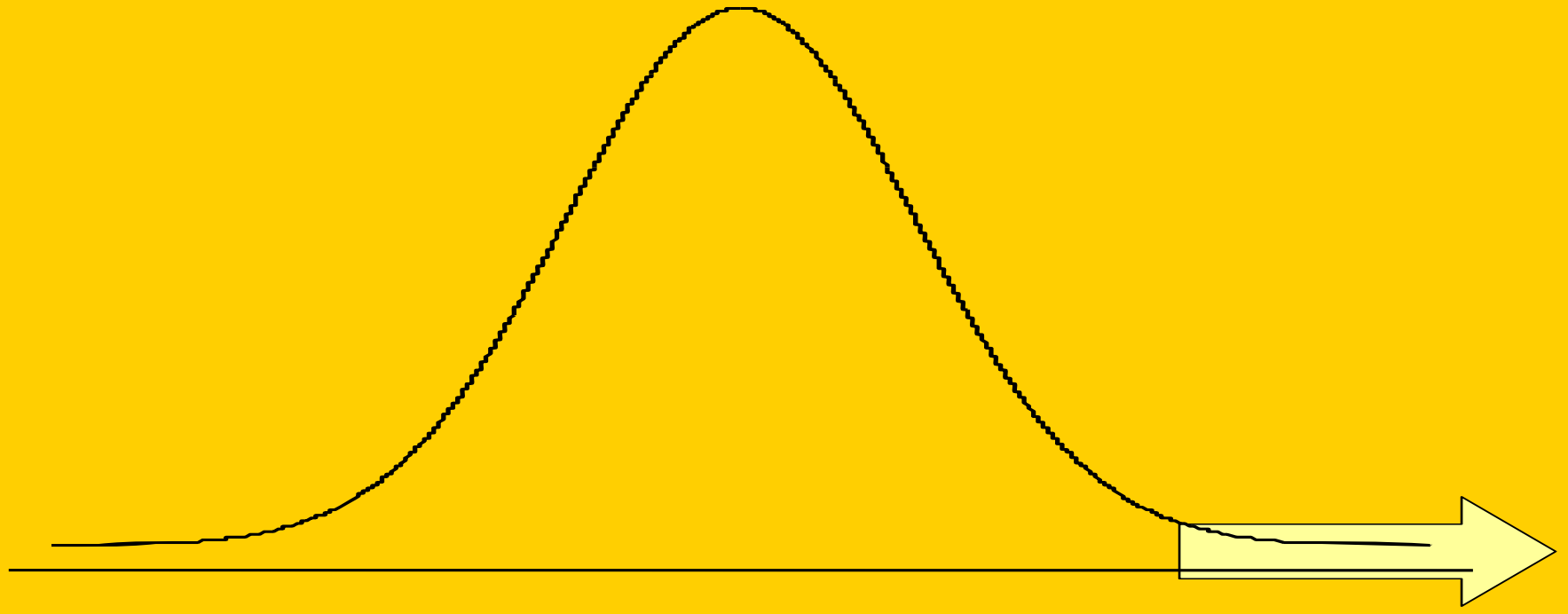
$$H_0 : \theta \geq \theta_0 \qquad H_1 : \theta < \theta_0$$



Tipos de prueba identificados por la formulación H_0 y H_1

Prueba unilateral de cola superior.

$$H_0 : \theta \leq \theta_0 \qquad H_1 : \theta > \theta_0$$



Supongamos que estamos en un juicio:

Sentencia del juez	Condición real del acusado: Inocente	Condición real del acusado: Culpable
Inocente	Correcto	Incorrecto
Culpable	Incorrecto	Correcto

Tipo de errores

Resultado de la prueba de hipótesis	Población (Hipótesis nula)	
	Verdadera	Falsa
No rechazar H_0	Correcto	Error tipo II β
Rechazar H_0	Error tipo I α	Correcto

Etapas en la Prueba de Hipótesis

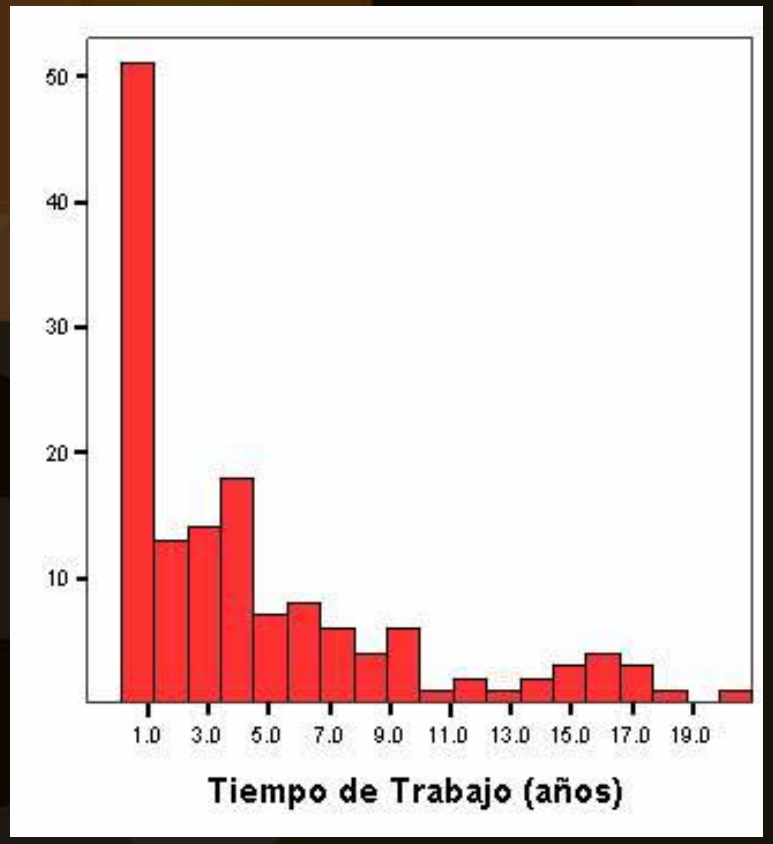
1. Evaluar los datos.
2. Revisar las suposiciones (normalidad de la distribución).
3. Formular las hipótesis estadísticas (nula y alternativa).
4. Seleccionar la prueba estadística.
5. Formular la regla de decisión.
6. Calcular la estadística de prueba.
7. Formular la decisión estadística (rechazar o no H_0).
8. Conclusión.
9. Valor p.

Recordando de la clase de distribución normal…

Al aplicar la fórmula, siempre se tendrá como resultado una variable transformada con $\mu=0$ y $\sigma=1$.

Sin embargo, la forma de la distribución no cambiará con la transformación.

Si la variable no presenta una distribución normal, tampoco la transformación.

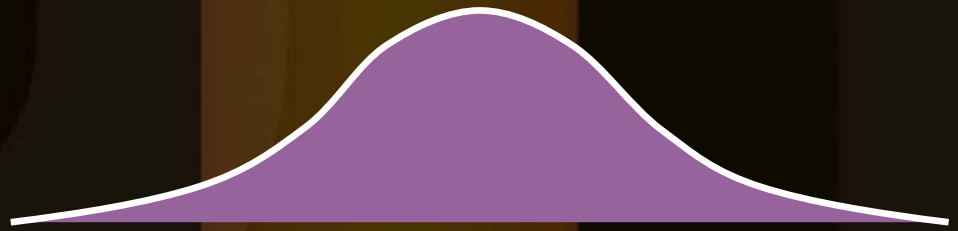


¿Cómo evaluar si una distribución es normal?

- Asimetría y curtosis.
- Mediante gráficos (histograma, tallo y hojas, cajas, Q-Q).
- Prueba de Kolmogorov-Smirnof.

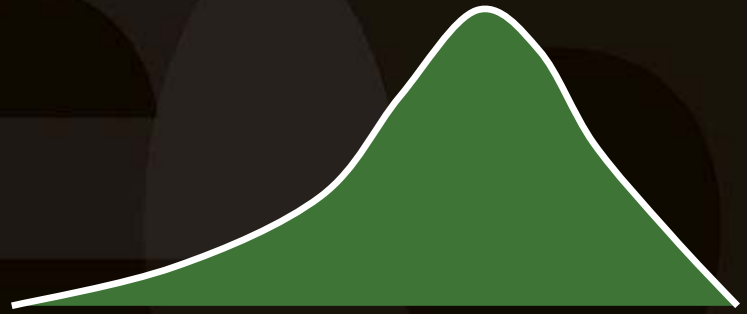
Variable	Estadística	Valor
Edad	Media	39.27
	Desviación estándar	9.70
	Asimetría	-0.16
	Curtosis	-0.60
Tiempo de servicio	Media	5.92
	Desviación estándar	5.65
	Asimetría	0.84
	Curtosis	-0.57

Curtosis > 0

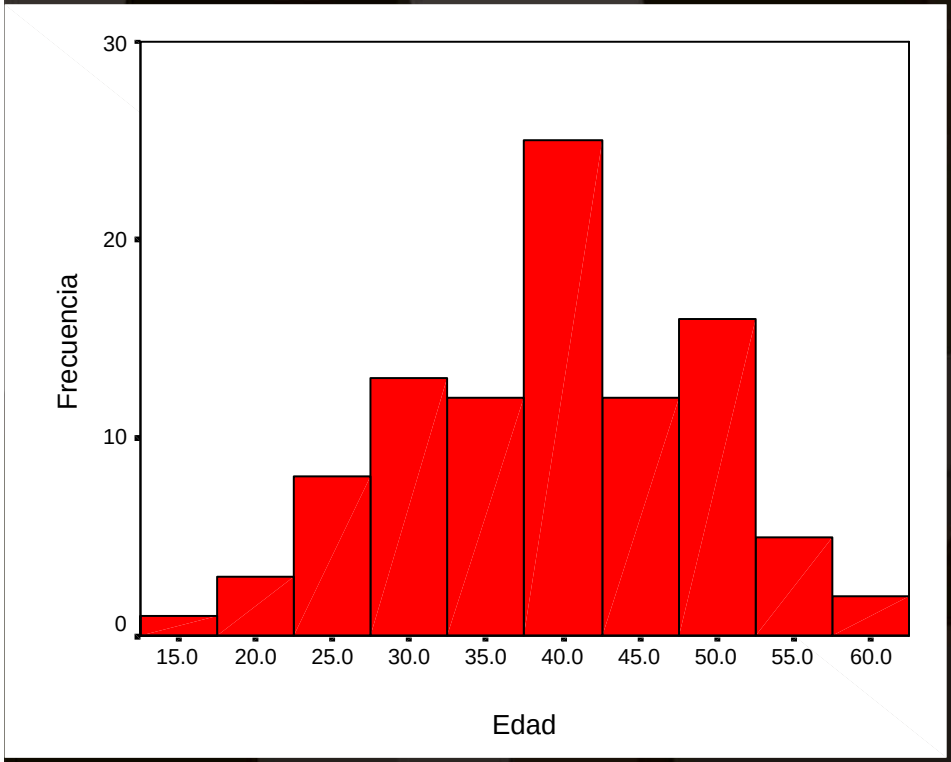


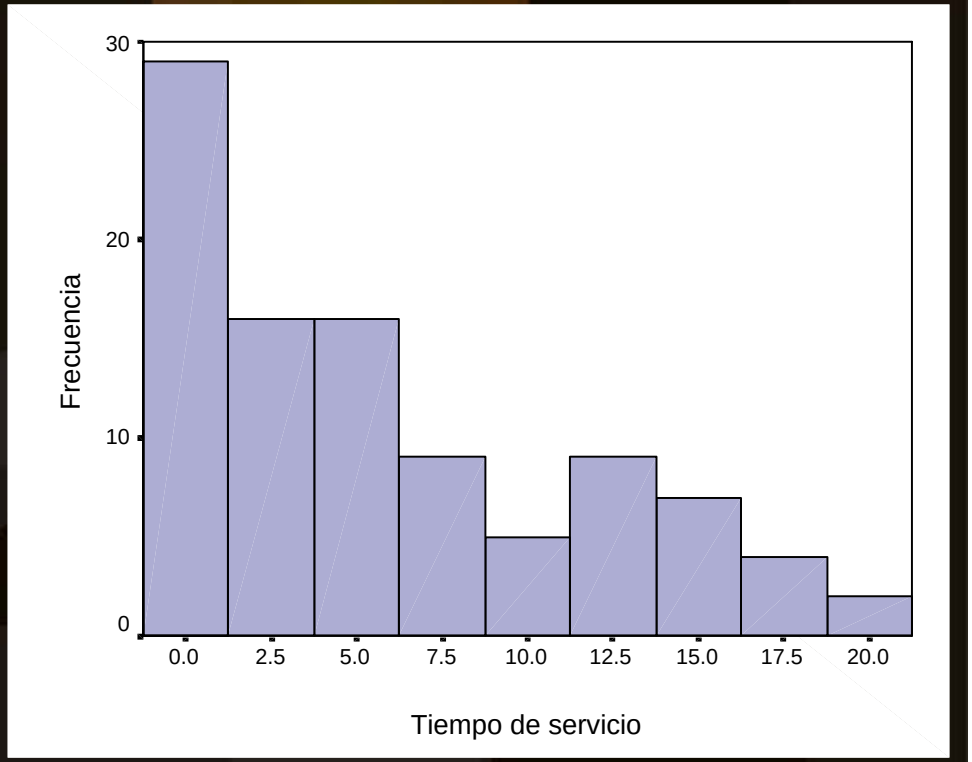
Curtosis < 0

Asimetría > 0



Asimetría < 0


30
20
10
0
Frecuencia
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
Edad


30
20
10
0
Frecuencia
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
Tiempo de servicio

Edad Stem-and-Leaf Plot

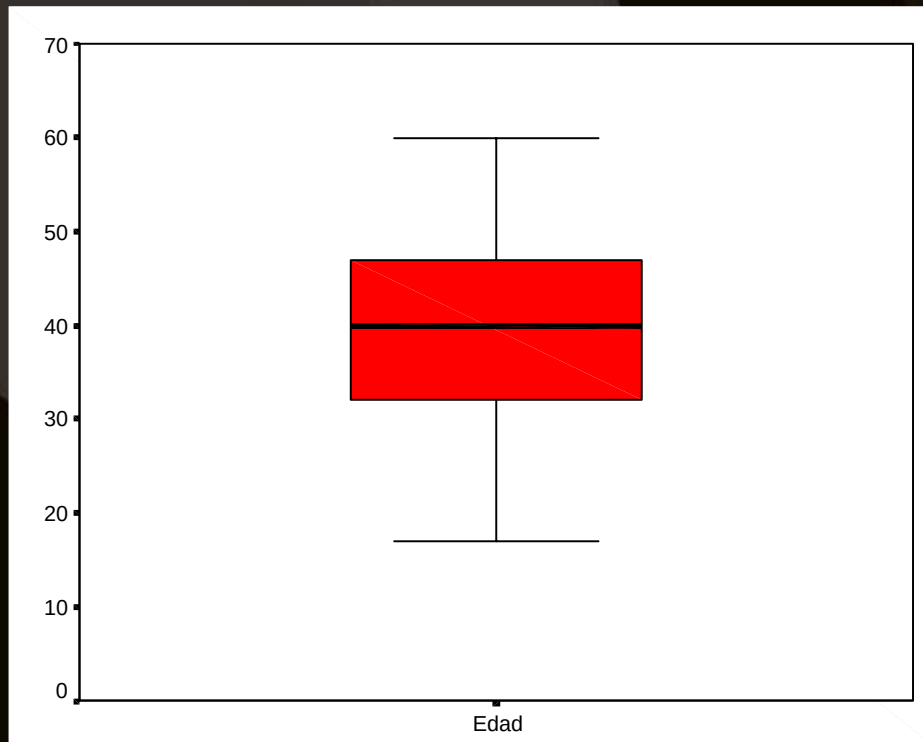
Frequency	Stem &	Leaf
2.00	1 .	78
5.00	2 .	02334
10.00	2 .	5666688889
15.00	3 .	001111223333444
13.00	3 .	5566788888899
23.00	4 .	00000011111222222333444
12.00	4 .	556677899999
14.00	5 .	00000122223344
2.00	5 .	69
1.00	6 .	0

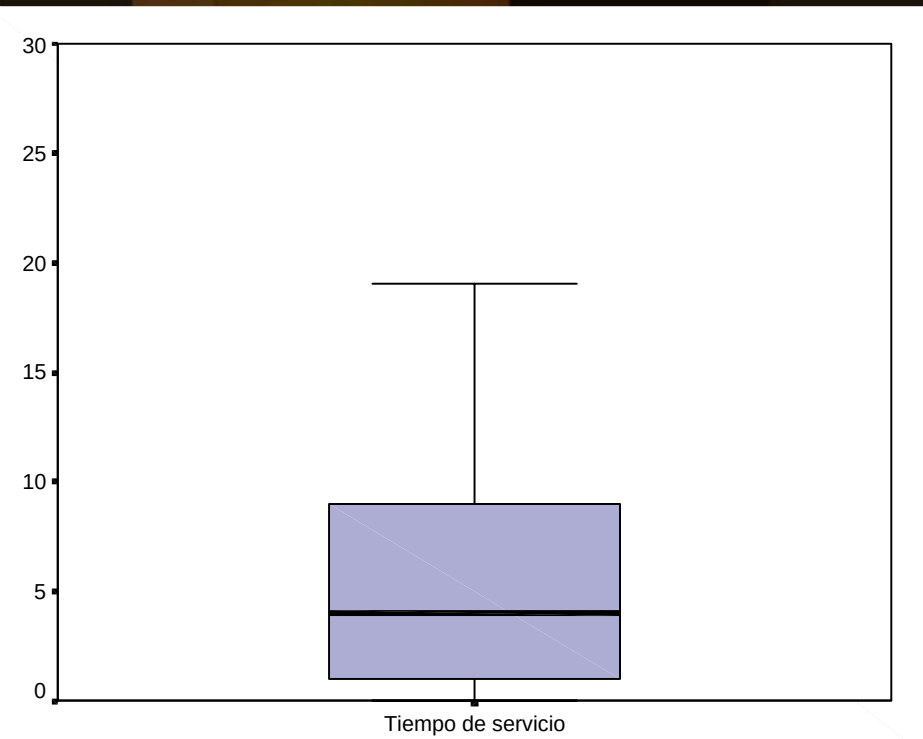
Stem width: 10
Each leaf: 1 case(s)

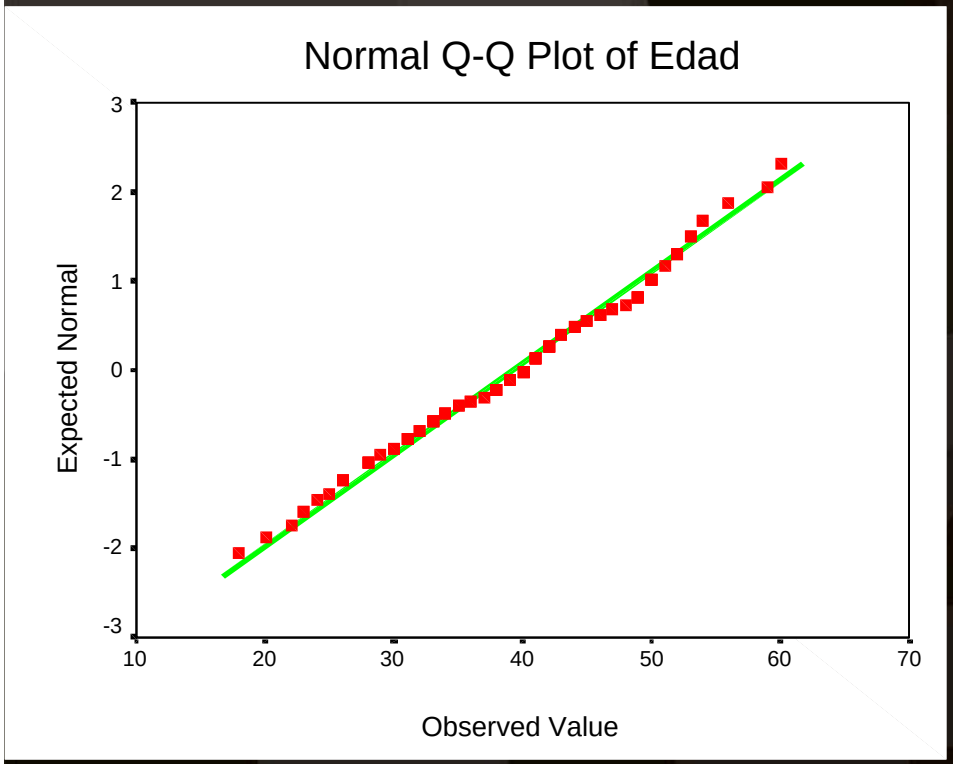
Tiempo de servicio Stem-and-Leaf Plot

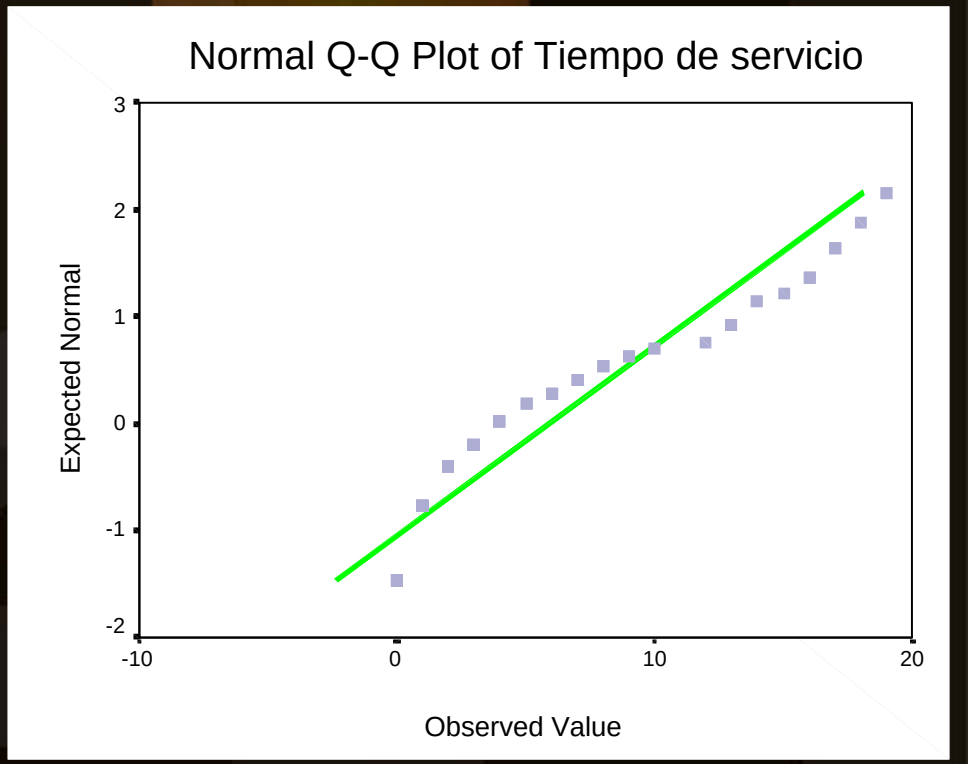
Frequency	Stem &	Leaf
13.00	0 .	0000000000000
16.00	1 .	0000000000000000
8.00	2 .	00000000
8.00	3 .	00000000
9.00	4 .	000000000
3.00	5 .	000
4.00	6 .	0000
6.00	7 .	000000
3.00	8 .	000
3.00	9 .	000
2.00	10 .	00
.00	11 .	
1.00	12 .	0
8.00	13 .	00000000
2.00	14 .	00
1.00	15 .	0
4.00	16 .	0000
3.00	17 .	000
1.00	18 .	0
2.00	19 .	00

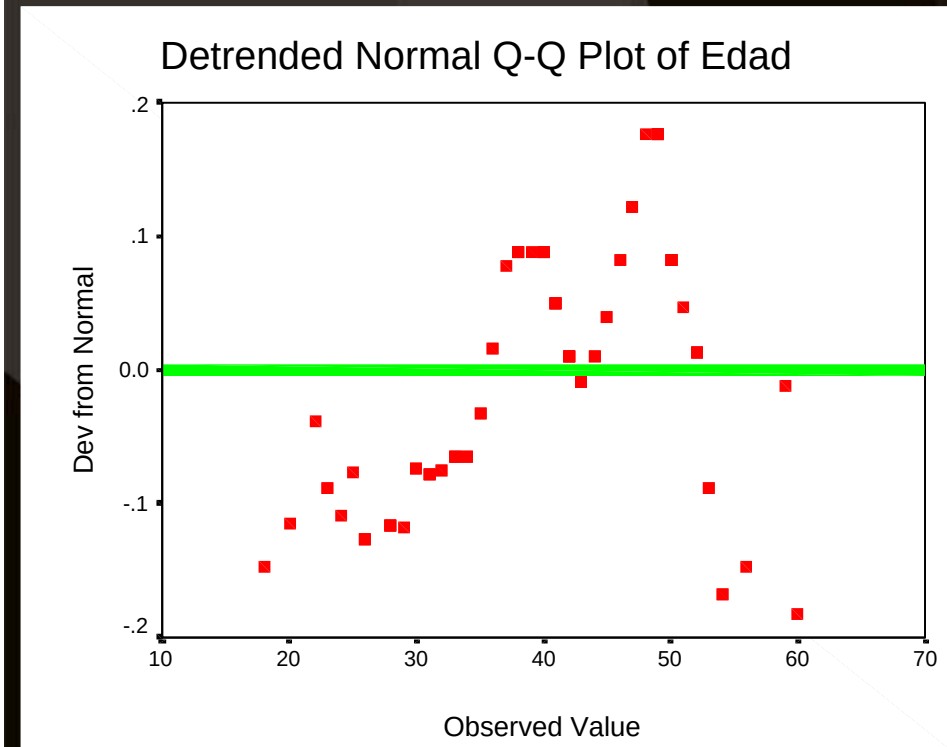
Stem width: 1
Each leaf: 1 case(s)

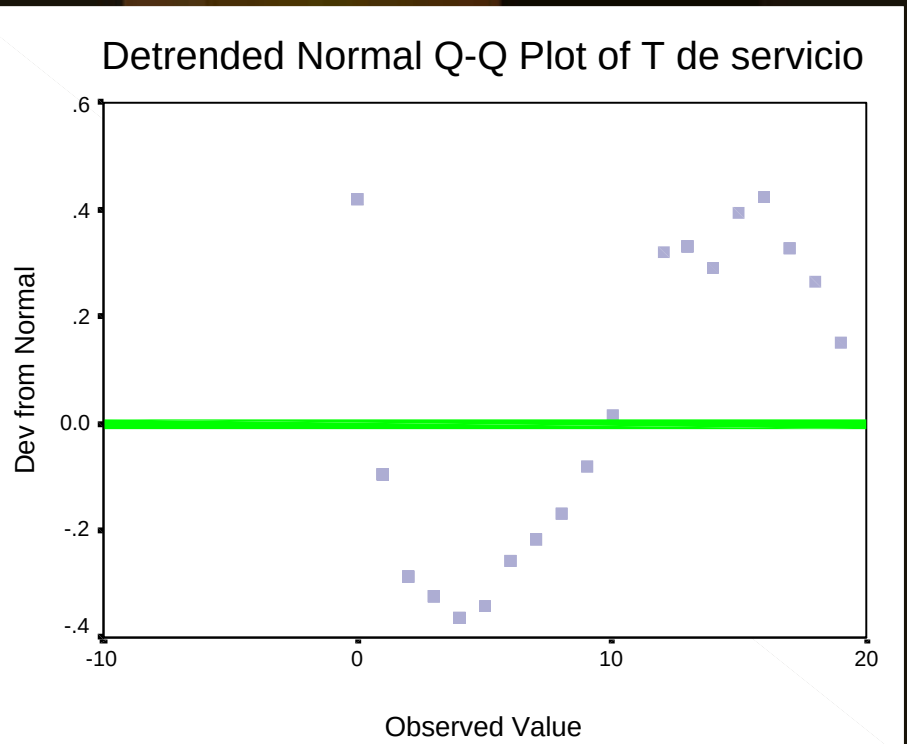

70
60
50
40
30
20
10
0
Edad


30
25
20
15
10
5
0
Tiempo de servicio


Normal Q-Q Plot of Edad
Expected Normal
Observed Value
3
2
1
0
-1
-2
-3
10
20
30
40
50
60
70


Normal Q-Q Plot of Tiempo de servicio
Expected Normal
Observed Value
3
2
1
0
-1
-2
-10
0
10
20


Detrended Normal Q-Q Plot of Edad
Dev from Normal
.2
.1
0.0
-.1
-.2
10
20
30
40
50
60
70
Observed Value


Detrended Normal Q-Q Plot of T de servicio
Dev from Normal
.6
.4
.2
0.0
-.2
-.4
-10
0
10
20
Observed Value

Prueba de Normalidad

	Kolmogorov-Smirnov		
	Estadístico de prueba	g. l.	valor p
Edad	0.07	97	0.20
Tiempo de servicio	0.19	97	0.00

Prueba de Hipótesis para comparar medias

- Comparación de dos medidas (muestras independientes).
- Comparación de dos medias (datos pareados).
- Comparación de tres o más medias (muestras independientes).

Comparación de dos medidas (muestras independientes)

- Se realiza a través de la prueba t de student.
- Se debe de conocer la media, varianza y número de individuos en cada uno de los dos grupos.

Comparación de dos medidas (muestras independientes)

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}}}$$

$$s_p^2 = \frac{(n_1 - 1)\, s_1^2 + (n_2 - 1)\, s_2^2}{n_1 + n_2 - 2}$$

Effects of community based nurses specialising in Parkinson's disease on health outcome and costs: randomised controlled trial

Brian Jarman, Brian Hurwitz, Adrian Cook, Madhavi Bajekal, Alison Lee

Abstract

Objective To determine the effects of community based nurses specialising in Parkinson's disease on health outcomes and healthcare costs.

Design Two year randomised controlled trial.

Setting 438 general practices in nine randomly selected health authority areas of England.

Participants 1859 patients with Parkinson's disease identified by the participating general practices.

Main outcome measures Survival, stand-up test, dot in square test, bone fracture, global health question, PDQ-39, Euroqol, and healthcare costs.

Results After two years 315 (17.3%) patients had died,

centres and hospital outpatients.[4,5] Surveys show that up to 70% of patients with Parkinson's disease have no regular contact with consultants and rely entirely on their general practitioners for medical care.[6–8]

The role of nurses specialising in Parkinson's disease has developed over the past 10 years.[9] These nurse specialists were initially promoted by consultants with an interest in Parkinson's disease in response to the need for coordination of their patients' education, monitoring, and care (box 1), but their effectiveness has not been evaluated comprehensively.[10,11] A small controlled study based in a tertiary hospital clinic for Parkinson's disease evaluated the effect of two community based nurse specialists undertaking two home

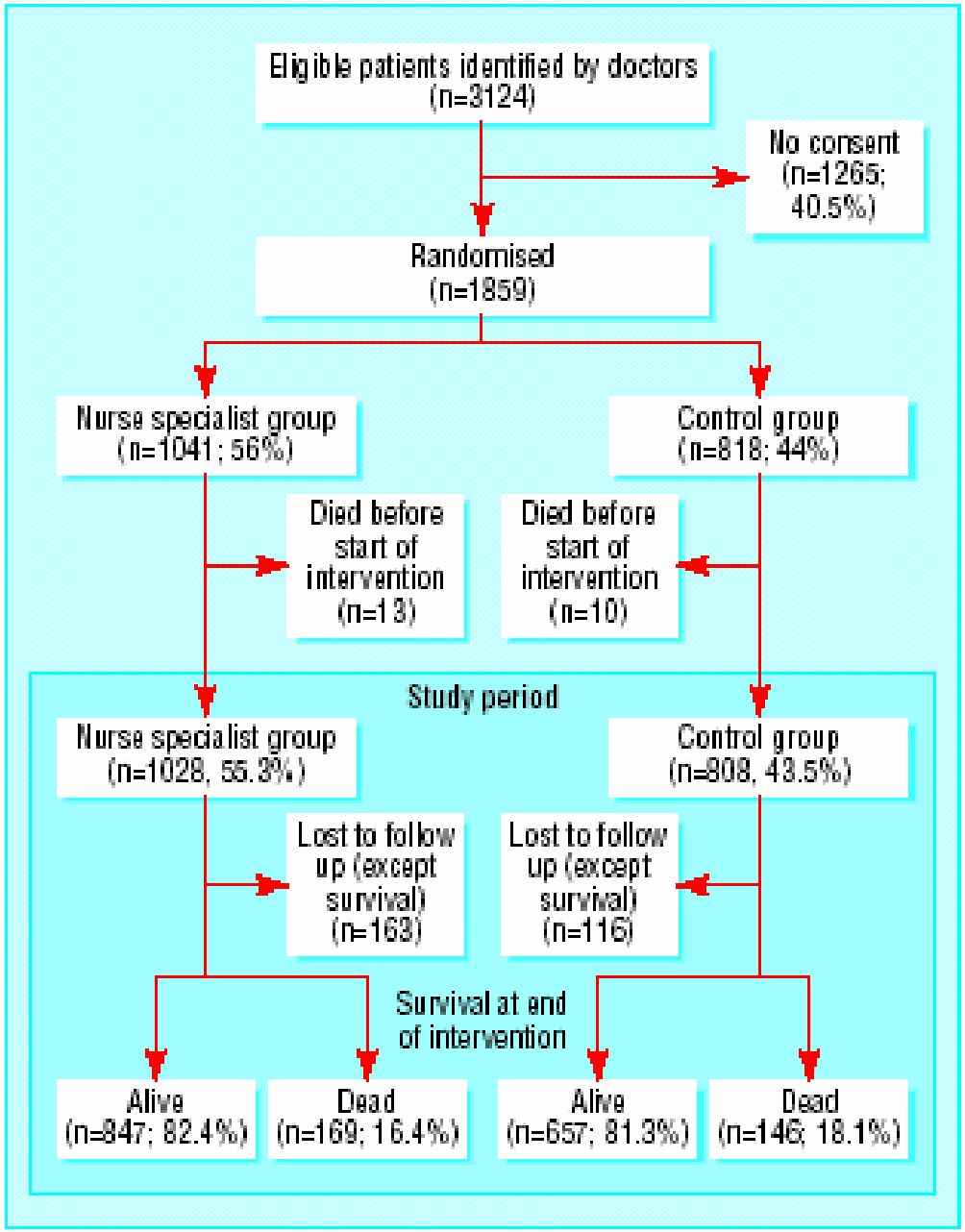


Fig 3 Participant flow through study

For each patient we calculated the changes in healthcare cost (excluding costs for carer and social security benefit) over the two years. We compared differences in the mean change of the nurse and control groups by using unpaired *t* tests. We report parametric confidence intervals for differences. Data

Table 6 NHS and local authority costs (in £000s), excluding benefits. Values are mean (maximum)

	Nurse group (n=1028)	Control group (n=808)
Year preceding study*	4.05 (55.4)	3.48 (35.0)
Year 2†	5.86 (39.1)	5.63 (33.1)
Individual mean increase†	2.54 (34.6)	2.80 (31.6)‡
Cost components in year 2†:		
Nurse specialist	0.20	
Institutional cost	2.86 (20.6)	3.31 (20.6)
Respite care	0.09 (12.8)	0.08 (7.98)
Hospital cost	0.79 (17.9)	0.74 (22.3)
Primary health care	0.15 (6.34)	0.19 (6.34)
Therapy	0.10 (4.33)	0.10 (4.71)
Drugs§	0.70 (25.3)	1.12 (3.74)
Home help	0.34 (2.50)	0.30 (2.50)

*All patients entering study.
†Patients at end of study.
‡P value 0.47 (difference −0.26, −0.98 to 0.45) (unpaired *t* test with unequal variances). P value and 95% confidence interval checked with 2000 bootstrapped samples.
§Excludes apomorphine.

What is already known on this topic

Most patients with Parkinson's disease have no regular contact with consultants specialising in the condition

Contact by nurse specialists of patients attending hospital increases provision of information and is subjectively valued

It has not been shown whether nurse specialists improve psychosocial functioning

What this study adds

Provision of community based nurses specialists in Parkinson's disease does not slow clinical progression of the condition

Nurses specialists help to preserve patients' sense of wellbeing

Healthcare costs are not increased

Comparación de dos medidas (datos pareados)

- Datos pareados son dos mediciones realizadas al mismo sujeto en momentos, por observadores o instrumentos diferentes.
- Se realiza a través de la prueba t de student.
- Se debe de conocer la media y varianza de la diferencia entre ambas medicione, y el número de individuos en estudio (un solo grupo).

Comparación de dos medidas (datos pareados)

$$t = \frac{\bar{d} - \mu_d}{s_d / \sqrt{n}}$$

$$s_d^2 = \frac{\sum d_i^2 - n \bar{d}^2}{n - 1}$$

Effectiveness of a Burn Prevention Campaign for Older Adults

Jensen Tan, BSc,* Carol Banez, RN, BScN, MA,† Yvonne Cheung, RN, BNSc, MHSc, CHE,‡ Manuel Gomez, MD, MSc, CTBS,§ Huy Nguyen, BSc,* Joanne Banfield, RN, BA,‡ Lina Medeiros, MSW, RSW,† Ruth Lee, RN, MScN, PhD,† Robert Cartotto, MD, FRCS(C),§ Joel S. Fish, MD, MSc, FRCS(C)§

Older adults are involved in one fifth of burn injury admissions in the Province of Ontario Canada. Most burn injuries in this population occur at home while cooking, bathing, or smoking. The purpose of this study was to evaluate the effectiveness of an educational campaign to improve burn prevention knowledge in older adults of a major metropolitan city. Changes in participants' burn prevention knowledge were determined using standardized precampaign and postcampaign (4–6 weeks) surveys. Of 209 older adult participants, 126 (60.3%) completed the precampaign and postcampaign surveys. There was a significant in-

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Statistical Analysis

Participant's responses of the postpresentation survey were compared with those of the prepresentation survey for each participant, and a score was assigned to each response. A score of 1 was assigned if there was a positive change in the response. A score of 0 was assigned if there was no change in the response. The statistical test used to compare pre- and postpresentation scores was a paired Student's *t*-test, with $P < .05$ considered significant.

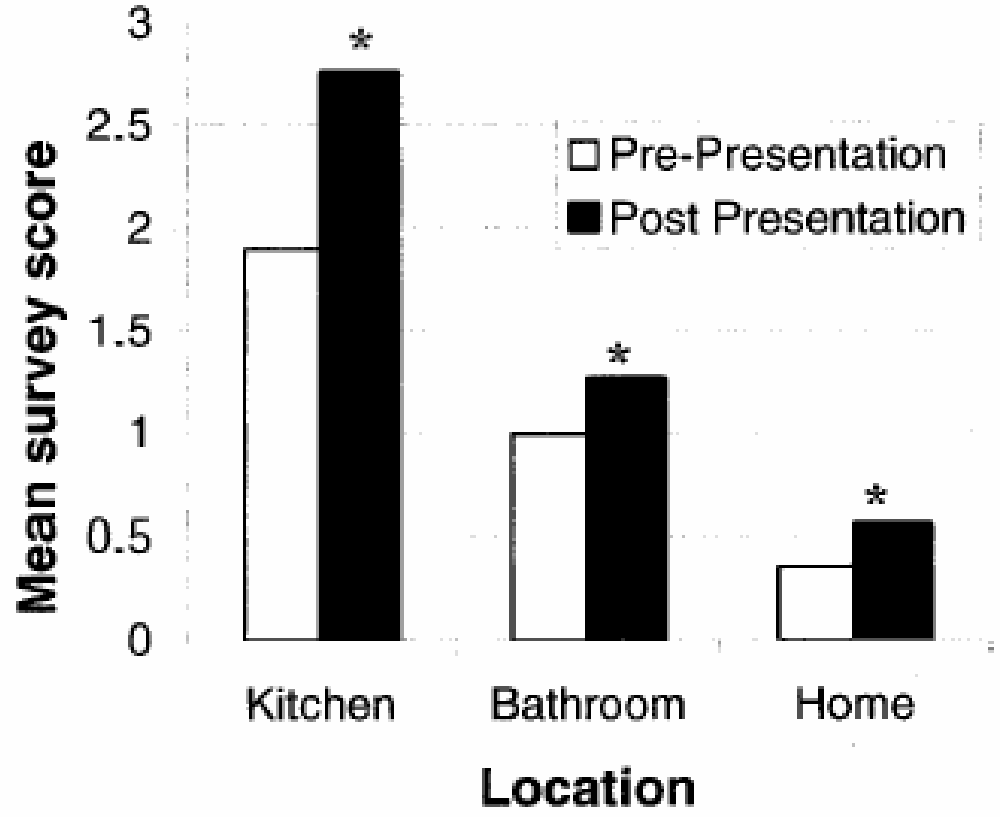

Figure 1. Changes in mean survey score before and after presentations. *There were significant increases in survey scores for kitchen ($P < .001$), bathroom ($P = .0004$), and home ($P = .003$) burn preventive knowledge.

CONCLUSIONS

A burn prevention educational campaign targeting older adults from a metropolitan city using different media (including a community presentation) was effective in changing participant's burn preventive knowledge within the kitchen, bathroom, and home. Age, education status, and living condition of the subjects did not affect changes in burn preventive knowledge.

Comparación de tres o más medias (muestras independientes).

- Se realiza a través del análisis de varianza (ANOVA).
- El ANOVA mide la diferencia entre el valor de cada sujeto de estudio y la media global. Esta diferencia consiste de dos partes:
  1. La variación de cada individuo y la media de su grupo.
  2. La variación entre la media de cada grupo y la media global.

Grupo 1	Grupo 2	Grupo 3	TOTAL
$X_{1,1}$	$X_{2,1}$	$X_{3,1}$	
$X_{1,2}$	$X_{2,2}$	$X_{3,2}$	
$X_{1,3}$	$X_{2,3}$	$X_{3,3}$	
.	.	.	
.	.	.	
$X_{1,j}$	$X_{2,j}$	$X_{3,j}$	
Media 1	Media 2	Media 3	μ
Varianza 1	Varianza 2	Varianza 3	σ^2

Comparación de tres o más medias (muestras independientes).

- El ANOVA usa la prueba F para probar la hipótesis nula:

$$H_0 : \mu_1 = \mu_2 = \ldots = \mu_k$$

¿Por qué usar ANOVA y no múltiples t de student?

- Al calcular múltiples pruebas t de student entre los diferentes grupos formados (3 ó más), el α empleado en cada comparación se altera (incrementándose) respecto al α de una prueba global.

Effect of Inactivity and Undernutrition After Acute Ischemic Stroke in a Rat Hindlimb Muscle Model

Myoung-Ae Choe ▼ Gyeong Ju An ▼ Yoon-Kyong Lee ▼ Ji Hye Im ▼ Smi Choi-Kwon ▼ Margaret Heitkemper

- ***Background:*** Stroke patients experience functional changes resulting from muscle atrophy related to disuse, lack or limited neuronal stimulation, and undernutrition. Acute ischemic stroke is assumed to induce muscle atrophy. However, there is little information regarding muscle changes after acute stroke.
- ***Objective:*** The purpose of this study was to examine the effect of inactivity and undernutrition after acute stroke on mass, myofibrillar protein content, and Types I and II fiber cross-sectional areas of rat hindlimb muscles.
- ***Methods:*** Adult male Sprague-Dawley rats (body weight, 240-270 g) were randomly assigned to one of three groups: a stroke group ($n = 7$) that had occlusion of the right middle cerebral artery, a control group ($n = 7$) that underwent a sham right middle cerebral artery procedure, and an undernourished group ($n = 9$) that was pair-fed to match the intake of stroke rats. Food and water intake as well as body
- ***Results:*** The stroke group at 7 days after ischemic stroke showed significant decreases ($p < .05$), as compared with the control rats, in diet intake and body weight, muscle weight of affected gastrocnemius, Type I fiber cross-sectional area of the affected soleus muscle, Types I and II fiber cross-sectional areas and Type II fiber distribution of the unaffected soleus muscle, and myofibrillar protein content of both the affected and unaffected soleus muscles. As compared with the control group, the undernourished group showed significant decreases ($p < .05$) in diet intake and body weight, Type I fiber cross-sectional area of the affected soleus muscle, Types I and II fiber cross-sectional areas and Type II fiber distribution of the unaffected soleus muscle, Type I fiber distribution of the affected gastrocnemius muscle, and myofibrillar protein content of both the affected and unaffected soleus muscles. As compared with the undernourished group, the stroke group showed significant decreases (p

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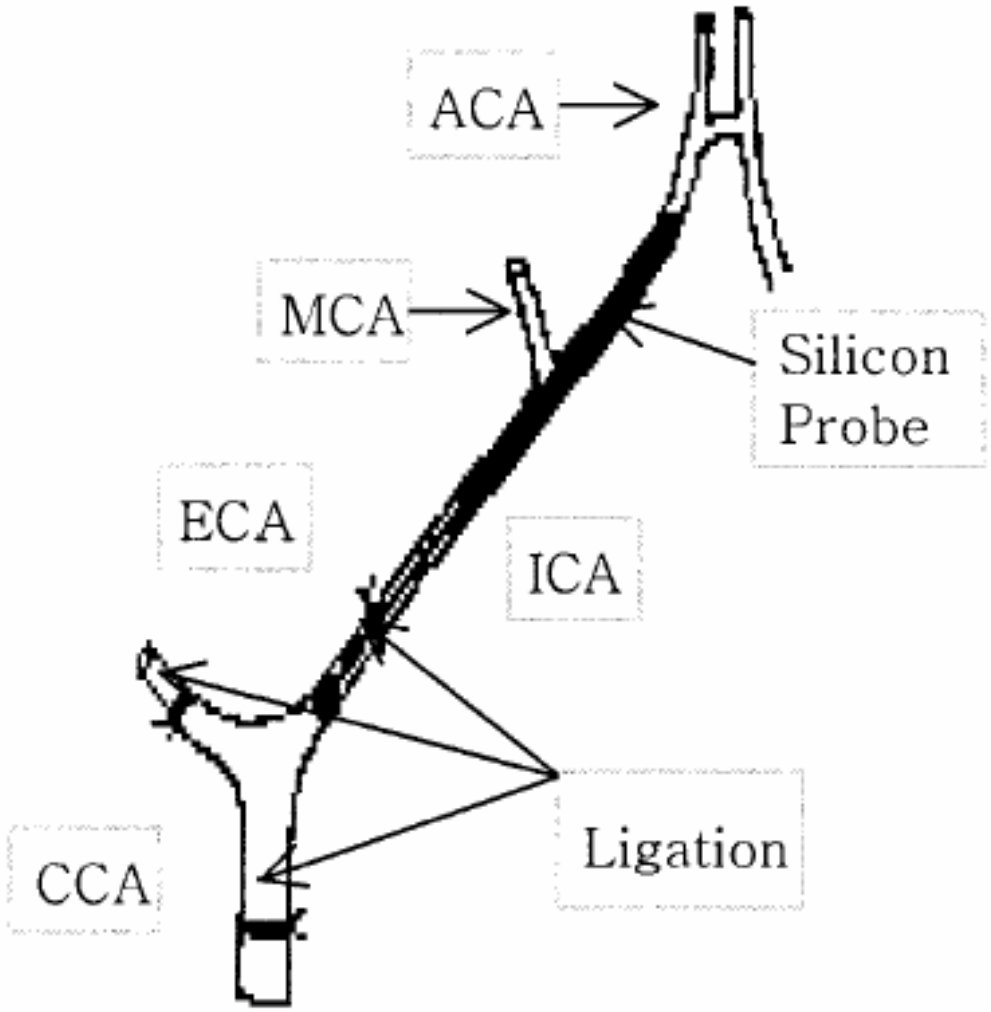

FIGURE 1. Focal cerebral ischemia model. The occlusion using a silicon probe obstructs the blood flow to the middle cerebral artery (MCA) in the focal cerebral ischemia model developed by Nagasawa and Kogure (1989). This figure was cited from Park (2002). CCA, common carotid artery; ECA, external carotid artery; ICA, internal carotid artery; ACA, anterior cerebral artery; MCA, middle cerebral artery.

Data Analysis

Data are presented as means ± standard deviations for all variables except fiber type distribution. The effect of group was determined by analysis of variance (ANOVA), and Duncan's procedure was used to determine specific group differences. Paired *t*-tests were used to compare pre- and post body weights, and nonpaired *t*-tests were used to compare affected and unaffected sides. Statistical significance was accepted at a p value less than .05.

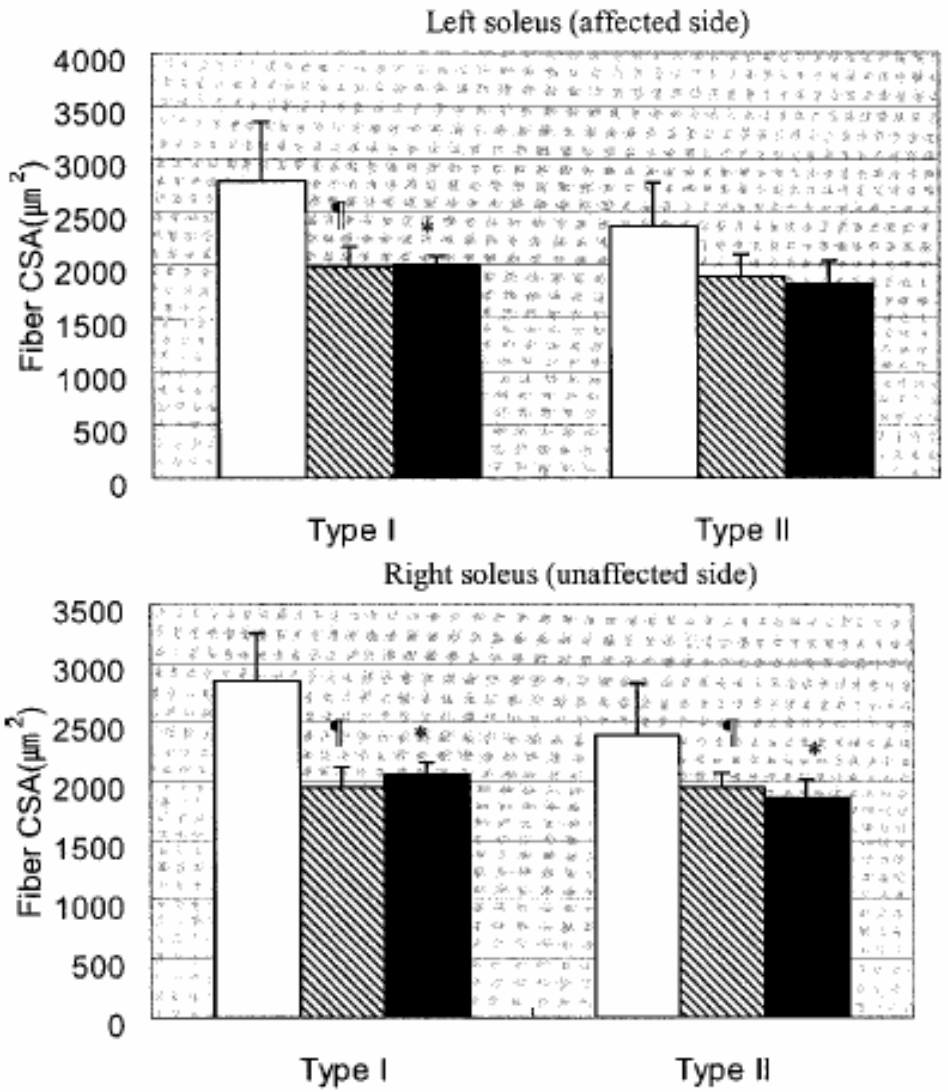

FIGURE 3. Types I and II fiber cross-sectional areas (CSA) of the soleus muscle in control (C [white box], $n = 7$), undernourished (UndN [striped box], $n = 9$), and stroke (S [black box], $n = 7$) rats. *Significant difference between the C and S groups ($p < .05$). ¶Significant difference between the C and UndN groups ($p < .05$).

- ***Conclusions:*** Hindlimb muscle atrophy occurs in both affected and unaffected sides after acute stroke, with Type I muscle changes more apparent than Type II changes.

Gracias por su atención

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