

Florence Nightingale : a Mathematician

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Université de Lille .

Sonia Kovalesky Maths Day
Mathematics Initiatives in Nepal,
24 April, 2021.

Historic Link





Sandakphu, 3636 m.

The Lady With the Lamp

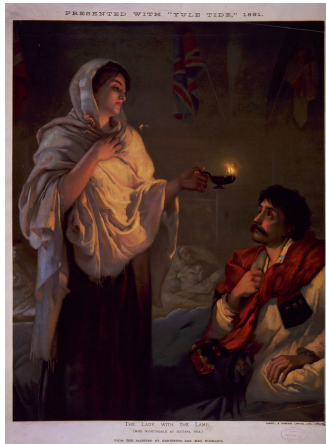
The devoted nurse of popular imagination.



Illustrated London News, 24th February 1855.

*A lady with a lamp shall stand
In the great history of the land,
A noble type of good,
Heroic womanhood.*

Henry Longfellow 1857, *Santa Filomena*



The Lady with the Lamp at Scutari, Henrietta Rae 1891

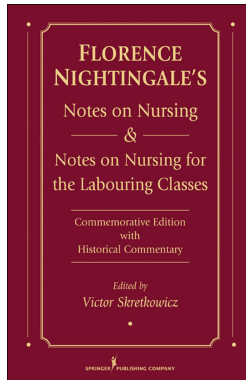
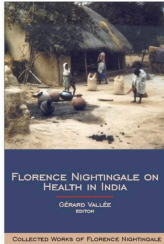
- Statues, poems, stamps paintings..the image continues...

Biography

- Born 12th May, 1820 in Florence (Italy) to affluent British parents. Birthday celebrated as *The International Nurses Day*.
- Father encouraged the education of daughters.
- Travelled with her family.
- Went to Germany (1844) to study nursing which was not acceptable for her time and status.
- Refused marriage proposals.
- Worked as a nurse in London in 1850.
- Sent to Crimean War (1853-56). Went to military hospital in Scutari (a district in Istanbul) in late 1854.
- Trained nurses, collected data and systematized record-keeping practices. Introduced **visual statistics**, not fashionable at that time.
- Proposed sanitary reforms and used statistical data.
- Wrote extensively on many social issues including womens' health and social condition in colonial India.
- Died in 1910.

Not only a nurse

- Florence Nightingale actually did little nursing in her life.
- The image that lives is more romantic than real.
- Went against established norms (marriage and children..). Was assertive and insistant.
- Pioneering statistician !



TO UNDERSTAND GOD'S THOUGHTS WE
MUST STUDY STATISTICS, FOR THESE ARE
THE MEASURE OF HIS PURPOSE.

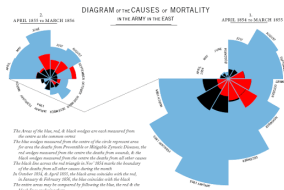
- FLORENCE NIGHTINGALE -

LIBQUOTES.COM

- "None but scientific men ever look into the appendices of a Report."
Letter to Sidney Herbert
- FN expected that the queen might look at her "*Observations on the Sanitary State of the Army in India*" 'because it has pictures.'

Lady with the chart

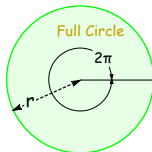
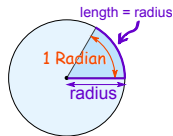
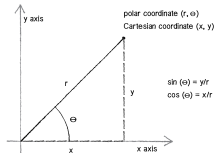
Nightingale's iconic chart: Causes of mortality in the army in the East, Sent to Queen Victoria 1858. ■ preventable diseases ■ wounds ■ other causes.



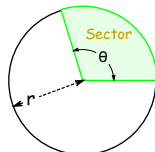
Notes on Matters Affecting the Health, Efficiency, and Hospital Administration of the British Army

Pie chart

The polar coordinate system is a two-dimensional coordinate system (r, θ) .



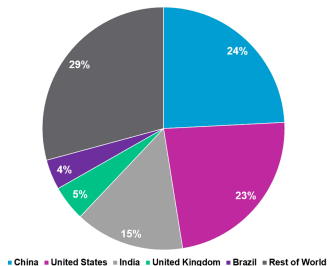
$$A = \pi \times r^2$$



$$A = \frac{(\theta/2\pi) \times \pi \times r^2}{= (\theta/2) \times r^2}$$

Area of a sector of a circle, θ in radians.

An example



Distribution of Covid19 vaccinations, April 2021

One parameter is represented in a circle. The *angles* are variable.

Bar chart, an example

Age



Total confirmed cases by age: Minnesota Department of Health, June 27, 2020

A parameter is represented in cartesian form, the *lengths* are variable.

Polar Chart

- A polar area chart is approximately a *radially plotted bar chart*.
- Shows values for different parameters.
- Angles of sectors are all same, but *areas* are different, how far they extend from the center of the circle.
- Nightingale's chart has 12 angles, one for each month.
- The radius of each slice is proportional to the square root of the death count for a given month, so the *area* of a sector represents the number of deaths in a month.
- Each slice has three sub-sections, so three different causes are represented every month.

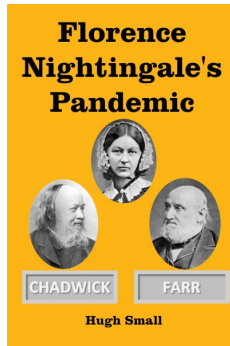
MORAL : Many more people died from preventable diseases and hospital conditions than in the war.

- Nightingale's statistical work influenced many government decisions.
: military and civil hospitals, training of nurses.
- In 1858 she was the first woman to be elected to the Royal Statistical Society.
- In 1874 she became an honorary member of the American Statistical Association.

Some Illustrious Collaborators

- 1 William Farr (1807-1883) British specialist of medical statistics.

Superintendent of Statistics at the General Register Office. 400 letters exchanged with FN.



Knowledge Leak, 2021

Adolphe Quetelet (1796-1874) Belgian mathematician who used statistics in social sciences, precursor of modern sociology. ~Physique


30 Old Burlington St,
July 13/60

45887

Monsieur,

Je solliciterai
vivement votre sympathie en
faveur d'un projet
que je dois soumettre
au Congrès pour
obtenir une statistique
uniforme dans les
Hospitales.

Ce sont vos



Sociale'.

Letter of 1860

Florence Nightingale deserves to be known better as a woman of science.



- Maryam Mirzakhani 12th May 1977 (Teheran)-2017 (Stanford). Birthday celebrated as *International Day For Women in Mathematics*
- Breakthrough work on Geometry and Dynamics, for example counting curves on certain surfaces.
- Only woman to receive the Fields' Medal

Documentary Film

Secrets of the Surface, The Mathematical Visions of Maryam Mirzakhani
by George Csicsery, Zala Films.



Students in Iran who attended a screening of the film in 2020.