

Dynamic / Chronological (Time) Series

Dynamic series

DYNAMIC SERIES is the set of the homogeneous values characterizing change of the phenomenon in time.

The chronological series

composed of two rows of parallel data, the first rows show variation of the time periods variation and the second row show the variation of the phenomenon or characteristics studied over time.

Levels can be presented by:

- **Absolute values;**
- **Relative values**
(intensive and ratio values);
- **Average values.**

Dynamic series can be:

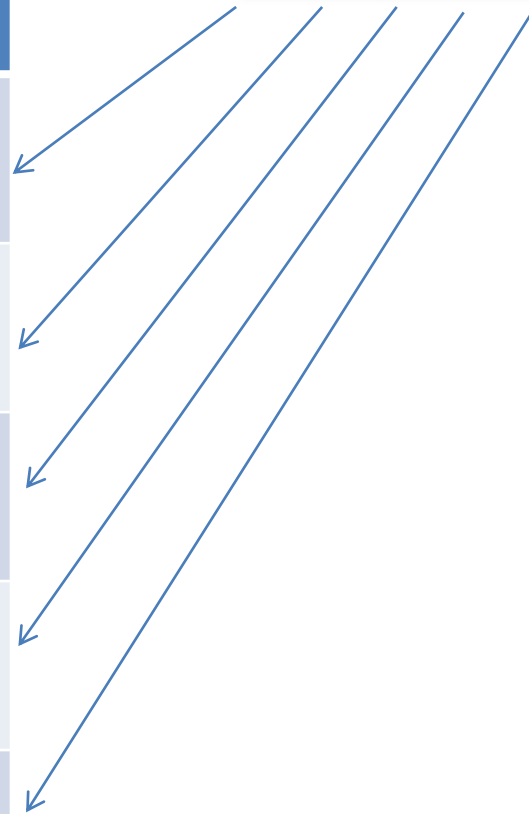
MOMENT – composed of the values characterizing the phenomenon for any certain moment of time.

INTERVAL – composed of the values characterizing the phenomenon for an interval of time.

Dynamic series

| Years | Birth rate, per 1000 population |
|-------|---------------------------------------|
| 2006 | 13,6 |
| 2007 | 13,4 |
| 2008 | 13,0 |
| 2009 | 12,7 |
| 2010 | 13,1 |

Levels of
Dynamic series



Dynamic series

| Years | 2007 | 2008 | 2009 | 2010 |
|-------------------|------|------|------|------|
| N. of beds | 450 | 457 | 440 | 430 |

| Years | 2007 | 2008 | 2009 | 2010 |
|--------------------------|-------|-------|-------|-------|
| N. of birth cases | 39456 | 39005 | 39673 | 40121 |



MOMENT dynamic series

– composed of the values characterizing the phenomenon for any certain moment of time.

INTERVAL dynamic series

– composed of the values characterizing the phenomenon for an interval of time

How to analyze the dynamic series?

Following the processing of time series are obtained absolute, relative and average indicators which together will characterize from statistical point of view the development of phenomena studied by the interpretation of the objective trend of their development in each stage

Indicators that characterize a time series

| Years | Incidence of stroke, per 1000 adult population | 1. Absolute increase / decrease |
|-------|--|---------------------------------|
| 2004 | 3,21 | - |
| 2005 | 3,53 | 3,53-3,21 = 0,32 |
| 2006 | 3,54 | 3,54-3,53 = 0,01 |
| 2007 | 3,39 | 3,39-3,54 = - 0,15 |
| 2008 | 3,58 | 3,58-3,39 = 0,19 |
| 2009 | 3,75 | 3,75-3,58 = 0,17 |

Absolute change (increase or decrease) ($\Delta_{i/i-1}$)

is calculated as difference between selected level and previous level

$$\Delta_{i/i-1} = X_i - X_{i-1}$$

Indicators that characterize a time series

| Years | Incidence of stroke, per 1000 adult population | 2. Dynamic index with fixed base |
|-------|--|-----------------------------------|
| 2004 | 3,21 | 100% |
| 2005 | 3,53 | $(3,53 / 3,21) * 100\% = 110\%$ |
| 2006 | 3,54 | $(3,54 / 3,21) * 100\% = 110,3\%$ |
| 2007 | 3,39 | $(3,39 / 3,21) * 100\% = 105,6\%$ |
| 2008 | 3,58 | $(3,58 / 3,21) * 100\% = 111,5\%$ |
| 2009 | 3,75 | $(3,75 / 3,21) * 100\% = 116,8\%$ |

Dynamic index with fixed base ($I_{i/0}$) – «Indicator of visualisation»

is calculated as the ratio of the selected level to the fixed level

$$I_{i/f} = (x_i / x_f) * 100\%$$

Indicators that characterize a time series

| Years | Incidence of stroke, per 1000 adult population | 3. Dynamic index with variable base |
|-------|--|-------------------------------------|
| 2004 | 3,21 | - |
| 2005 | 3,53 | $(3,53 / 3,21) * 100\% = 110\%$ |
| 2006 | 3,54 | $(3,54 / 3,53) * 100\% = 100,3\%$ |
| 2007 | 3,39 | $(3,39 / 3,54) * 100\% = 95,8\%$ |
| 2008 | 3,58 | $(3,58 / 3,39) * 100\% = 105,6\%$ |
| 2009 | 3,75 | $(3,75 / 3,58) * 100\% = 104,7\%$ |

Dynamic index with variable base ($I_{i/i-1}$) – «Rate of growth»

is calculated as the ratio of the selected level to the previous level

$$I_{i/i-1} = (x_i / x_{i-1}) * 100\%$$

Indicators that characterize a time series

| Years | Incidence of stroke, per 1000 adult population | 4. Rate of increase (decrease) |
|-------|--|--|
| 2004 | 3,21 | - |
| 2005 | 3,53 | $((3,53-3,21) / 3,21) * 100\% = 10\%$ |
| 2006 | 3,54 | $((3,54-3,53) / 3,53) * 100\% = 0,3\%$ |
| 2007 | 3,39 | $95,8\% - 100\% = -4,2\%$ |
| 2008 | 3,58 | $105,6\% - 100\% = 5,6\%$ |
| 2009 | 3,75 | $104,7\% - 100\% = 4,7\%$ |

Rate of increase (decrease) ($R_{i/i-1}$) – «Rate of gain»

is calculated as the ratio of the absolute change to the previous level

$$R_{i/i-1} = (\Delta_{i/i-1} / x_{i-1}) * 100\%$$

$$\text{or: } R_{i/i-1} = I_{i/i-1} - 100\%$$

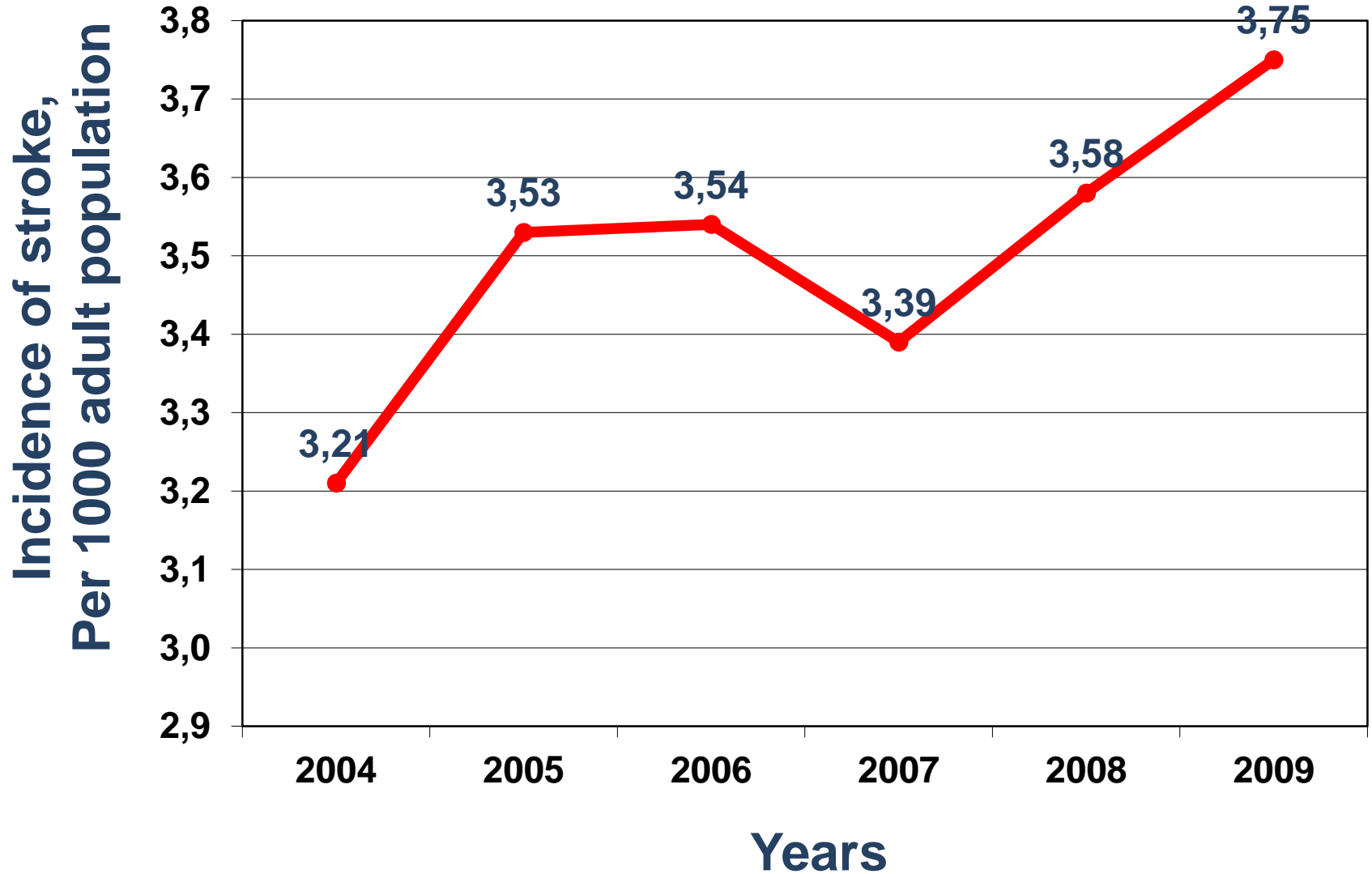
Indicators that characterize a time series

| Years | Incidence of stroke, per 1000 adult population | 5. Absolute value of a percentage of increase (decrease) |
|-------|--|--|
| 2004 | 3,21 | - |
| 2005 | 3,53 | $(0,32 / 10\%)*1\% = 0,03$ |
| 2006 | 3,54 | $(0,01 / 0,3\%)*1\% = 0,03$ |
| 2007 | 3,39 | $(0,15 / 4,2\%)*1\% = 0,04$ |
| 2008 | 3,58 | $(0,19 / 5,6\%)*1\% = 0,03$ |
| 2009 | 3,75 | $(0,17 / 4,7\%)*1\% = 0,04$ |

Absolute value of a percentage of increase (decrease) ($A_{i/i-1}$) is calculated as the ratio of the absolute change to the rate of increase

$$A_{i/i-1} = (\Delta_{i/i-1} / R_{i/i-1}) * 100\%$$

The dynamic series on the line graph

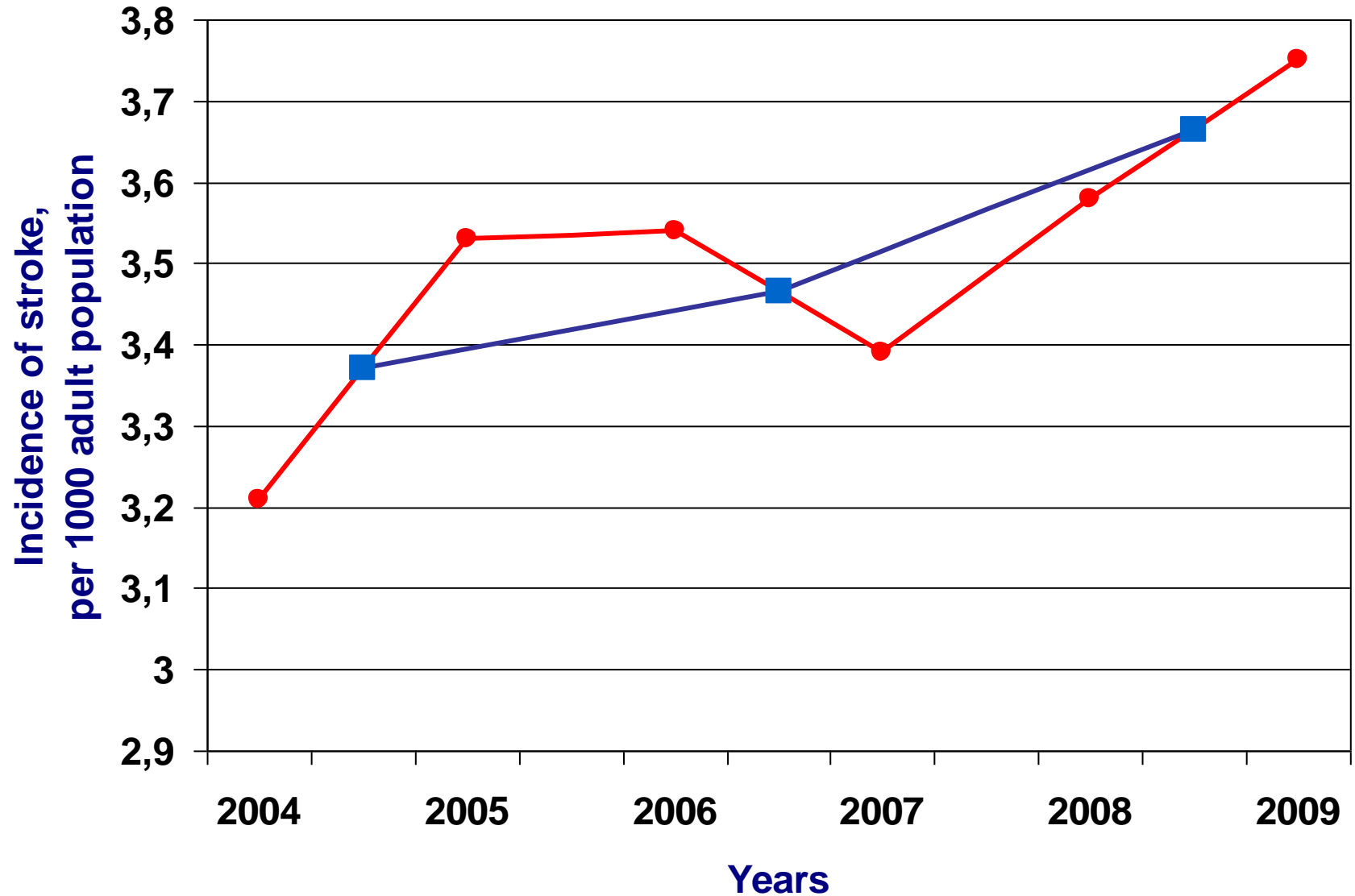


Methods of alignment of dynamic series

| Years | Incidence of stroke, per 1000 adult population | Enlarging the intervals |
|-------|--|--------------------------|
| 2004 | 3,21 | $(3,21+3,53) / 2 = 3,37$ |
| 2005 | 3,53 | |
| 2006 | 3,54 | $(3,54+3,39) / 2 = 3,47$ |
| 2007 | 3,39 | |
| 2008 | 3,58 | $(3,58+3,75) / 2 = 3,67$ |
| 2009 | 3,75 | |

Method of enlarging the intervals – is calculation of the mean of 2 or more intervals

Method of enlarging the intervals

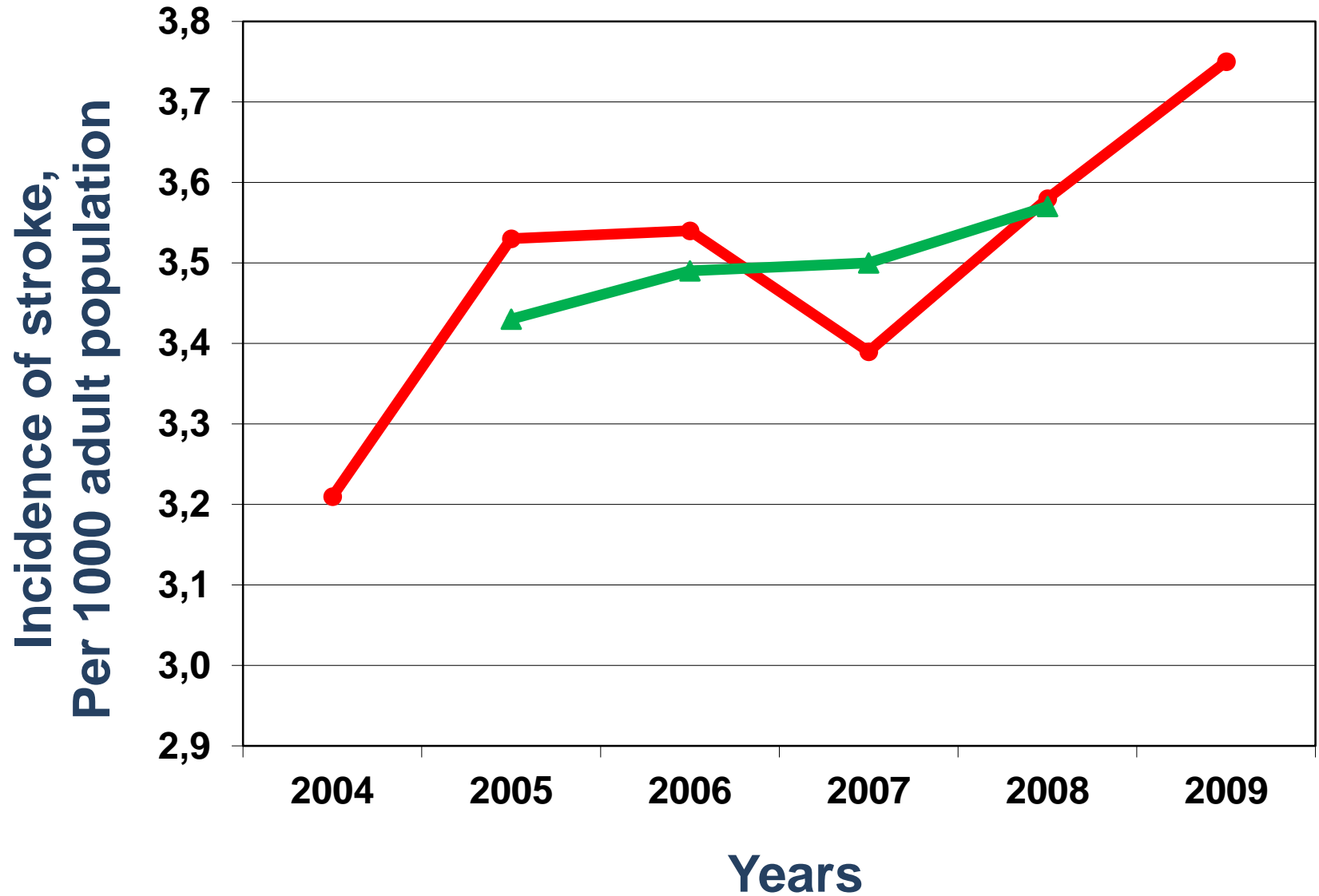


Methods of alignment of dynamic series

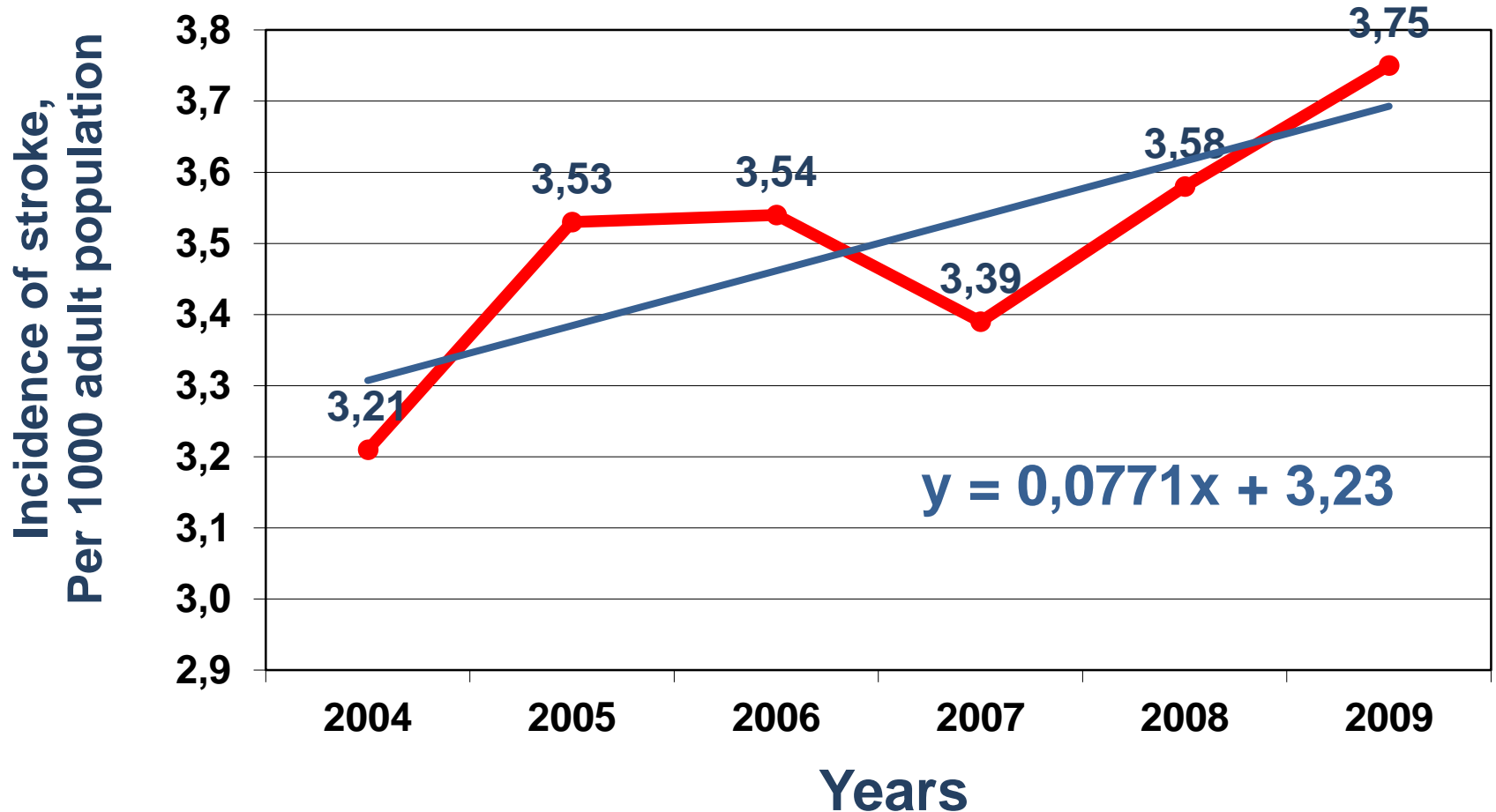
| Years | Incidence of stroke, per 1000 adult population | Methods of a sliding mean |
|-------|--|-------------------------------|
| 2004 | 3,21 | - |
| 2005 | 3,53 | $(3,21+3,53+3,54) / 3 = 3,43$ |
| 2006 | 3,54 | $(3,53+3,54+3,39) / 3 = 3,49$ |
| 2007 | 3,39 | $(3,54+3,39+3,58) / 3 = 3,50$ |
| 2008 | 3,58 | $(3,39+3,58+3,75) / 3 = 3,57$ |
| 2009 | 3,75 | - |

Method of a sliding mean – is calculation of the mean of 3 overlapping intervals

Method of a sliding mean



The least squares method



The least squares method allows to build the line, which is located at the smallest distance from the actual points