

## MODULE 3

# THE STRATEGIC USE OF INFORMATION

(1 day - 8 academic hours)

**Topic Overview:** In a more decentralized environment where mid-level and local managers have more decision-making authority, they need to know how to use information to inform their decisions as well as to monitor the effectiveness of their decisions. This goes beyond monitoring and evaluation to understanding what types of information are most useful for planning and monitoring.

### **Objectives of the Module:**

- a) Participants should understand the value of accurate information in decision-making and how different types of information (population-based, facility-based, etc.) are used for different purposes;
- b) Participants should learn how to analyze the validity of data based on statistics and internal consistency rather than source;
- c) Participants should learn how to use modern technology to access and process information, including trends in data management, use of electronic libraries and the availability of international sources of data.

### **STRUCTURE OF THE MODULE:**

**Lecture 1:** (2 academic hours)

***Using Heterogeneous Data in Health Care: Systematic Informational Methodologies***

(K.O. Chaliy)

**Case 1:** (3 academic hours)

***The Importance of Effective Approaches in Making Management Decisions***

(V.V. Krasnov)

**Case 2:** (3 academic hours)

***The Dynamics of Infant Mortality: A Systematic Informational Analysis of Factors***

(K.O. Chaliy)

# USING HETEROGENEOUS DATA IN HEALTH CARE: SYSTEMATIC INFORMATIONAL METHODOLOGIES

By K.O. Chaliy

## Using Heterogeneous Data in Health Care:

### Methods of Systematic Information Analysis

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## Statistic Regularity

A definite succession (reoccurrence) of phenomena, processes, and their quantitative parameters, which is formed and clearly manifested in multiple mass processes.

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## Systematic Analysis

- Systematic analysis (SA) – A method of research and analysis of the combination of elements that create a system. SA evaluates the behavior of an object of study along with all the factors that affect its function as a total system. SA is widely used in complex research and studies of an object and its system as a whole. There is no one method of SA in scientific research.
- In research, SA is made up of the following methodologies: theoretical research procedures that allow for quantitative evaluations, the study of system analysis under certain conditions, such as uncertainty, etc.

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## Types of statistic regularities

Time changes  
(dynamic regularities)

Related to the distribution of a totality's units by a certain indicator

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Changes in a totality's composition and structure

Related to the interconnection between indicators

## Section 1: Information in the Health Care System

- Types, sources, and methods of information processing
- Epidemiology as a means of analyzing biomedical statistics
- Population analysis with the help of databases and modeling

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## Basic Statistic Categories

- **Qualitative indicators** – Indicators whose values do not have any numerical expression and are different in substance rather than in size (e.g. gender, etc.)
- **Discrete quantitative indicators** – Indicators with a discrete numerical value (e.g. the number of children in a family, age, etc.)
- **Internal quantitative indicators** – Indicators that acquire any numerical value within a certain interval (temperature, pressure, etc.)
- **Alternative indicators** – Indicators that can only have two mutually incompatible meanings (survived-died, etc.)

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### Specificity of Biomedical Data

- Heterogeneous data
- Frequent updating of data
- Safety and confidentiality limitations
- The need for long-term storage

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### Different methods are used in statistical investigation, namely:

- General scientific methods
- Methods used in other areas of study, such as in mathematics, economics, etc.
- Statistic methods developed in the process of research and practical activities

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### Sources of Data

- Official statistics
- Departmental statistics
- Administrative information from local governments
- Population survey results

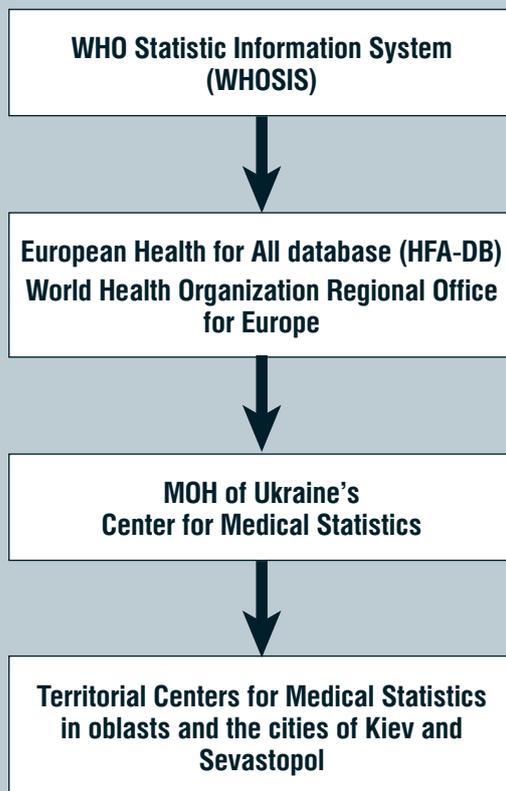
8

### Methods of Comparing Data

- With other territories or regions
- With the value from the previous time period
- With regulatory indicators values (if they have been approved or recommended)
- With the indicator value calculated through an expert method
- With average statistic values (nationwide or regional ones)

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### Sources of Statistical Data in Ukraine



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### Epidemiology – An Instrument that Helps in Making Managerial Decisions

Newly obtained epidemiological data must be used for disease prevention and healthy lifestyle promotion.

- The essence of public health care practice
- A special approach to the study of diseases, which uses probability theories, statistics, and the scientific method
- A tool that helps make managerial decisions in the area of public health care using scientific evidence, cause and effect relationships, and common sense

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### Epidemiology – The Main Science of Public Health Care

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- Epidemiology is the main science that deals with investigating factors and conditions to determine the frequency of the spread of a disease in a population
- Epidemiology studies the causes and conditions that shape population morbidity by analyzing its temporal spread within a certain territory and among certain population groups (**the systemic methodology of medicine**)
- Epidemiology is used in the development of cross-sector strategies and tactics for disease prevention

### Qualitative and Quantitative Approaches to Epidemiology

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- Classifying the problems of disease prevention for ontological and other diseases
- Assessment of the needs related to disease prevention
- Definitions, assessments, and justifications of hypotheses related to risk factors (**epidemiological diagnosis**)
- Assessment of the intermediate and final results of social interventions (**continuity of epidemiological research**)

### Purposes of Applying Epidemiology to Health Care Management

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- To direct the development of health care services by establishing the extent and distribution of disease and health related problems
- To expose the ecological causes and other factors that may help in controlling these diseases or impact them in any way
- To develop methods for determining the effectiveness of measures aimed at disease control and the improvement of a population's health

### Categories of Epidemiological Variables

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- Variables characterizing a population's health or that of particular groups (diseases, deaths, disabilities)
- Variables of individuals, whether healthy or sick, such as age, gender, blood pressure, blood type, level of antibodies, cholesterol, etc.)
- Factors determined by human lifestyle indicators, including socioeconomic status (income, education), reproduction and family relations, habits, etc.
- Factors determined by environmental pollution, such as the content of detrimental substances in the air, water, food, soil, etc.
- Factors in the quality of health care services provided, such as availability, timeliness, fullness, qualification, etc.

### Statistic Methods used in Epidemiology

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- Methods of mass observations
- Methods of statistic grouping (classification) and use of statistic charts
- Methods of analysis by means of generalizing indicators
- Methods of correlation/regression analysis
- Methods of multidimensional statistic analysis
- Methods of analysis of phenomenon structure
- Major and minor methods of analysis of long-term dynamics and seasonal prevalence

**Model** – A preexisting or generated system that, through the representation and mimicking of the cognitive processes of an original system, is similar to it; thanks to a model, new information can be learned about the original it represents

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**Mathematical modeling** – The creation and use of relationships between mathematical systems, which describe a process or phenomenon being studied and present in model form

## Purposes of Mathematical Modeling

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- Confirming intuitive conclusions
- Correcting them if intuition fails
- Predicting behaviors
- Researching the system's underlying behavior principles

## Models and Modeling

**Structural models** reproduce the composition of the elements within an object, system, or phenomenon and their connections (i.e., the structure of the modeled object)

**Functional models** imitate the original's behavior and its functional dependence on the external environment

**Analytical models** obtain obvious dependencies for the variables and parameters that characterize a phenomenon

**Numerical models** provide the possibility for obtaining the value of required quantities through quantitative methods

**Imitating models** are implemented with the help of computers in the form of modeling algorithms (programs) that calculate the value of initial characteristics and determine the condition of the model by using variables, parameters, and the initial condition of the model

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“The method of presenting phenomena by their models allows for the creation of competing models that describe the functioning of a system. In addition, these models are checked based on experimental data. The assessment of a model's adequacy characterizes the probability of observing during an experiment a given behaviour predicted by the model. Thus, the model supports the principal methodology for determining the relative probability of implementing a competing hypotheses. The demonstration of approximately the same affects by several models reveals the key feature that connects them. This feature represents an important characteristic of the relationships within a complex (medical and biological) system.”

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– D. K. Gifford, *Science*

## Example: Modeling of the Earth's Population Size By Sergei Kapitsa



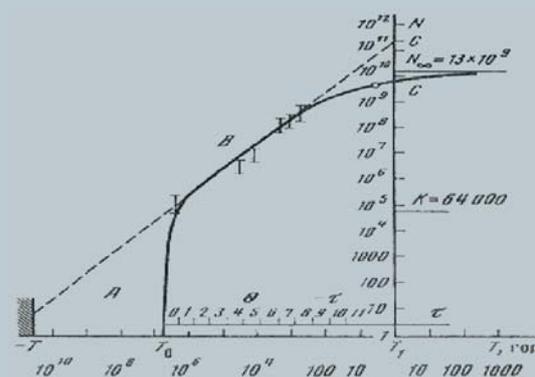
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## General Theory of Mankind

- States that mankind is considered to be a dynamic system
- Uses a system approach based on the mathematic modeling of mankind's growth to examine its development
- Elucidates the degree of impact of external resources on the increase and development of mankind in the foreseeable future
- States that phenomenological and mathematical models can be used to analyze the world's demographic process and that now the world is in a stage of demographic transition

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## World Population Growth From the Moment of Its Origin Up to Its Foreseeable Future



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## Section 2. Methodologies for Internet Research of Scientific, Medical, and Statistic Information

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- Internet search tools
- Specialized scientific and medical bibliographic resources on the Internet
- Systematic overviews and meta-analyses as sources of medical evidence

## The Four Databases of the Cochrane Library :

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- A database of reviews
- A database of reports on the effectiveness of medical treatments
- A register of controlled clinical tests
- A database of articles on methodology

## Internet Medical Resources

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- Electronic medical libraries
- Electronic versions of journals
- Websites of medical institutions and organizations
- Abstracts of research papers and projects
- Multimedia learning websites
- Virtual atlases and textbooks
- Software and other computer-based programs

## Medline/PubMed

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- According to data from the United States National Library of Medicine, about 13-14 thousand biomedical periodicals are currently published in 80 countries around the world. More than 5,000 of them can be found in the Medline database ([www.nlm.nih.gov](http://www.nlm.nih.gov)).

**PubMed**

A service of the National Library of Medicine  
and the National Institutes of Health

[www.pubmed.gov](http://www.pubmed.gov)

## The Major Biomedical Bibliographic Databases

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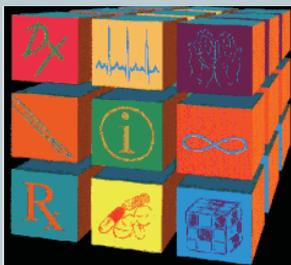
- Medline
- Embase
- BioMed Central
- PubMed Central
- Cochrane Library
- Scirus

- Medline hosts information from about 75% of the journals (mainly English-speaking) published each year **since 1950**. It contains more than **15 million** references.
- Medline contains every reference in the three leading medical bibliographic reference books:
- Index Medicus
- Index to Dental Literature
- International Nursing Index



Today, electronic medical databases are the most popular and reliable sources for scientific and medical information.

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Entrez-PubMed - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites History Print

Address http://www.ncbi.nlm.nih.gov/entrez/query.fcgi

NCBI PubMed National Library of Medicine NLM

PubMed Nucleotide Protein Genome Structure PMC Taxonomy OMIM Books

Search PubMed for Go Clear

Limits Preview/Index History Clipboard Details

- Enter one or more search terms, or click [Preview/Index](#) for advanced searching.
- Enter [author names](#) as smth jc. Initials are optional.
- Enter [journal titles](#) in full or as MEDLINE abbreviations. Use the [Journals Database](#) to find journal titles.

PubMed, a service of the National Library of Medicine, provides access to over 12 million MEDLINE citations back to the mid-1960's and additional life science journals. PubMed includes links to many sites providing full text articles and other related resources

**Bookshelf Additions**

**New PubMed Features**

The Summary page displays a new icon link for free full-text articles.

Now available: new and updated material in [The NCBI Handbook](#) and [Genes and Disease](#).

New data and additional search options, including an [e-mail](#) selection, have been added to PubMed. See [New/Noteworthy](#).

**Severe Acute Respiratory Syndrome**

Citations to articles about [Severe Acute Respiratory Syndrome \(SARS\)](#) are provided during this time of peak interest to facilitate searching this topic.

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osteoporosis results on scirus.com, for scientific information - Opera

Файл Правка Вид Закладки Виджеты Инструменты Справка

Создать вкладку S osteoporosis results on s... C osteoporosis - Поиск в G...

http://www.scirus.com/srsapp/search?t=all&q=osteoporosis&cn=all&co=AND&t=all&q=&cn=titlef ?

SCIRUS - Search - Pop-up Blocker OFF Highlight

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Basic Search [Advanced Search](#) [Search Preferences](#)

osteoporosis Search

Journal sources  Preferred Web sources  Other Web sources  Exact phrase

Searched for: All of the words **osteoporosis**

Found: **656,797 total** | [61,323 journal results](#) | [40,397 preferred web results](#) | [555,077 other web results](#)

Sort by: **relevance** | [date](#)

Save checked results Email checked results Export checked results

- [National Osteoporosis Foundation](#) [21K]  
Aug 2006  
...UPDATES JCAHO Announces Call for **Osteoporosis** Performance Measures NOF Scientific...Statement on Osteonecrosis National **Osteoporosis** Foundation Hosted its Eleventh...7th International Symposium on **Osteoporosis**: Translating Research into Clinical...  
[more hits from](#) [http://www.nof.org/]  
[similar results](#)
- [Medical Management of Osteoporosis and Vertebral Compressor Fracture](#) [24K]  
Dec 2006  
The **osteoporosis** information you need. Click on these key links! What is **osteoporosis**? Are **osteoporosis** and osteopenia the same? What are the causes? **Osteoporosis** Myths and Fallacies Will diet supplements prevent it? Treatment and Prevention...  
[more hits from](#) [http://www.spineuniverse.com/displayarticle.php/articl...]  
[similar results](#)

Refine your search using these keywords found in the results:  
[aged, 80 and over](#)  
[alendronate](#)  
[bisphosphonate](#)  
[dual-energy x-ray absorptiometry](#)  
[female](#)  
[fractures, bone](#)  
[fragility fractures](#)  
[hip fracture](#)  
[male](#)  
[middle aged](#)

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The screenshot shows the homepage of The Cochrane Library. At the top, there is a navigation bar with links for Home, About Cochrane, Access to Cochrane, For Authors, Help, and Save Title to My Profile. The main header features the Cochrane Library logo and the tagline "Evidence for healthcare decision-making". Below the header, there are sections for "BROWSE" and "SEARCH". The "BROWSE" section lists various review types and other resources. The "SEARCH" section includes a search input field, a dropdown menu for search criteria (set to "Title, Abstract or Keywords"), and a "Go" button. Below the search bar, there are links for "Advanced Search", "MeSH Search", "Search History", and "Saved Searches". A "SEARCH TIPS" section on the right provides guidance on using Boolean operators and provides examples. The "Restrict Search by Product" section allows users to filter results by database type.

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The screenshot shows a Google search for "osteoporosis" in a browser window. The search results page displays several links, including the National Osteoporosis Foundation, Wikipedia, MedlinePlus, and the National Institute of Health. The search results are ranked by relevance, with the National Osteoporosis Foundation at the top. The browser window also shows the address bar with the search URL and the Google logo.

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Module 3

### Section 3. Aspects of information relevant to health care management

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- Assessment of data relevance and validity
- Problem of aggregation of heterogeneous data
- System approaches to the analysis and interpretation of information

### Methodological Aspects of Informational and Analytical Activities

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- Shaping the goal of research
- Creating a conceptual system
- Providing sufficient information
- Disclosing the meanings of facts
- Determining causes and their consequences
- Considering historical developments and tendencies
- Ensuring a high authenticity level
- Shaping conclusions and recommendations
- Providing feedback

**Adequacy of indicators** – The ability to display and characterize the properties of phenomena and processes studied

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**Precision of measurement** – The concept that looks at the difference between a real system and the model or statistics used to describe it; it is based on the processes used to assess the system and create its model

**Variation** – The range a given variable can change within in a system

### The Main Components of a System Approach in Analytical Research

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- Determining the purpose
- Determining the structure
- Determining the interaction with other subsystems

### Information Comparison

Finding data that is linked to the research object (time, place, number of cases, etc.) and also is associated with other data. For this, there are three steps:

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- Ordering information – Gathering all types of information on a particular feature or the selection of facts
- Actual comparison – Surface analysis in order to detect obvious and possible links with the object or other parts of the study
- Confirming links

### Data Synthesis

**Data Synthesis** – The logical association of statistics and information that seem unrelated; the projection of that data in a single direction with emphasis placed on the formation of a legitimate hypothesis

At this stage, problems solved include:

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- Establishing connections between disparate elements, fitting them into a single, logical scheme (i.e. a descriptive model or pattern of behavior)
- Forming of a plan of action based on models and supported by the hypothesis
- Defining needs and attitudes toward the process

### System Approach

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**Experimental approach** – An approach based on carrying out experiments to obtain a new information

**System approach** – An approach based on presenting the object of research as a large, complicated system; also based on the use of methodologies of system analysis and synthesis

**System analysis** – A method of research in which an object is seen as system that is then analyzed

### Logical Methods of Cause and Effect Analysis

#### Method of Elimination

The cause can be determined by excluding all circumstances, even those present but not influential, that result in similar effects. After thorough examination, the goal is to be left with one circumstance whose effect does not fit the rest. It can then be determined as the cause.

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### Logical Methods of Cause and Effect Analysis

#### Method of Similarity

If an effect occurs in circumstances different except for one factor, then this factor is determined to be the cause.

The sources of and conditions needed for the effects can be examined for similarities.

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### Logical Methods of Cause and Effect Analysis

#### Method of Differences

If an effect usually occurs under the same set of circumstances but fails to do so when one is missing, that circumstance (or factor of a circumstance) is determined as the cause.

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## Case 1

## THE IMPORTANCE OF EFFECTIVE APPROACHES IN MAKING MANAGEMENT DECISIONS

By V. Krasnov

Dr. Panas, the Head of the Department of Health for Zhytomyr Oblast and a former trauma doctor, had to make a decision about how to distribute the 30 million UAH allocated to the oblast for the support and development of maternity hospitals. At that time, there were two major maternity hospitals in Zhytomyr, each using a different model of care.

The first institution, Maternity Hospital №1, employed the traditional model of maternal care, supported by the current medical system. This hospital was characterized by large pre- and postnatal wards, communal delivery rooms and neonatal wards. Visitors were not allowed before or after delivery. The hospital contained a special department for monitoring patients with special medical conditions or complications. Newborns were cared for and monitored by nurses and breastfed hourly by their mothers.

### In addition:

1. Three years ago, the hospital was supplied with modern diagnostic equipment.
2. The doctors learned to use this equipment at practical trainings conducted by the manufacturers. Because the hospital had the equipment and the doctors knew how to use it, the hospital administration established procedures requiring multiple examinations for all pregnant women.
3. The hospital received a Quality Control System certificate signifying its compliance with existing international standards.
4. During hospital staff meetings, the head doctor would share with staff his opinions about the new model for maternity care.
5. The head doctor is an oblast-level public figure with political influence.

The second institution, Maternity Hospital №2, used the latest perinatal technologies introduced in Zhytomyr after the success of similar technologies in Volyn and Donetsk oblasts. These include the creation of family delivery rooms, use of partograms to monitor labor and systems to monitor and prevent neonatal hypothermia. In addition, mothers were allowed to share the same hospital room with their newborn ("rooming in"), to have visitors during and after the birth, and to breastfeed their newborn on demand. The program that introduced these technologies was the USAID-funded Maternal and Infant Health Project (MIHP), which lasted for 4 years (2002-2006) and had the goal of implementing modern WHO standards for safe motherhood, that were rooted in evidence-based medicine.

Dr. Panas obtained the official effectiveness indicators for each model of obstetric care. They are as follows:

No	Activity Indicators	MH №1	MH №2
1	Number of deliveries per year	3,000	3,000
2	Mortality (deaths per year)		
	- Perinatal	5.6	10.5
	- Antenatal	2.1	8.7
	- Intranatal	5	5

	- Early neonatal	6	8
3	Number of infants referred to other health care facilities for treatment	104	232
4	Number of mucopurulent infections	12	21
5	Use of anesthesia during delivery	90%	40%
6	Frequency of episiotomies	30%	5%
7	Rate of newborn hypothermia	80%	1%

Perinatal mortality (the death of a fetus or infant in the time period after 28 weeks of gestation until the seventh day after birth) is the primary indicator used by the Ministry of Health of Ukraine (MOH) to compare the success of different maternity hospitals. Perinatal mortality in Maternity Hospital №1 was similar to the national statistic for Sweden and half that of Maternity Hospital №2.

However, Dr. Panas received a good deal of positive anecdotal feedback from patients who delivered at Maternity Hospital №2. This made him rethink the validity of the MOH's evaluation system. This feedback included:

Vasyl, 32 years old:

*"This was our first baby. Before the delivery, my wife and I attended parenting classes where we learned about the process of pregnancy, its trimesters and what to do so the baby would be born healthy. During the delivery, I supported my wife, calmed her down, and, when I held our newborn baby in my hands, I realized just how much I love them both."*

Maria, 28 years old:

*"My older daughter Aleksandra is already five years old. When I was delivering her at a traditional maternity hospital, there were four of us in the labor room. We were all crying and weren't allowed to get up because we were told we might rupture something. I was scared and didn't understand what was going on. When I gave birth to Daryna, my second daughter, my husband and the midwife were there with me. The midwife supported me and told my husband what to do. I was walking, sitting on a ball, holding my husband's hand and holding onto the support wall. The delivery was fast and without any ruptures. I am thankful to the staff for my experience."*

After these confusing results, Dr. Panas decided to look at the problems occurring in each hospital to see if there was any indication of which hospital was better. Dr. Panas' assistants spoke with the head doctors at both hospitals and informed him of the problems in both, including:

#### *Maternity Hospital №1*

1. Complaints of staff carelessness and a lack of attention to women;
2. Rumors that newborn babies were switched while in the hospital;
3. Complaints that several women with complications were refused services and had to go to another maternity home for delivery.

#### *Maternity Hospital №2*

1. Patients sometimes complained about the idea of partner-assisted delivery, claiming it was inappropriate;
2. Maternity Hospital №2's model was an expensive endeavor that put a good deal of financial pressure on the facility because it included funding for the following:
  - a. Retraining the entire staff in the new approaches, which is expensive and interferes with day-to-day operations;

- b. Individual labor rooms and separate wards so that mothers and babies can stay together;
- c. Population education campaigns, classes on responsible parenthood and preparing both partners for delivery;
- d. Additional staff to provide support during labor.

At a recent training he had attended with MIHP, Dr. Panas had received a list of statistics from the project's work in Donetsk and Volyn oblasts, which he pulled out to compare to the information he had from Maternity Hospital № 2.

Statistics from MIHP activities in Volyn and Donetsk oblasts (compared with maternity hospitals that practice traditional approaches):

- Neonatal mortality in pilot maternity hospitals was reduced by 67%;
- Normal, uncomplicated deliveries increased from 30% to 75%;
- Surgical deliveries were reduced in all maternity hospitals: from 26% in 2002 to 16% in 2006.

Dr. Panas did not know whether to use the funds allocated to the Oblast Department of Health to disseminate the technologies and practices used in Maternity Hospital № 2 to all maternity hospitals in Zhytomyr Oblast. These technologies seemed to generate positive anecdotal feedback, but Dr. Panas was reluctant to disregard the statistical evidence that pointed to Maternity Hospital № 1's superior results. Maybe he should use the funds to purchase modern equipment for Maternity Hospital № 1 and support their traditional methods that produce better perinatal mortality indicators? Dr. Panas wondered if there was a way to get beyond the statistics to explain the disparity between the poorer statistics in Maternity Hospital № 2 and the positive anecdotal evidence.

### DISCUSSION QUESTIONS:

1. Which model of care seems to work better? Why? How did you come to this conclusion?
2. What factors other than quality of care could affect each of the indicators?
3. Identify and analyze the factors that determine the quality of care provided by each maternity hospital and try to identify the most important factors.
4. Should the validity of the statistical data be called into question? What further questions should you ask and what further data should you seek, based on the information provided, to further clarify the situation presented in the statistics.
5. How reliable is anecdotal evidence? How could anecdotal evidence be standardized and expanded to be a better, more dependable indicator?
6. How could political influence be useful in controlling indicators?
7. Which maternity hospital would you fund and why?

### TEACHING NOTES:

#### *Teaching objectives:*

1. Participants should understand that the traditional process of service assessment—a purely official results-based analysis—may not provide an accurate picture of services.

2. Participants should be able to identify alternative methods of assessing the quality of services.

The instructor should take an initial poll to gauge students' reactions to each maternity hospital. Hopefully, half of the students will support one model while the other half will support the other model. As students discuss the reliability and complexity of each indicator, as well as the validity of anecdotal evidence, hopefully most will come to support the model of care employed by Maternity Hospital № 2.

The instructor should guide students in a discussion that leads to the following conclusions:

1. Perinatal mortality is the primary indicator used in Ukraine for determining the quality of obstetric services.
2. The modern perinatal technologies implemented in Maternity Hospital № 2 produced poor indicators, and financial difficulties meant that work was slow in getting off the ground. For this reason, the group should consult the statistics from MIHP's work in Volyn and Donetsk oblasts.
3. After receiving data from the MIHP projects in Volyn and Donetsk oblasts, the group must determine the external factors that cause the significant differences between the data from Donetsk and Volyn oblasts and those from maternity hospitals №1 and №2.
4. To do this, the group should list the factors that could lead to major differences between the two maternity hospitals. Some of these factors could include:
  - a. If a baby is born with complications, it is usually transferred early on to a children's hospital. The death of the newborn does not show up in the indicators of the maternity hospital;
  - b. Cases of stillbirths can be left unregistered, with the consent of the parents;
  - c. Maternity hospitals №1 and №2 operate from different starting conditions. That means that the data on infant mortality are not entirely reliable when comparing the two facilities.

The instructor should direct the group toward external factors that could cause the differences in indicators between the two hospitals. The group can use the table in Supplement 1, at the end of this section, to help. These differences might include:

- a. The number of women with diagnosed with conditions/complications at the time of admission to each maternity hospital—the more women with problems who are admitted for care, the worse the indicators will be. In Maternity Hospital №1, women with complications complained about being turned away;
- b. Pregnant women's place of residence in relation to the nearest maternity hospital—in rural areas, women with complications may get to the hospital too late for treatment;
- c. The indicators surrounding early neonatal death in other health care facilities.

Perinatal mortality remains the most significant indicator for assessing obstetric care in Ukraine, but this indicator is influenced by more than just the quality of obstetric care.

Participants may be interested to know the outcome of the case in real life:

The head doctor of Maternity Hospital №1 has influence in the city and has a lot of different friends in official positions. He hired highly professional specialists for the women's consultation and admissions office of his hospital. These doctors were able to assess women's risk factors

before admission and refer high risk women to Maternity Hospital №2. This ensured that there would be a lower level of complicated pregnancies in Maternity Hospital №1.

After receiving the full information, Dr. Panas decided to use the oblast funds to update the oblast's maternity hospitals so they could all follow the example of Maternity Hospital №2.

*Supplement 1: Additional data related to the activities of maternity hospitals №1 and №2:*

№	Indicators	Hospital №1	Hospital №2
1	Pregnant women's place of residence	Urban areas	City of Zhytomyr, Zhytomyr Oblast (including rural areas), other cities
2	Number of high risk pregnant women admitted	132	380
3	Number of pregnant women complaining of a lack of fetal activity	0	20
4	Number of early neonatal deaths while women were in other health care facilities or maternity hospitals	7	7

## Case 2

## THE DYNAMICS OF INFANT MORTALITY: A SYSTEMATIC INFORMATIONAL ANALYSIS OF FACTORS

By K. O. Chaliy

Recent literature issued by the Ministry of Health of Ukraine provides evidence of a high level of infant mortality in Prydniprovskya Oblast\*. When going over the data, Petro Ivanenko, the head of the Oblast Department of Health, grew worried. Behind the statistics, he was able to see the tragedy of each family that lost a child. He knew that he worked very hard to be a professional and to keep his population healthy, but there were certain things that were beyond his control. This sad statistic seemed like one of them. Was there anything he hadn't yet tried? Or maybe the indicator would just improve naturally over time? He read the disappointing statistics over and over again to see if they might contain any hints.

Petro had access to a lot of literature he could use to analyze and try to improve the infant mortality indicator in his oblast, including:

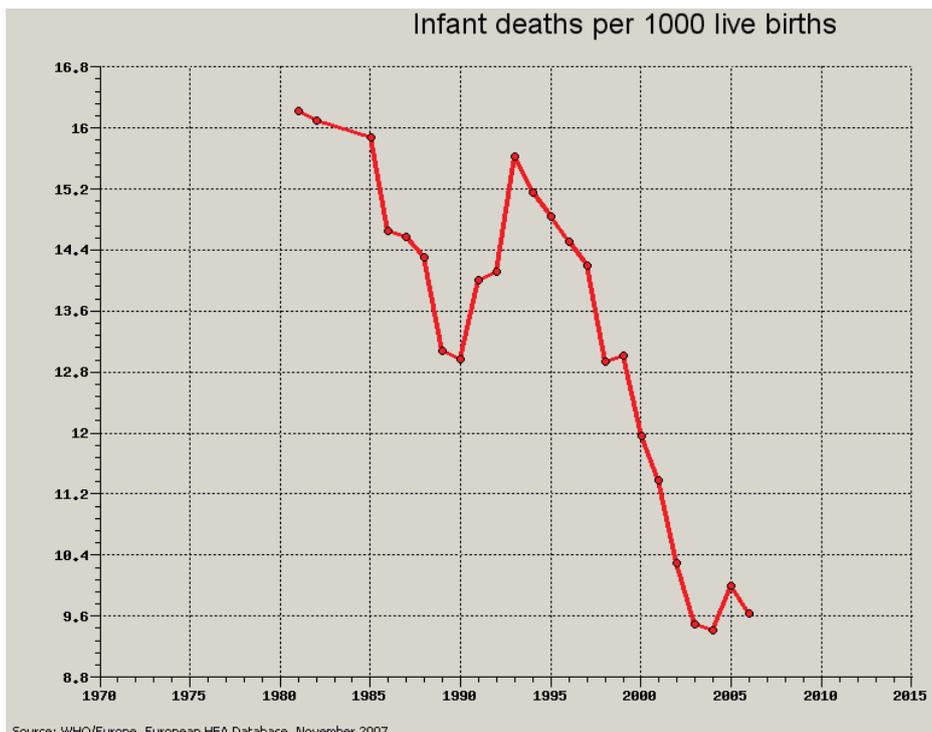
- A draft of the cost estimate of expenditures for the Oblast Department of Health;
- Information on the work of the oblast maternity hospitals;
- Published materials from a staff meeting of the Ukraine Ministry of Health (MOH);
- Data from the European Health for All database (HFA-DB), published by the WHO Regional Office for Europe.

After carefully examining the MOH staff meeting materials, Petro learned that the following oblasts had the highest infant mortality rates in Ukraine over the previous six months: Pridniprovskya Oblast (14.79 deaths per 1,000 live births), Desnyanska Oblast (13.98), Dnistrovskya Oblast (13.26.) The average national infant mortality rate was 10.12 per 1,000 live births. The infant mortality rate over a five-month period this year in Pridniprovskya Oblast was 25.7% higher than the rate for the same five-month period last year. This meant that infant mortality had actually increased in the past year. Judging from his discussions with colleagues in other oblasts, Petro came to the conclusion that this was caused by the post-neonatal mortality level in his oblast, which was twice as high as the national average.

What could have led to such dramatic changes in infant mortality indicators? To answer this, Petro turned to the European Health for All database (HFA-DB), published by the WHO Regional Office for Europe to see what sort of information he could find there about trends in infant mortality in Ukraine (Chart 1). After analyzing these data, he was able to make some general observations, such as:

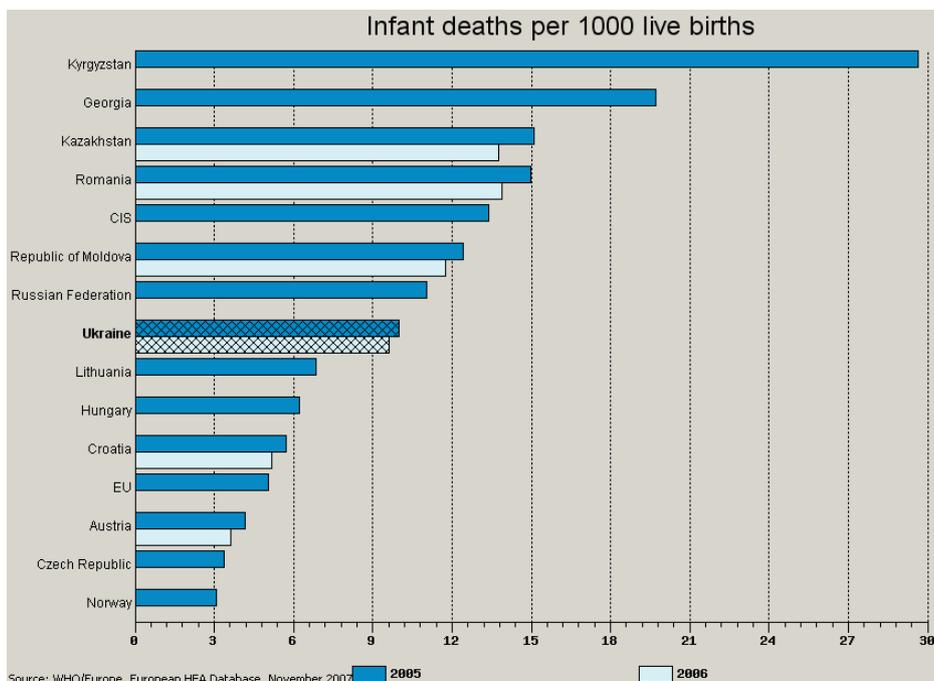
- In the 10-year period from 1993 to 2003 there had been a steady decrease in the rate of infant mortality in Ukraine;
- The current infant mortality rate in Pridniprovskya Oblast was the same as the national average in 1995;
- In 2005, the national infant mortality rate decreased from 10.1 to 9.3 per 1,000 live births;
- In 2006, the national infant mortality rate again decreased.

Perhaps the situation in Petro's oblast merely reflected demographic or other processes occurring nationwide. The infant mortality rate fluctuated, as seen in the rate's increase between the years 2004 and 2005.



**Chart 1** Trends in the infant mortality rate (number of infant deaths per 1,000 live births) in Ukraine, 1981-2006, according to the Health for All database of the WHO Regional Office for Europe, 2007.

Petro was still concerned about the problem and continued researching to find out more. His fears were slightly calmed when he came across infant mortality statistics for various countries in Europe and Central Asia (Chart 2). It showed that the infant mortality rate in Pridniprovsk Oblast was less than that of Romania, which was now part of the European Union.



**Chart 2** Infant mortality rates (infant deaths per 1000 live births) in selected countries, 2005 and 2006, according to the Health For All database of the WHO Regional Office for Europe, 2007.

Petro knew that he could not draw any conclusions from numbers alone because they did not give the reasons behind the indicators. He turned back to the MOH staff meeting materials to see if any of the causes of infant mortality had been discussed. He began to understand that most of the problems associated with the infant mortality rate were systemic and permanent, were characteristic for perinatal and infant care, and that dealing with these issues required managerial, system-wide approaches and not medical approaches, as he had originally thought. Though Petro generally left such big decisions to the officials of the MOH, he knew that there were some managerial changes he could make as the Head of the Oblast Department of Health. Rather than just finding a way to justify the poor indicator in his oblast, Petro decided he needed to find the reasons behind the statistics in order to figure out ways to strengthen the health care system for maternal and infant care.

After looking again at the available data, Petro started to realize that the increase in infant mortality due to prenatal conditions, respiratory diseases, traumas and accidents was indicative of major problems in the organization of maternal and infant health care. It was not just a medical issue—that infants were sicker than usual—but a public health and management issue. The system was not operating the way it should and it was preventing doctors from curing sick infants. Although there were a lot of statistics associated with infant mortality in Pridniprovskia Oblast, Petro realized that he would have to look beyond the numbers to try to get at the root of the problem. As a manager, he could either blame the doctors, telling them they need to improve the statistics, or he could try to figure out the systems issues behind the problem. He decided to go through the statistics one by one and figure out which parts of the health care system contributed to the indicator.

#### Statistical data for Pridniprovskia Oblast

1. 27.6% of infants died in inpatient maternity hospitals, 25% in the Oblast Children's Hospital, 13.4% in central district hospitals and 21.2% at home.
2. A substantial majority (70%) of post-neonatal infant deaths occurred in rural areas.
3. 47.8% of early neonatal deaths in the current year occurred in central district hospitals. Several cases of late neonatal mortality had been registered in inpatient maternity facilities in different districts.
4. For the past two years, congenital fetal defects were the major cause of early neonatal mortality. Some of these defects can be detected during pregnancy through antenatal technology, such as ultrasound or amniocentesis.
5. Five cases of late neonatal mortality were diagnosed in oblast level inpatient maternity facilities.
6. Eight of the 23 obstetric facilities in the oblast have newborn respiratory equipment; in three of these 23 facilities there are no incubators; these 23 facilities manage 150-170 deliveries per year; obstetric inpatient care facilities in the oblast handled 13,500 deliveries per year; only eight of these facilities have fetal monitors.
7. There are 153 vacancies for pediatricians at the oblast level; 49 for ob-gyns, 15 for neonatologists, and 21 for children's anesthesiologists.
8. According to the Center for Disease Control's 1999 Reproductive Health Survey in Ukraine, 25.5% of women were asked by a medical professional if they wanted to discuss contraception postpartum, 4.5% of women were referred elsewhere for contraceptive services or counseling postpartum, and 3.8% of women left the facility with a contraceptive method or prescription in hand postpartum.

Clearly, these data were indicative of many different sides of the problem of infant mortality, and Petro was not in a position to address all of them. He set about brainstorming which indicators he could address with management solutions, and how he could go about doing so.

He hoped that through a thoughtful analysis of the situation, he would be able to find a way to improve infant mortality at the oblast level.

### DISCUSSION QUESTIONS:

1. Which of the indicators listed in Petro's data could be affected by changes implemented by a manager? Which issues cannot be addressed by a manager?
2. For the indicators that can be affected by a manager, what systemic issues could account for the indicators listed in Petro's data? Try to brainstorm system-wide changes that could be implemented to improve each relevant indicator.
3. What is the difference between perinatal, neonatal, infant and child mortality? Why are these distinctions important?
4. Which rates should be considered most informative for the decisions that Petro has to make in order to find the solution to his problem?
5. Evaluate the sources of Petro's data. Which are more reliable than others? Why?
6. From the beginning of 2005, the infant mortality rate in Ukraine increased by 4%. Ten out of every 1,000 newborn babies die, and 175 other infants die before they reach their first birthday. The maternal mortality rate also increased by 22%. Fifty-seven women died only during the first nine months of 2005, compared to just 59 deaths during the whole of 2004.
  - a. Can the increase in the infant and maternal mortality rates be caused by common factors?
  - b. If so, what are they?
  - c. How can Petro influence these factors in his oblast?
  - d. What statistical methods could help solving the abovementioned issues?

### TEACHING NOTES:

#### *Teaching objectives:*

1. Participants should understand the value of using accurate information in decision making; how various types of information can be used for different purposes; and how to identify the specific information needed to make a decision;
2. Participants should understand the importance of using modern technologies and research strategies that provide access to information; and the importance of quality analysis in assessing the validity and relevance of data.

The text of this case needs to be distributed to participants in the morning, during the planning session. During the presentation of the narrative, the instructor should place it in the broader context of health care management, so that participants are thinking generally about management and not specifically about infant mortality or medicine. After the presentation of the narrative, the instructor should provide the group with the "Discussion Questions." During the discussion of the data, participants may need some extra guidance in reaching appropriate conclusions. Below are some "prodding questions" to draw out the group's thinking. Although somewhat dependent on the level of expertise and involvement of the participants, it is up to the instructor to decide how the session should unfold.

1. 27.6% of infants died in inpatient maternity hospitals, 25% in the Oblast Children's Hospital, 13.4% in central district hospitals and 21.2% at home.
  - i. This indicator is a little broad on its own to prompt any conclusions. Participants might discuss what could make this indicator useful, such as comparing it to similar data from neighboring oblasts, historical data from Pridniprovskaya Oblast or national averages.
2. A vast majority of post-neonatal infant deaths occurred in rural areas.
  - i. This could point to a breakdown in the referral and emergency transportation system between primary, secondary and tertiary medical facilities as well as to problems with the ability of staff in rural medical facilities to identify the need for emergency care. The instructor might ask the following questions:
    - a) What resources might the rural medical facilities lack that could lead to such a high rate of post-neonatal infant death?
    - b) Where could these resources be found?
    - c) What is preventing infants from reaching facilities that have the appropriate resources?
    - d) What could you, as a manager, do to fix this situation?
  - ii. A more difficult project to undertake, but also a reasonable solution, would be to train staff in rural medical facilities in neonatal care. This could be difficult because often neonatal care involves expensive equipment. However, rural staff could be trained in low-tech methods of neonatal care as well as in preventative care.
3. 47.8% of early neonatal deaths in the current year occurred in central district hospitals. Several cases of late neonatal mortality have been registered in inpatient maternity facilities in different districts.
  - i. This could be interpreted similarly to the last statistic. However, since central district hospitals are expected to serve large districts at a secondary level of care, if a significant proportion of early neonatal deaths are occurring in central district hospitals, this indicator points to a lack of appropriate equipment and skilled specialists at the central district hospital. A manager could address this by initiating in-service training or continuing education courses in modern methods of neonatal care for specialists and identifying funding for equipment procurement. The instructor may ask such questions as:
    - a) What sort of services are central district hospitals expected to provide?
    - b) What might prevent them from providing these services?
    - c) How could these inadequacies be fixed?
4. For the past two years, congenital fetal defects were the major cause of early neonatal mortality. Some of these defects can be detected during pregnancy through antenatal technology, such as ultrasound or amniocentesis.
  - i. This indicator may point to a lack of knowledge among medical professionals about ultrasound technology and how to address congenital fetal defects during pregnancy, delivery and afterwards. A manager could affect this indicator by initiating in-service training or continuing education courses in ultrasound technology, hiring specialists to screen for and treat congenital fetal defects or training staff in dealing with congenital abnormalities after the infant is born.
    - a) Questions from the manager could include: If congenital fetal defects can be detected and dealt with in a preventative manner, what factors could contribute to their not being detected and treated?

5. Five cases of late neonatal mortality were diagnosed in oblast-level inpatient maternity facilities.
  - i. This indicator may be too broad for participants to deal with. The instructor should ask participants what could make the indicator more useful, such as the total number of late neonatal mortality cases in the oblast, the figure for other oblasts or similar historical figures.
6. Eight out of the 23 obstetric facilities in the oblast have newborn respiratory equipment; three of these 23 facilities have no incubators; these 23 facilities manage 150-170 deliveries per year; obstetric inpatient care facilities in the oblast handled 13,500 deliveries per year; only eight of these facilities have fetal monitors.
  - i. It is relatively clear that this indicator points to a lack of adequate equipment in maternity facilities. A manager could affect this indicator by locating funding to buy equipment.
  - ii. Participants should look at these figures critically; however, they should also question (or the instructor should point out) the connection between equipment deficits and infant mortality. How large a role does equipment play in preventing infant mortality?
7. There are 153 vacancies for pediatricians at the oblast level; 49 for ob-gyns, 15 for neonatologists and 21 for children's anesthesiologists.
  - i. First of all, participants should be encouraged to look critically at the need for staff in these facilities, since many Ukrainian health care facilities are overstaffed. This indicator could prompt an analytical discussion about the staffing needs and realities of individual departments.
  - ii. This indicator might point to a need for qualified specialists. Questions the instructor might ask include:
    - a) What sort of program could be designed to motivate medical students to become pediatricians?
    - b) What sort of program could be designed to attract qualified specialists in pediatrics to work in Pridniprovska Oblast?
8. According to the Center for Disease Control's 1999 Reproductive Health Survey in Ukraine, 25.5% of women were asked by a medical professional if they wanted to discuss contraception postpartum, 4.5% of women were referred elsewhere for contraceptive services or counseling postpartum and 3.8% of women left the facility with a contraceptive method or prescription in hand postpartum.
  - i. Questions the instructor might ask include:
    - a) What is the connection between family planning and infant health?
    - b) What could these indicators on postpartum family planning counseling mean for other forms of counseling, such as antenatal and postpartum?
    - c) What could be done to improve counseling at a clinical level? (This could include training specialists in counseling but also training midlevel medical staff in counseling, since doctors are often too busy to do the counseling themselves.)
9. The instructor should facilitate a conversation among participants about the "Discussion Questions."
10. At the end of session, the instructor should provide conclusive information on the case and the work conducted by summarizing the conclusions.

**Discussion Questions:**

1. Are there reasons to believe that the issue with the infant mortality in Pridniprovskaya Oblast is the expression of certain countrywide periodic demographic processes? How could one prove it? What does impact these changes at the country and oblast levels?
2. Is it possible to determine several main causes of death in infants from Pridniprovskaya oblast? Please tell what are these causes? Which one of these reasons is the first Dr. Petro should address? Why is that?
3. How could one make the Ukrainian citizens who do not want to change their bad habits and have a healthy behavior to become more responsible in regards to their own reproductive health and the health inherited by their children? Is this one of Dr. Petro's tasks? Is it going to lower the infant mortality the next year?

**Generalization and Conclusions**

Due to a concrete identification of the main determinants of infant mortality, Dr. Petro has managed to develop and implement a set of effective managerial measures to improve the situation! For 9 months of the year 2007 his oblast has shown a visible tendency towards the decrease in infant mortality – 8.82 in 1000 live newborns. According to verified data this indicator was equal to 12.78 in 1000 live newborns in 2006. This means that infant mortality decreased by 31% in one year. To compare, the mean infant mortality in Ukraine for 9 months of 2007 was 10.79 in 1000 live newborns.

In order to further improve the infant mortality related situation a set of cross-sectoral measures is needed in order to address social issues, improve the situation of health facilities in regards to technical equipment and human resource issues, by creating acceptable working conditions, especially in villages, for highly qualified professionals. The health care facilities providing health care services to mothers and children require prioritized financing.

## GLOSSARY OF TERMS

**Methodology** – A way of doing something. Generally it is documented in a way that it can be repeated again in the future.

**Systems analysis** – A review of a system in which the interrelationships among individual parts are reviewed, rather than simply reviewing the individual components of a system.

**Statistical regularity** – A recurrence of phenomena, processes and their quantitative parameters that shapes and reveals itself in mass processes with a large number of units as a sum total.

**Medical statistics** – Measures of individual or population health that can be used generally for any statistical analysis related to health.

**Epidemiology** – The study of the causes and conditions of the incidence of disease in human populations over time and geography, and the application of this study to control health problems.

**Statistical grouping** – The breakdown of the units of a whole into classes, groups and sub-groups, according to their special characteristics.

**Population health** – A set of measures of the health of a population. It often includes measures such as life expectancy, disease specific mortality rates, frequency of certain diseases and the disability of a certain population group.

**Morbidity** – The incidence of disease among a population.

**Model** – A simplified system that describes a larger, more complex system, allowing for the study of the larger system.

**Mathematical modeling** – A process in which a complex system is simplified into a standardized mathematical system for the purposes of description and prediction.

**Medical Internet resources** – Electronic libraries, electronic versions of periodicals, websites of health care institutions and organizations, descriptions of scientific research projects, multimedia training servers, virtual atlases, applied software, etc.

**Statistical indicator** – A quantitative measure that provides information about a process or outcome.

**Precision of measurement** – The concept that compares a real system with the model and statistics used to describe it. It is based on the processes used to assess the system and create the model.

**Variation** – The range within which a given variable can change in a system.