

DYNAMICS OF MANUFACTURING INJURIES IN MEAT PROCESSING OF FOOD INDUSTRY OF UKRAINE

**Evtushenko Olga, a candidate of Technical Science, head lecturer, Lych Inna, a candidate of Technical Science, docent, Vlasyuk Ivanka, student
National University of Food Technologies, Kyiv**

Analysis of traumatism reasons at meat processing factories allows to develop reasonable and effective ways of workers' injury prevention and risk reduction. The methods of univariate correlative-regressive analysis and retrospective prognostication were applied. We had determined factors affecting injuries occurrence. The most dangerous professions at meat processing factory are: a butcher, a loader, a repair mechanic and a carcass processor. The dynamics of butcher's traumatism is described by an exponential function and tends to increase. The dynamics of loader's traumatism is described by 3rd degree polynomial. The dynamics of carcass processor's traumatism changes with acceleration and is described by 5th degree polynomial. The dynamics of repair mechanic's traumatism is described by 4th degree polynomial. Comparative evaluation of prognosis results and industrial traumatism statistics for 2012 year showed that average prognosis reliability made up to 85,37%. The research results can find their application in improvement of management decision projects as to providing safe working conditions for meat processing factory employees.

Анализ причин травматизма на мясоперерабатывающих предприятиях позволяет разработать обоснованные и эффективные способы профилактики и снижения риска травматизма работников. Применены методы однофакторного корреляционно-регрессионного анализа и ретроспективного прогнозирования. Определены факторы возникновения травм. Наиболее опасными на мясоперерабатывающем предприятии являются профессии: забойщика скота, грузчика, слесаря-ремонтника и обработчика туш. Динамика травматизма забойщика скота, описывается экспоненциальной функцией, имеет тенденцию к росту. Динамика травматизма грузчика описывается полиномом 3-й степени. Динамика травматизма обработчика туш изменяется с ускорением и описываются полиномом 5-й степени. Динамика травматизма слесаря-ремонтника описывается полиномом 4-й степени. Сравнительная оценка результатов прогноза на 2012 год статистике производственного травматизма за 2012 год показала, что средняя достоверность прогноза составила 85,37 %. Результаты исследования можно использовать при совершенствовании проектов управленческих решений по обеспечению безопасных условий труда работников мясоперерабатывающих предприятий.

Keywords: safety, work, traumatism, risk, accident, prognosis.

Introduction. The current status of occupational safety in the agricultural sector of Ukrainian economics can't be considered satisfactory even with increased funding of OSH measures and improvement of supervisory activities.

By the number of industrial accidents agricultural sector stands down only to the coal industry, and as to fatal accidents it ranks first among all industries [1–2].

Because of breaches in the integrity of agricultural organizational structure the safety ensurance system was also broken. Such situation hinders carrying out focused OSH work both at the plant and its subdivisions, detecting dangers of its economic activities timely, analyzing them, taking precautions to reduce probability of accidents, preventing of situations that could cause injury to employees [3].

Scientific background and OSH measures ensurance in meat processing industry, based on it, are unsatisfactory, too.

This situation is largely caused by presence of significant number of industrial hazards, elimination of OSH services at enterprises, district and regional Agricultural Development offices in state administrations, poor competence of branch safety management system, absence of appropriate traumatism analysis. The reasons above are complemented with lack of preventive measures, irresponsibility of employers, who neglect the demands listed in the Law of Ukraine "On Labour Protection" and regulatory acts regarding OSH, and little number of scientific research on development of ways and means to eliminate industrial hazards.

Studying injury reasons and circumstances at agricultural complex meat processing branch would allow to elaborate reasonable and effective ways of workers' injury prevention and risk reduction. Due to this it will become possible to determine directions and guidelines for accident prevention at the sectoral, regional and industrial levels of safety management in agricultural production. This is an important scientific task, primarily related to the solution of social problems.

A purpose of this work is to study occupational traumatism indications at meat processing plants of AC.

Research object: occupational traumatism occurrence at meat processing plants of AC during 2001...2011 years.

Research methods: the study was carried out using methods of univariate correlative-regressive analysis and retrospective prognostication.

Results and discussion. The study of OSH condition at meat processing plants of Ukraine was carried out during 2001...2011 years, using improved method of univariate correlative-regressive analysis [5-6].

As a result of accounting and analysis, relevant indications of occupational injuries were selected and used as the primary database for analysis and prediction of such traumas, and preliminary analytical smoothing was conducted. The resulting sequence of smoothed values at regular time intervals (1 year) is perceived as a time series, which is used to study the law of average value change, with the construction of mathematical model of the trend and based on this – a prediction of the future time series' behavior. For ease of calculations, we assume the year number (t) reduced by 2000 as factor variable (x): $x = t - 2000$, and as resultant variable (y) – the number of accidents. Trend analysis is performed using method of simple regression procedure. During it the following results were produced: from a few mathematical models were selected those with greater accuracy in the experimental dependency description; a prognosis was made on the basis of the selected model with 95% confidence intervals.

When analyzing accidents at the meat processing enterprises, it was found that 31% of all accidents occur in butchering and primary processing of livestock [4]. Analysis of injury dynamics in primary processing of livestock displays approximately even growth of the indication at regular intervals and is described by increasing linear dependency (Fig. 1).

In the raw material area deboning, trimming and cutting of meat take place. Analysis of injury dynamics in that area showed accelerating changes of dynamic series levels, and those are described by 4th degree parabola (Fig. 2). Analysis of injury dynamics in edible fats melting area showed accelerating changes of dynamic series levels, which are described by 4th degree polynomial (Fig. 3).

In the thermal area roasting of meat production in ovens is carried out; variations of technological parameters are characteristic, this can cause accidents. Analysis of injury dynamics in thermal area showed accelerating changes of dynamic series levels, which are described by 5th degree polynomial (Fig. 4).

It is found that the most dangerous professions at meat processing factory in primary processing of livestock are: a butcher, a loader, a repair mechanic and a carcass processor.

The dynamics of butcher's traumatism in the last few years tends to increase (Fig. 5). The most adequate description of it is expressed by exponential function. The dynamics of loader's traumatism is described by 3rd degree polynomial (Fig. 6). The dynamics of carcass processor's traumatism changes with acceleration and is described by 5th degree polynomial (Fig. 8). The dynamics of repair mechanic's traumatism is described by 4th degree polynomial (Fig. 7).

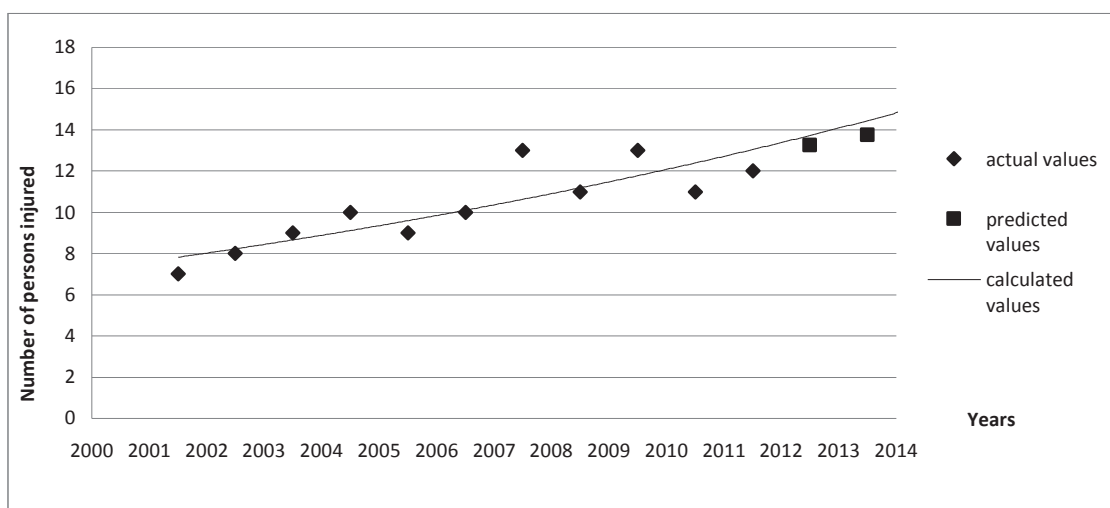


Fig. 1 – Dynamics of the number of injured people in the shop of slaughtering

The dynamics of number of injured persons is shown on Fig. 9-12 as diagrams by type of events. Dynamic series of the number of workers, injured with objects that move, rotate or fly, tend to decrease.

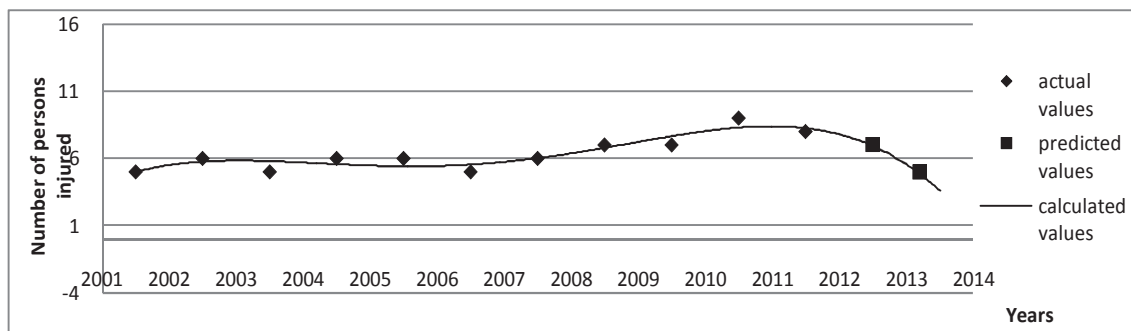


Fig. 2 – Dynamics of the number of injured people in the raw area

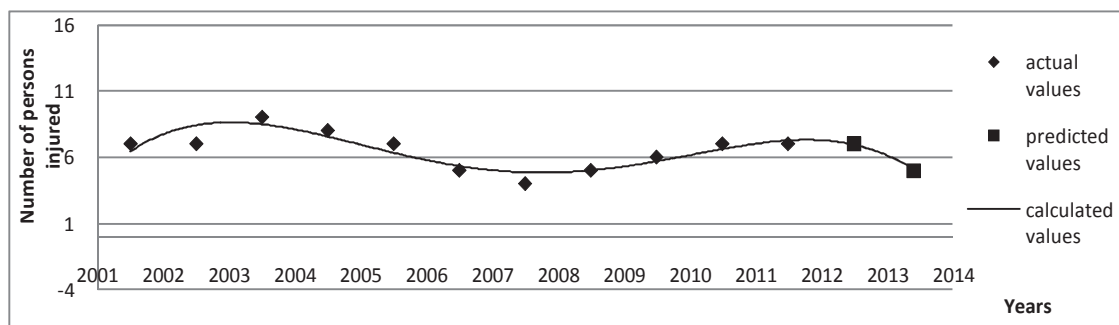


Fig. 3 – Dynamics of the number of injured people in the section of melting fat

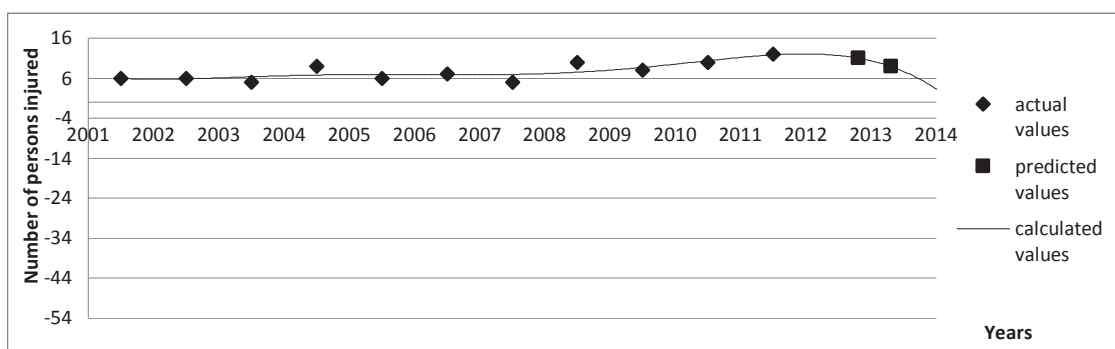


Fig. 4 – Dynamics of the number of injured people in the thermal section

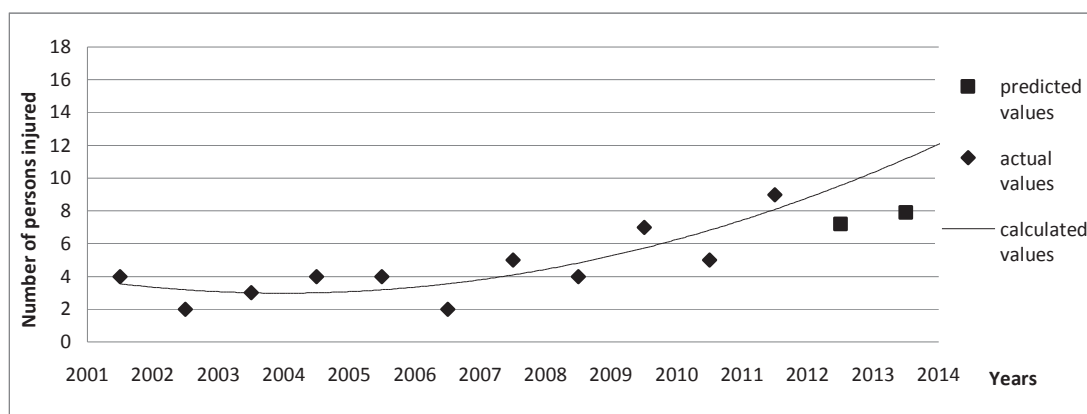


Fig. 5 – Dynamics of the number of injured people by the profession cattle slayer

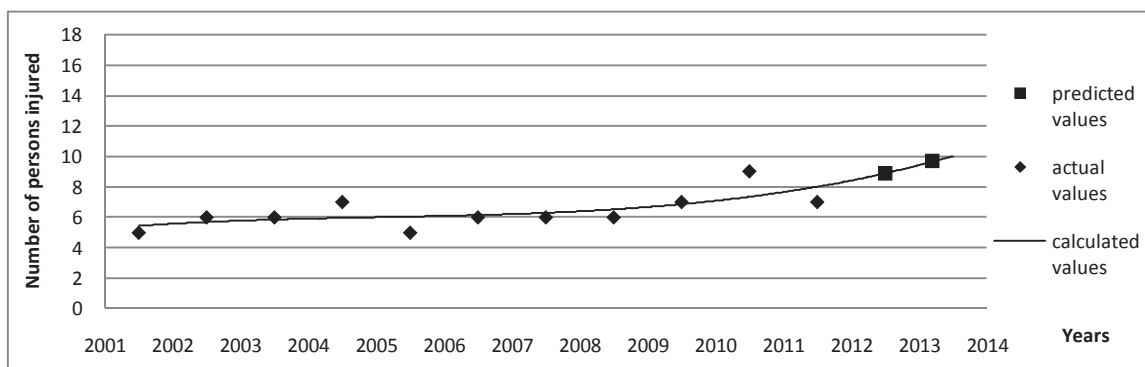


Fig. 6 – Dynamics of the number of injured people by the profession loader

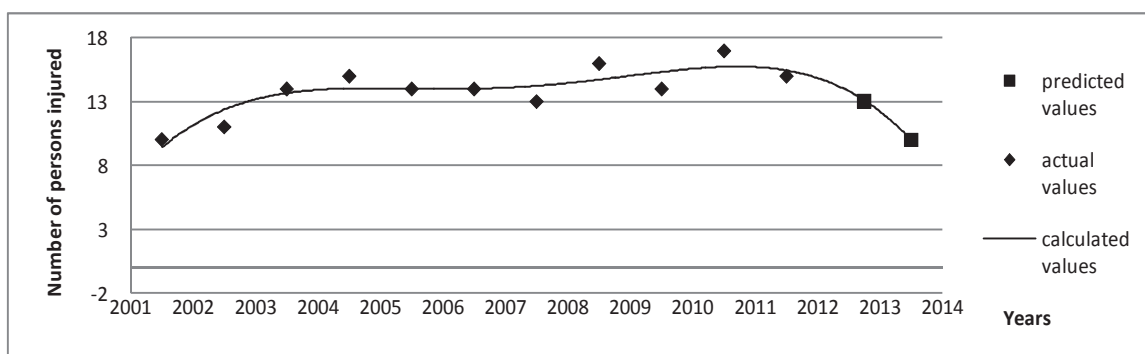


Fig. 7 – Dynamics of the number of injured people by the profession millwrights

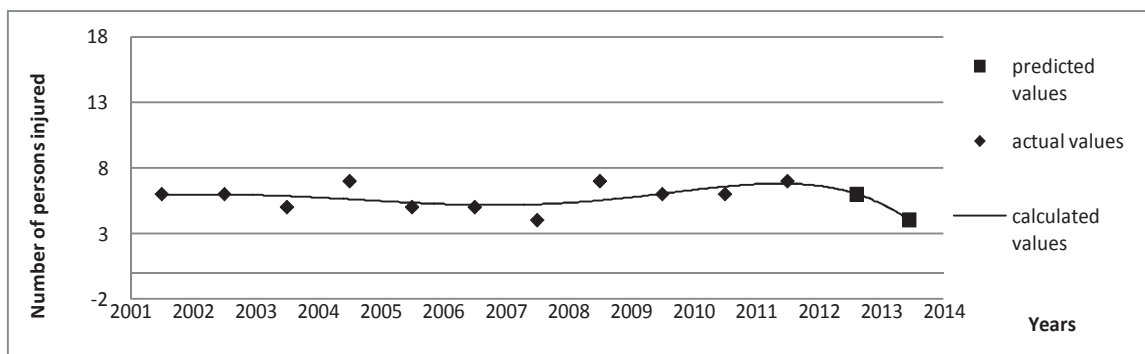


Fig. 8 – Dynamics of the number of injured people by the profession handler of brawn

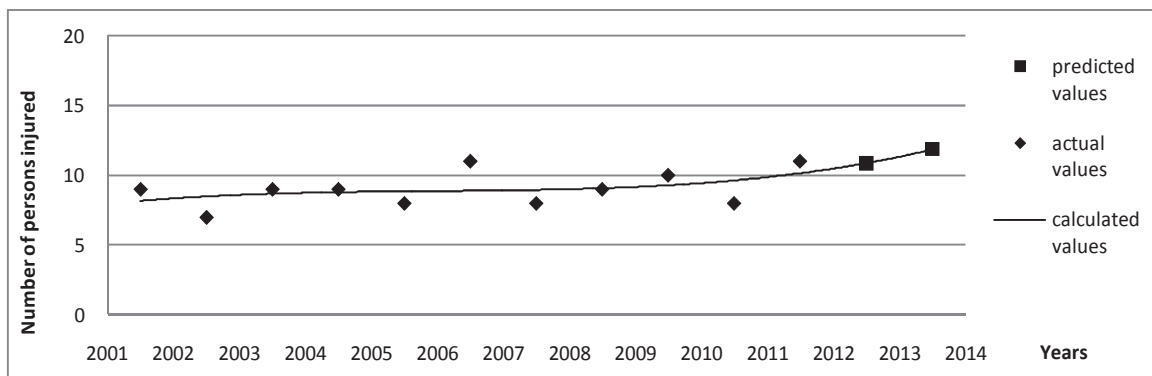


Fig. 9 – Dynamics of the number of injured people by types of events (fall of the injured person)

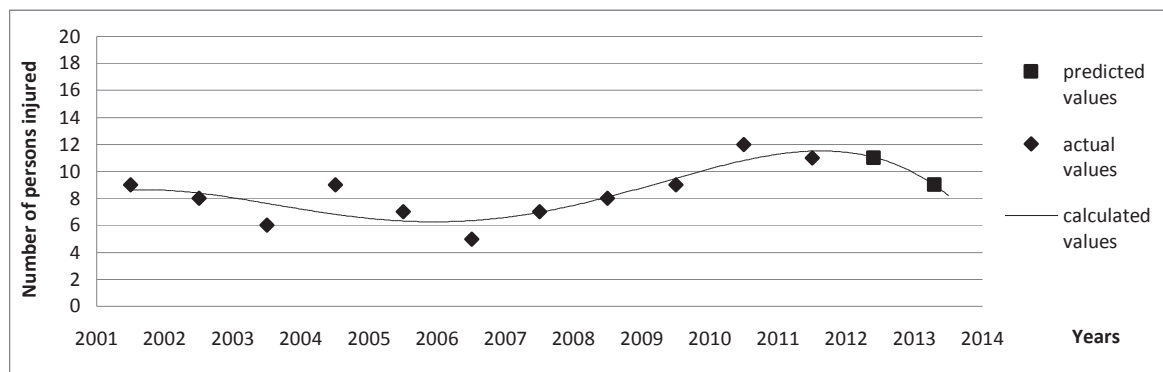


Fig. 10 – Dynamics of the number of injured people by types of events (influence of the moving objects)

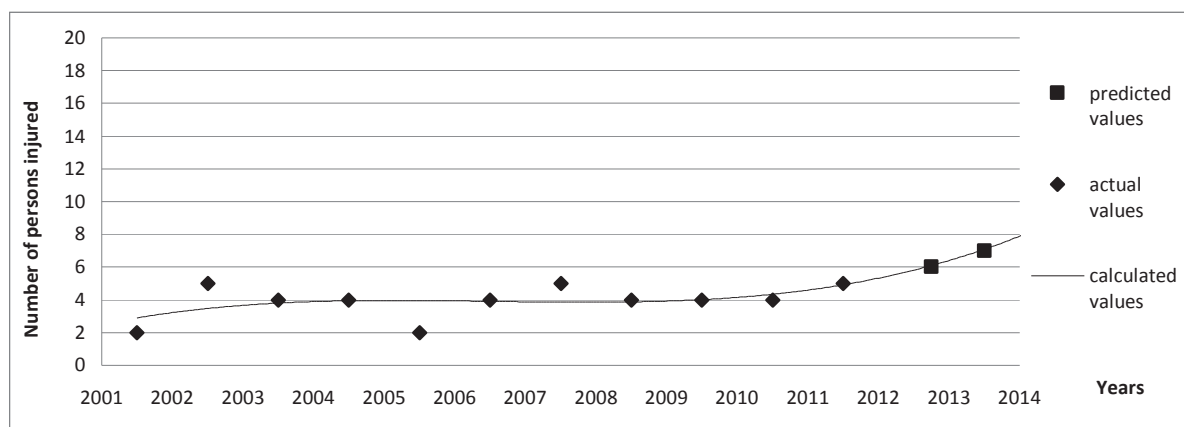


Fig. 11 – Dynamics of the number of injured people by types of events (influence of the harmful substances)

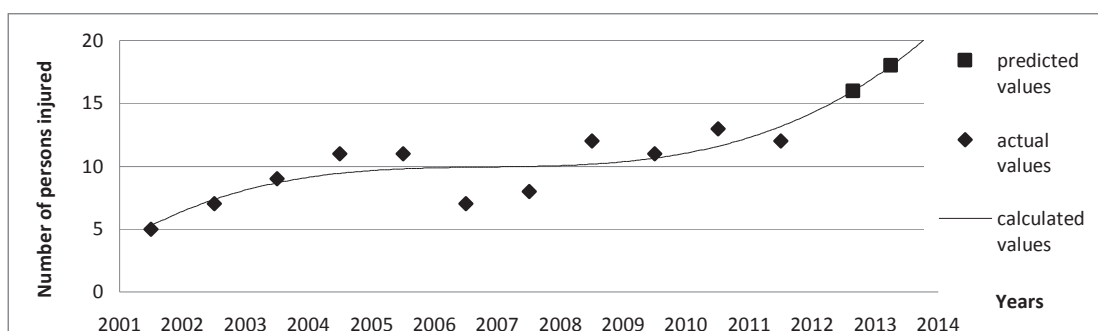


Fig. 12 – Dynamics of the number of injured people by types of events (fall of the objects)

The most adequate description of such dynamics is expressed by 4th degree polynomial. Dynamic series of number of persons injured because of themselves falling, those of persons injured because of hazardous substances and those of persons injured because of falling or collapsing objects or materials tend to increase and are described by polynomial dependency.

The results of traumatism indications prognostication for 2012 are listed in Table 1.

Prognosis error “-” means deteriorating social-economic conditions and non-usage of preventive measures, while “+” means responding and carrying out preventive safety measures based on determined indications.

Comparative evaluation of prognosis’ and industrial traumatism indications analysis’ results for 2012 year showed that average prognosis reliability made up to 91,26 %. Scale of reliability estimations states it as a good result. Especially great benefits from prognosis are to be made in control of events specific for injury prevention, though its reliability degree is difficult to check. The reason of this is “self-annulment”: prognosis becomes unreliable just because it was made. All this demonstrates that forecast quality can’t be measured only by its reliability. For example, when subdivision chiefs receive a prognosis on injury circumstances, they will act in a way to

prevent accidents. Therefore, prognosis has to be evaluated not only by its reliability, but by its benefit for decision-making specialists.

Table 1 – Prognosis results for total traumatism indications

| Parameter name | 2012 | | |
|--|--------------|-----------|---------------------|
| | Initial data | Prognosis | Prognostic error, % |
| 1. Place of accident occurrence: | | | |
| - slaughter and primary processing of live-stock | 14 | 13,2 | -6,06 |
| - raw materials area | 8 | 7,1 | -12,68 |
| - edible fats melting area | 6 | 7 | 14,29 |
| - thermal area | 11 | 11,8 | 6,78 |
| 2. Victim profession: | | | |
| - butcher; | 10 | 9,5 | -5,26 |
| - repair mechanic; | 14 | 14,3 | 2,10 |
| - loader; | 9 | 9,4 | 4,26 |
| - carcass processor | 6 | 6 | 0,00 |
| 3. Event type: | | | |
| - fall of the injured person | 10 | 10,8 | 7,41 |
| - fall or collapse of objects, materials | 13 | 13,7 | 5,11 |
| - effect of hazardous substances | 6 | 5,9 | -1,69 |
| - effect of objects that move, rotate or fly | 10 | 11 | 9,09 |

Conclusions. Experimental complex research of industrial traumatism indications in case of Ukrainian meat processing factories allowed to determine the most important factors affecting injuries occurrence. The most dangerous professions at meat processing factory are: a butcher, a loader, a repair mechanic and a carcass processor. For example, in the last few years dynamics of butcher's traumatism, which is described by exponential function, tends to increase. The dynamics of loader's traumatism is described by 3rd degree polynomial. The dynamics of carcass processor's traumatism changes with acceleration and is described by 5th degree polynomial. The dynamics of repair mechanic's traumatism is described by 4th degree polynomial.

The most efficient method of injury risk prognostication is retrospective prognosis. Comparative evaluation of prognosis results and industrial traumatism statistics for 2012 year showed that average prognosis reliability made up to 85,37%. However, when predicting risk of occupational injuries for a long term, it is difficult to verify its reliability, since the presence of prognosis makes factory chiefs acting to eliminate accidents reasons.

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