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# РОЗУМНИЙ КОМУНІКАТОР ДЛЯ ОЦІНКИ ЗДОРОВ'Я МАЛИХ СУБПОПІЛЯЦІЙ З ВИКОРИСТАННЯМ ІНСТРУМЕНТУ «STEPS»

# SMART COMMUNICATOR FOR SMALL SUBPOPULATIONS HEALTH ASSESSMENT USING STEPS INSTRUMENT

**Анотація**. Запропоновано впровадження електронної версії опитувальника STEPS на основі самообстеження респондента з самотестуванням сечі. Це один із найдоступніших за ціною та найефективніший з точки зору охоплення невеликих груп населення (місцевих, робочих, студентів, пацієнтів загальної практики чи інших спільнот) у країнах із низьким рівнем доходу. Метою роботи є використання розумного комунікатора, розробленого в Інституті кібернетики імені Глушкова у співпраці з Інститутом геронтології імені Д.Ф. Чеботарьова.

**Abstract**. The digital version of the STEPS survey implementation based on self-examination of the respondent with self-testing of urine is offered. It is one of the most affordable in costs and most effective in terms of coverage for small subpopulations (local, labor, student, GP patients or other communities) in low-income settings. The aim of the work is to use smart communicator developed in Glushkov Institute of Cybernetics in collaboration with D.F. Chebotariov Institute of Gerontology.

In Ukraine, like in many low- and middle-income countries, the institutionalization of public health is in its infancy. In this regard, the problems of epidemiological surveillance remain unresolved. Unfortunately, so far in Ukraine, mostly passive (i.e., based on statistics from various sources) epidemiological surveillance on non-communicable diseases is used. Monitoring data under this surveillance are suitable for the analysis and prediction of morbidity and mortality, but do not provide any information on behavioral risk factors, which is usually collected as part of active epidemiological surveillance. At the same time, the Global Burden of Diseases project currently identifies more than 80 risk factors for noncommunicable diseases, which are divided into 3 groups - environmental, behavioral, and metabolic [1]. Alcohol abuse, smoking, malnutrition, and low physical activity are just some of the behavioral risk factors that can be modified for the population health improvement. Information on these risk factors together with the fixation of the most common chronic conditions is collected in a very limited form within the framework of the All-Ukrainian Household Survey [2].

Undoubted advantages of the passive epidemiological surveillance are its relative cheapness and coverage of large areas. However, due to the dependence on different providers, the quality and timeliness of receiving data is difficult to control. In addition, some data, such as behavioral or metabolic risk factors, can only be obtained through one-to-one communication, which is only possible with active surveillance. Active surveillance provides the most accurate and timely information, but it is also expensive.

To assess the main behavioral and biological risk factors for noncommunicable diseases among Ukrainians, in 2019 a population survey was conducted with a medical examination, consistent with the principles, methods and procedures of the WHO-approved Stepwise approach to surveillance (STEPS) [3]. This survey not only provided unique information, but also showed the breadth of the STEPS technology potential of both in the assessment of risk factors for noncommunicable diseases, and in the planning and evaluation of the results of preventive interventions [4]. Although the STEPS technology offers its electronic version, its transfer to the subpopulational level causes difficulties of an institutional, regulatory, organizational and technical nature.

We offer a digital system of active monitoring of the health of small middle-sized subpopulations (local communities, workers, students and other groups) according to the already tested STEPS methodology using Poin-of-Care Testing technologies.

Methods. The development of Point-of-Care Testing (POCT) technology as a form of laboratory rapid analysis in many countries have contributed to the regular active surveillance of diseases and their risk factors with mobile communications use. POC diagnostics offers significant advantages over traditional laboratory tests due to their portability, low cost, speed and ease of use [5]. For active epidemiological surveillance, POC-diagnostics using urinal test strips is especially relevant. In mass medical examinations, urine test strips are usually used to analyze urine for hemoglobin, protein or albumin, leukocytes, nitrites and glucose. In screening, the use of a combined urinary indicator is to some extent comparable to such a procedure in the framework of conventional preventive medical examination, taking into account the balance of benefits and harms for a number of particularly dangerous diseases.

Digital version of the STEPS survey based on self-examination of the respondent with self-testing of urine on test strips is one the most affordable in costs and most effective in terms of coverage for small and middle-sized subpopulations (communities, labor and student collectives etc.). Meanwhile, the most challenging issue for some groups of respondents is the ability to manage survey in digitalized form.

Expanding access to the Internet has increased the availability of health information, but many Internet users continue to face problems accessing high-quality, computer-literate medical content. It should be emphasized that individuals who do not have sufficient skills to navigate the Internet may unknowingly gain access to health information that is inaccurate and potentially dangerous to their overall health. This phenomenon is especially problematic for the aging population, which is at particularly high risk of disability and chronic diseases. Compared to their younger peers, older people are more likely to have poor health literacy, which negatively affects access to health care, chronic disease management and health control. Computer (or digital) literacy involves a person's ability to be productive and efficient, and easily adaptive to new technologies to solve problems or answer questions with an electronic device. Computer literacy is especially important among an aging population because skillful use of technology can help slow the decline in cognitive function in persons at the age of 50+. Low computer literacy among the elderly often prevents these groups from successfully accessing and deciphering high-quality sources of medical information on the Internet. Both health and computer literacy are not static; rather, they depend on a person's health, motivation, level of education, and changes in technology. Without proper attention to health and computer (or digital) literacy among the aging population, there is a risk of restoring the intergenerational gap in digital competence, exacerbating existing disparities in health care for different age groups and perpetuating inequalities, leading to the spread of behavioral risk factors, endangering patient safety, and deteriorating health among vulnerable populations.

Another important obstacle in the implementation of a digital system for active surveillance of noncommunicable diseases and its risk factors may be individual functional impairments of survey participants. In particular, the adequacy of color vision is an important element in the validity of self-testing using an urine test strip. In the case of any form and severity of color blindness, the data of visual analysis of urine are unreliable and should not be included in the overall results. In the proposed communicator, the online Ishihara Color Blindness Test is used for testing the subjects for the adequacy of color vision, the reliability and relevance of which has been confirmed by the research of Marey H. et al. [6].

An important problem in all online surveys is the cognitive adequacy of the subjects. In this case, we are talking about survey participants who are objectively unable to correctly answer some questions due to their cognitive difficulties and impairments. This refers primarily to the elderly and Minority Populations with Low Education Levels. According to Wood RY et al. (2021) [7] in community interventions or research the results of the MMSE can be used as inclusion criteria for individuals participating. In this regard, the authors considered it appropriate to introduce some questions from the traditional MMSE test into the online history.

All of the described functions are included in smart communicator developed in Glushkov Institute of Cybernetics [8]. It is one of the key components of digital system of epidemiological

surveillance for small subpopulations. The communicator is a portable electronic STEPS data collection device suitable for communicating with any STEPS data management platform using Wi-Fi or mobile networks. It provides the main interface for collecting STEPS data and transmitting it to a data management server (or site) during fieldwork. The server, in turn, provides basic data management tools by remotely receiving and processing data (via a mobile network or Wi-Fi).

Communicator supposes to be used for three purposes. First is data processing during the STEPS electronic survey. Second is generating individual test results. Third is generating generalized epidemiological information on the prevalence of noncommunicable diseases and their risk factors in the target subpopulation, suitable as information support for planning and implementing preventive interventions in target subpopulations. Although a STEPS survey requires the use of multiple communicators, the cost of acquiring them is fully offset by the savings in traditional survey costs.

Conclusions. The advantages of the proposed digital system for active monitoring of the health of small subpopulations is that it is based on the already proven STEPS methodology using cheap Poin-of-Care Testing technologies. Within the framework of this system, the collection of information according to STEPS standards and the integration of databases into the EpidInfo package [9], specially designed for processing the results of STEPS survey, are provided. In addition, within the framework of this system, actuarial analytics, CEA analytics, and forecasts of changes in the health of the subpopulation in accordance with the invested funds are available. The system works both online and offline, can be implemented both stationary and in the form of mobile modules, has significant commercial potential.

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# РОЛЬ ПАТЕНТНИХ ДОСЛІДЖЕНЬ В ПАТЕНТНІЙ СТРАТЕГІЇ НАУКОВОЇ УСТАНОВИ

# THE ROLE OF PATENT RESEARCH IN THE PATENT STRATEGY OF A SCIENTIFIC INSTITUTION

**Анотація**. Розглянуто питання проведення патентних досліджень в наукових установах, їх роль в патентній стратегії наукової установи. Патентні дослідження дозволяють визначити патентну ситуацію щодо об'єкта господарської діяльності, встановити рівень техніки для підготовки розробки до патентуванню та відіграють важливу роль в патентній стратегії наукової установи.

**Abstract**. It is considered conducting patent research in scientific institutions, their role in the patent strategy of a scientific institution. Patent research allows to determine the patent situation regarding the object of economic activity, to establish the level of technology to prepare patenting and play an important role in the patent strategy of the scientific institution.