



# The place of work diagnostic instrumental measurements in the protocols of occupational health tasks

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## Abstract

**Aim:** Work diagnostic examinations are carried out to assess aptitude, job selection, pre-rehabilitation assessment and follow-up, career guidance. Work diagnostic tests include aptitude tests, various questionnaires, work practice tests and instrumental examinations. For instrumental testing, portable work psychology testing instruments or so-called ‘work-simulators’ can be used. Work simulators have been used for selection, assessment of aptitude, training for jobs requiring a high level of attention and with an increased risk of accidents. In the author’s opinion, work diagnostic instrumentation, work simulator tests (e.g. ErgoScope) can be well integrated into the protocol of primary and specialised occupational health care tasks.

**Methodology:** The author conducted an online questionnaire survey among occupational health specialists working in Hungary to find out whether they use work diagnostic tools, and if so, which ones, and whether they would be willing to send workers for instrumental work diagnostic tests. 272 second-level medical fitness for work examinations were reviewed for their inclusion in the instrumental work diagnostic tests.

**Findings:** It is clear from the questionnaire responses that very few occupational health specialists have the opportunity to use occupational diagnostic instrumentation in their work, but 60.62% of them would be happy to send patients for instrumented skills testing. From the documentation of the second level

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medical fitness for work examinations, the author selected those where aptitude tests had been carried out and those where an instrumental aptitude test would have assisted the assessment.

**Value:** It can be concluded that, in addition to the second level occupational/professional medical fitness tests, instrumental occupational diagnostic tests could be easily integrated into the examination protocols of occupational health, in the first level occupational/professional medical fitness tests, in career counselling and in the occupational rehabilitation process, and would significantly assist the work of occupational health professionals.

**Keywords:** occupational diagnostics, work simulator, ErgoScope, occupational health

## Introduction

In Hungary, employees have the right to safe working conditions and a working environment that do not endanger their health, which the employer is obliged to provide. The occupational health service assists the employer in this task (Act XCIII of 1993<sup>1</sup>). Employers must provide basic occupational health services for their employees. Occupational health services at all three levels (primary occupational health care, specialised care and central services) provide occupational health services. The basic occupational health services carry out medical fitness for work examinations, care for workers with chronic illnesses and provide information to workers on their job, health and safety at work. The primary occupational health services work with employers to prevent ill health and to create a safe working environment that does not endanger health. This is achieved through participation in risk assessment and occupational rehabilitation measures. The main tasks of occupational health centres are to carry out secondary occupational and vocational medical fitness examinations and to assist in the investigation of occupational diseases. The Occupational Health Centre has clinical, occupational psychology, toxicology and ergonomics departments, and in addition to investigating occupational diseases and providing expert advice, it also supports the work of occupational health professionals working in primary and specialist care by offering consultation and professional guidance (Act XCIII of 1993<sup>1</sup>, Decree No 27/1995<sup>2</sup>). The compulsory instrumentation

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1 Act XCIII of 1993 on Labour Protection.

2 Decree 27/1995 (VII.25.) NM on occupational health services.

of occupational health practices is regulated by a decree, according to which portable occupational psychological testing devices and work simulators are not compulsory equipment in the practices of primary and specialised occupational health care services.<sup>3</sup>

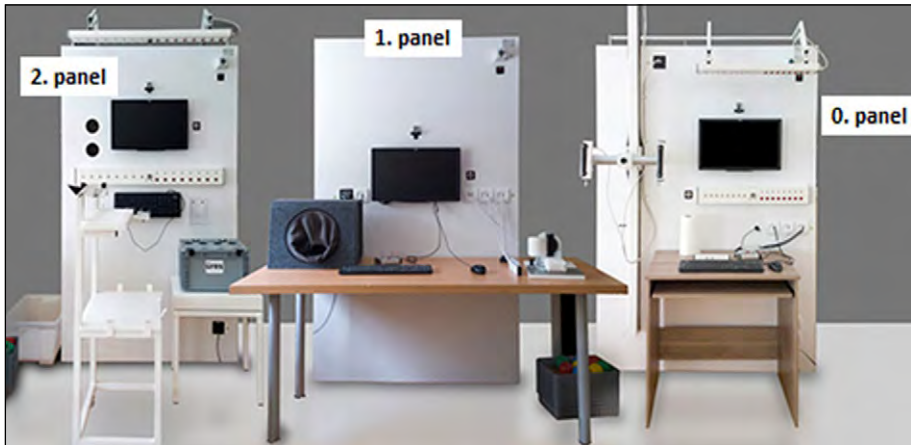
Occupational diagnostic tests are carried out in a wide range of cases, to assess aptitude, for job selection, pre-rehabilitation assessment and follow-up, career readiness, career guidance. The general occupational diagnostic examination assesses the general abilities, mental and physical condition that affect the ability to work. The purpose of a targeted job diagnostic test is to assess the skills needed to perform a job, a sub-task. Job diagnostic testing is done using aptitude tests, various questionnaires, work practice tests and instrumental tests. Work psychology testing instruments can measure specific sub-skills, the so-called ‘work sample tests’, the work simulators can be used to test several skills and tasks in one test. Work simulators have long been used for training, assessing aptitude, selection for a particular job (aircraft simulator, nuclear power plant control room simulator, live working training track, material handling simulator, medical, surgical simulators), skills development, entertainment. To assess work readiness, according to the international literature, the most commonly used work simulators would be the Blankenship FCE system, ERGOS work-simulator, Ergo-Kit, Valpar Work Samples, Metriks Education, Isenhagen Work System, and a four-panel work diagnostic tool developed in Poland. The Ergo-Scope work simulator (Figure 1), developed in Hungary, was first used in the Government Offices but now the University of Pécs and a security service company also have ErgoScope work simulators (Izsó, 2012; [URL1](#); Juhász, 2019; Tokarski, 2022; [URL4](#); Goutteborge, Wind, Kuijer & Frings-Dresen, 2004; Rustenburg, Kuijer, & Frings-Dresen, 2004; Izsó, Székely & Dános, 2015; Dévényi & Tibold, 2022).

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3 Decree No 60/2003 (X. 20.) of the EESC on the minimum professional conditions for the provision of health services. Annex No 1 Occupational health code: primary and specialised occupational health care 2501 and 2502.

**Figure 1**

*ErgoScope work simulator*



*Note.* [URL2](#).

The ErgoScope, an installed work simulator, consists of 3 panels (panel 0, panel 1, panel 2) and can be used to perform 36 tasks, workflows and measure 203 sub-skills. On panel 0 of the ErgoScope, dynamic and static forces can be tested (pushing, pulling horizontally, vertically and lifting to chair height) (Figure 2). On panel 1, the tasks (wrist grip, finger grip, touch, one-handed, two-handed, pencil use) can be performed in a sitting position (Figure 3). In panel 2, all tasks are performed standing up, and eye-hand coordination, attention, complex tasks, tolerance of monotony and workload are tested (sequencing switches, quickly manipulating buttons, performing tasks in the right order, sorting, sorting and quickly completing) (Figure 4). The psychological and functional realism of the ErgoScope work simulator matches the simulated work tasks (Juhász, 2019; Rustenburg, Kuijjer, & Frings-Dresen, 2004; Jókai, 2018).









## Objective

We aim to integrate work diagnostic instrumental measurements into the testing protocols for primary and specialised occupational health care tasks in a way that best supports the work of occupational health professionals. Before reviewing the testing protocols, we wanted to get the views of occupational health specialists working in primary care in Hungary on the use of occupational diagnostic instrumentation.

## Methods

In 2020, we conducted an online questionnaire survey among occupational health specialists working in Hungary entitled '*Demand for the use of occupational diagnostic tools in primary and specialised occupational health care – Survey*'. The link to the questionnaire was sent to the e-mail address list of occupational health specialists provided to the Occupational Health and Hygiene Department of the National Center for Public Health and Pharmacy (NNGYK) for professional correspondence. In addition to the consent form, the questionnaire contained 20 questions, including 12 single-choice, 4 multiple-choice, 2 multiple-choice checkboxes and 2 opinion questions. The completed and submitted questionnaires were received in excel spreadsheets and did not contain any identifiable data, thus ensuring complete anonymity during the online survey. The questions covered the branches of the economy served by the occupational health services, the occupational diagnostic testing tools used or known to be used by the services, and knowledge of assistive technologies.

The online questionnaire survey showed that work diagnostic instrumental tests were welcomed by the profession, so we analysed the feasibility of incorporating instrumental aptitude tests through examples of aptitude tests already carried out.

To support the justification for the instrumental aptitude tests, we analysed the documents of the second level occupational medical aptitude tests carried out at the Occupational Health Care Unit of the NNGYK between 2019 and 2021. Of the cases reviewed, we selected those where an instrumental aptitude test was performed and analysed whether the objective result of the aptitude test influenced the decision on fitness.



## Results

The link to the questionnaire was sent to 1307 addresses, 235 person have opened the questionnaire, a total of 88 completed questionnaires were received, 3 of which were answered in the negative to the consent form, so these questionnaires were excluded from the processing. Finally, 85 questionnaires were processed. Half of those surveyed work full-time exclusively as occupational health specialists. The response rate is low, but it should be noted that this is typical for online surveys. On the other hand, the sample was obviously selective, as only those with a higher propensity to complete the questionnaire and who were interested in the questionnaire topic were included in the sample. The valid responses received are not representative of all primary occupational health services, but those that are open to new tasks are. According to the respondents, the diseases that were most often problematic in the assessment of fitness were the same as the diseases most often encountered in the prescription of the NNGYK at the stage II fitness assessment. Thus, despite the few responses, the target group for whom we would like to introduce instrumental occupational diagnostic testing in occupational health as a priority has been confirmed.

The primary occupational health services that responded to the questionnaire serve workers from all sectors of the economy. A single primary occupational health service may have contracts with several companies, so that it can cover workers from several sectors of the economy. To question 3 of the questionnaire ‘For which medical conditions/illnesses did you most often request a grade II occupational/professional medical fitness examination?’ the occupational health specialists in the survey most often referred workers for a degree II medical examination for psychiatric conditions, cardiovascular and musculoskeletal disorders (Figure 6). In Table 1, the lesions for which work diagnostic instrument measurements would have helped in deciding on eligibility (lesions marked in green) represent 56 mentions, 36.1% of the total. This means that in more than a third of the cases where occupational medical aptitude tests at stage II requested by the doctors completing the questionnaire, instrumental aptitude tests would have helped in the decision.

**Figure 6**

*Percentage of health conditions for which a Grade II medical examination is most frequently requested, based on the online questionnaire survey. The health conditions for which an occupational diagnostic assessment might have been warranted, depending on the nature of the condition, are highlighted in green.*

Disease	Number of mentions	Percentage distribution of mentions
Psychiatric disorders	25	16,13%
Musculoskeletal disorders	21	13,55%
Cardiovascular diseases	16	10,32%
Epilepsy	15	9,68%
Post-stroke condition	13	8,39%
Ophthalmic disorders	12	7,74%
Noise pollution	12	7,74%
Diabetes mellitus	11	7,10%
Other neurological abnormalities	8	5,16%
Disability: reduced mobility	6	3,87%
Disability: hearing impairment	5	3,23%
Cancer diseases	4	2,58%
Imbalances	3	1,94%
Endocrinological lesions	2	1,29%
Disability: intellectual disability	1	0,64%
Autoimmune diseases	1	0,64%
Disability: visual impairment	0	0%
Disability: autism spectrum disorder	0	0%
<b>Total mentions</b>	<b>155</b>	<b>100%</b>

*Note.* Table prepared by the author.

Questions 10 to 19 of the questionnaire asked about knowledge of occupational diagnostic measuring instruments and whether occupational health specialists would be willing to send workers for testing. 60.62% of the respondents had no experience but would send. 3.61% have experience and would still send a patient for an instrumented skills test. The highest percentage would be sent for a balance test (stabilometer) ([URL5](#)), a memory test (tachyscope) ([URL6](#)), an attention test and a work simulator test (ErgoScope) ([URL2](#)). Of the 85 survey respondents, 76 (91.57%) occupational health specialists do not have access to an ability test.

At the Occupational Health Specialist Care Unit of the NNGYK, I reviewed the documentation of 272 second-level occupational medical fitness examinations from 2019 to March 2021. The three most common health conditions for which the Grade II medical fitness for work examination was carried out were the same as in my online questionnaire survey, musculoskeletal, psychiatric and cardiovascular conditions. Of the secondary occupational medical fitness tests reviewed, 29 would have benefited from an instrumental occupational diagnostic test to assess fitness. Of the 29 cases, only 6 workers had the possibility of an instrumented aptitude test.

Some of the more interesting cases are the 23 secondary occupational medical examinations in which it was not possible to carry out an occupational psychological instrumental aptitude test:

- Residual paralysis due to stroke as a symptom of right upper limb weakness. They have to use a computer for their work, and the existing abilities of their fingers and hands should have been tested. The use of a keyboard on panel 1 of the ErgoScope ([URL2](#)) work simulator would have been ideal for this test.
- The small joints of the upper limb of a patient with multiple sclerosis were also affected. Much of their work involves using a computer, with a small amount of light manual handling. They would have had to test the movement of fingers, hands, arms, grip strength of fingers and hands. To perform this test, they were required to perform the tasks of keyboard use, key grip, pencil use and hand grip on the ErgoScope work simulator panel 1 ([URL2](#)).
- A person working as a kitchen assistant has a weak left side due to paralysis. Hand grip, hand-arm stability, wrist and hand rotation, standing, manual material handling skills should have been tested. These abilities could be tested with the ErgoScope work simulator in panel 0 lifting to chair height and in panel 1 hand grip, wrist flexion and in panel 2 with the workload task ([URL2](#)), Risossay finger dexterity tester ([URL7](#)).
- An employee who is undergoing an examination because of a hand finger amputation would be working as a warehouse worker. Hand grip, hand and arm stability, wrist and hand rotation, and manual material handling skills would have been assessed. These abilities could be assessed using the ErgoScope Panel 0 lifting to chair height and panel 1 hand grip, wrist flexion and panel 2 workload task ([URL2](#)) and the Ricossay finger dexterity test ([URL7](#)).
- The person was working as a cleaner until the employee suffered a skull injury with residual symptoms of loss of vision and paralysis. In this case, the following abilities should be assessed: hand grip, hand and arm stability, wrist and hand rotation, manual handling, motor coordination, standing,

utility. These abilities can be measured using the ErgoScope Panel 0 dynamic lift to chair height, panel 1 hand grip, wrist flexion and extension, panel 2 rotation from the eye, workload task (URL2), Ricossay finger dexterity tester (URL7), Crawford work test (URL8), tremor meter tests (URL9).

- The employee was working as a cleaner until the employee suffered a skull injury with residual symptoms of loss of vision and paralysis. In this case, the following abilities should be assessed: hand grip, hand and arm stability, wrist and hand rotation, manual handling, motor coordination, standing, utility. These abilities can be measured using the ErgoScope Panel 0 dynamic lift to chair height, Panel 1 hand grip, wrist flexion and extension, Panel 2 rotation from the eye, workload task (URL2), Ricossay finger dexterity tester (URL7), Crawford work test (URL8), tremor meter tests (URL9)
- The young employee, who worked as an electrical engineer, suffered an accidental injury to their hand and a residual contracture of the fingers. The skills to be tested are finger grip, hand grip, hand and arm stability. Work diagnostic tools to be used to test the required skills: ErgoScope 1st panel key grip, pencil grip, hand grip, 2nd panel rotation from the eye (URL2), Ricossay finger dexterity test (URL7), Crawford work test (URL8).

The six secondary occupational medical examinations, during which it was possible to take an occupational psychological instrumental aptitude test:

- Case 1. Dentist has memory loss due to a cerebral infarction. During the aptitude test, a tachistoscope memory test (URL6), an attention test (URL10), and the Ricossay finger dexterity test [20] for hand and finger dexterity, eye-hand coordination were performed. The scores were within the reference values and good manual dexterity was observed. They could continue working.
- Case 2. Armed security guard with limited movement of upper arm after shoulder injury. Tested with a tremor meter at examination (URL9), unable to hold the tremor meter in the target position. The employee accepted that he could not work as an armourer and would like to learn a new trade.
- Case 3. Armed security guard, non-dominant hand IV and V finger accidental amputation was questionable fitness. They were tested with a tremor meter (URL9), could not hold the tremor meter on purpose, so accepted that they were not fit for armed guarding, employer was able to transfer them to another job.
- Case 4. A worker with poor eyesight, who had been working as a cook for 20 years due to constantly deteriorating eyesight, was assessed for hand coordination (URL11) and Ricossay finger dexterity (URL7). Accurate hand and finger movements, a firm grip with fingers and good hand-eye coordination were observed and allowed to continue working as a cook.

- Case 5. Mechanical mechanic, progressive neurological disease as a consequence of musculoskeletal complaints due to their examination of their fitness. The worker was tested with a stabilometer balance test ([URL5](#)) and Ricossay finger dexterity test ([URL7](#)). The worker scored close to the lower limit of the reference values and was allowed to continue working. After a few weeks of work, they became tired quickly and their movements became unsteady due to fatigue, so they were no longer employed. In this case, if we had had the opportunity to perform the test series on panel 2 of the ErgoScope work simulator ([URL2](#)), we would have found out his excessive fatigue during light physical work.
- Case 6. Chimney sweep presented for a grade II fitness for work examination due to latent strabismus. They do not have to go out on the roof during their work. Their sense of balance was tested with a stabilometer ([URL5](#)), with good results. The employee was allowed to continue working.

## Discussion

Despite the small number of valid questionnaires completed (85 valid questionnaires received out of 1307 sent out), the responses received confirmed the importance of the wider use of occupational diagnostic instrumentation in occupational health and, through this, in occupational safety and health. More than half of the respondents, despite not using ability meters, would be happy to send patients for testing. Of the 18 groups of health conditions for which workers are sent for a second-degree occupational medical assessment, 6 (musculoskeletal conditions, post-stroke, ophthalmological conditions, mobility impairment, balance disorder, intellectual disability) may be worthwhile to perform work diagnostic measurements, depending on the loss of function, which accounts for one third of the requests for a second-degree occupational medical assessment in the questionnaire responses.

An analysis of the documentation of secondary occupational medical fitness examinations revealed that instrumental ability tests play a significant role in the assessment of fitness for work in secondary occupational medical fitness examinations. In five out of the six cases where we had the opportunity to carry out an instrumental assessment of ability, the assessment helped us to make a decision and supported the final opinion. In one case, the results of an instrumental occupational psychology test were acceptable, but were subsequently confirmed as unsuitable. In this case, further instrumental ability tests would clearly have helped to reach an earlier decision on unfitness, but due to a lack

of equipment, this was not possible. The ErgoScope work simulator could have been used to carry out the workload, monotony tolerance test series in order to find out the fatigue of the work.

During the analysed secondary occupational medical fitness examinations, it was realised during the routine medical examination that it was necessary to carry out occupational diagnostic tests. Thus, a long period of time elapsed between the first level medical examination and the second level medical opinion. If it is available to occupational health practitioners in primary services, i.e. they can refer a worker for an instrumented occupational diagnostic test, the time for the process can be shortened. Thanks to the shorter time to decide on fitness, the worker is off work for a shorter period and the employer does not have to pay replacement or absence. During the occupational rehabilitation procedure, instrumental work diagnostic examinations could be part of the scheme of occupational medical fitness tests, already carried out during the occupational fitness examination due to the changed health condition, and thus the occupational health specialist could immediately make a recommendation for the adaptation of the job, work environment, and the new job. In the occupational rehabilitation process, the time factor is also important for both the worker and the employer. A good example of the use of work diagnostic tests in career guidance is the career guidance and labour market counselling and development for disadvantaged young people at the Piarist Outlook Centre (Török, 2018; Glied, Nagy & Lázár, 2021).

## Summary

When occupational health specialists were interviewed, it was clear that specialists in the primary occupational health service were in favour of the possibility of sending workers for occupational diagnostic tests. Analysis of documentation of second-degree occupational medical fitness examinations has shown that in many cases instrumental occupational diagnostic tests would support or help in the decision. Most often, the use of the ErgoScope work simulator would have been necessary.

Among the tasks of occupational health, in addition to the second-degree occupational medical examination, first-degree occupational medical examinations, occupational medical examinations, career counselling and occupational rehabilitation procedures, instrumental occupational diagnostic tests would be of great help. For young people who are learning a trade, have a health condition or a disability, it is very important that they learn a trade that matches their abilities, so that they have a chance of finding work in the labour market.

Occupational rehabilitation can only be carried out successfully if the worker's skills are known and the risks of the jobs in the company and the skills required to fill them are known. Occupational rehabilitation is successful when a worker with a disability, chronic illness or disability can return to work and perform a full-time job.

Today, when some sectors of the economy are facing labour shortages, it is very important that all people of working age can find a job that matches their skills. This is the only way to optimise the distribution of labour in the labour market. This would be facilitated by the availability to occupational health services of instrumented occupational diagnostic tests, tests on the ErgoScope work simulator and portable occupational psychological ability testing devices. This could be achieved if at least the occupational health centre, and ideally some of the occupational health centres, were equipped with a 3-panel ErgoScope work simulator and portable occupational psychological ability testing equipment.

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## Online link in the article

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URL1: *Alkalmasság vizsgálati eszközök Magyarországon*. <https://prezi.com/cwl8epgjzidh/alkalmassagvizsgalati-eszkozok-magyarorszagon/>

URL2: *Innomed Medical’s website*. <https://www.innomed.hu/munkaszimulatorok>

URL3: *Munkaköri alkalmasság – vizsgálatok megváltozott munkaképességű és sérülékeny dolgozói csoportok körében.* [https://www.dsgi.hu/met/subsites/enye31/JokaiErika\\_ENYE31.pdf](https://www.dsgi.hu/met/subsites/enye31/JokaiErika_ENYE31.pdf)

URL4: *Ocena zdolności do pracy z zastosowaniem narzędzi do oceny funkcjonalnej oraz testów e-kompetencji.* [https://m.ciop.pl/CIOPPortalWAR/file/96348/Ocena\\_zdolnosci\\_do\\_pracy.pdf](https://m.ciop.pl/CIOPPortalWAR/file/96348/Ocena_zdolnosci_do_pracy.pdf)

URL5: *Description of Stabilometer.* <http://www.strukturainstruments.hu/stabilometer.html>

URL6: *Description of Tachistoscope.* <http://www.strukturainstruments.hu/dtc.html>

URL7: *Description of Risossay finger dexterity tester.* <http://www.strukturainstruments.hu/ricossay.html>

URL8: *Description of Crawford work test.* <http://www.strukturainstruments.hu/crawford.html>

URL9: *Description of Tremormeter.* <http://www.strukturainstruments.hu/mtr.html>

URL10: *Description of attention test.* <http://www.strukturainstruments.hu/aat.html>

URL11: *Description of hand coordination.* <http://www.strukturainstruments.hu/hct.html>

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