Comparison of three methods of pre-employment medical evaluations

Shlomo Moshe¹,², Michal Shilo¹, Yaron Yagev³, Doron Levy⁴, Dan Slodownik⁵, Gabriel Chodick²,⁴ and Michael Levin⁶

**Background**
Increasing efforts are being made to prevent sickness absence and to increase worker efficiency, including the use of costly pre-employment medical assessment of white-collar workers and labourers, excluding occupations for which medical supervision is required by law.

**Aim**
To investigate whether filling out an occupational health questionnaire (OHQ) as pre-employment assessment was more efficient than previously used protocols which included a physical examination and laboratory tests performed for each applicant.

**Methods**
Retrospective study comparing three groups of job applicants: Group A—applicants examined by an occupational physician (OP); Group B—applicants examined by a general practitioner (GP) whose medical records were subsequently evaluated by an OP and Group C—the applicant filled out an OHQ which was evaluated by an OP.

**Results**
The study included 1940 pre-employment assessments divided into groups A (618), B (256) and C (1066). The restriction rate was 2.1, 1.2 and 2.3%, respectively. The lowest restriction rate (1.4%) was among applicants 29 years old and younger and the highest one (3.6%) among 50 years and older. The most frequent diagnoses among restricted applicants were musculoskeletal and circulatory diseases (15 and 12%, respectively).

**Conclusions**
The restriction rate achieved by medical examinations either done by an OP (Group A) or by a GP (Group B) was the same as in OHQ (Group C). The use of a self-administered questionnaire evaluated by an OP is the preferred method of pre-employment evaluation for non-hazardous occupations.

**Key words**
Assessment; cost benefit; health examination; health services; occupational epidemiology; pre-employment.

**Introduction**

Over the past 25 years, pre-employment evaluations have undergone considerable changes. The modern pre-employment evaluation is generally restricted to two determinations: whether the individual can perform essential job functions with or without accommodation and whether the individual represents a direct threat to himself or others [1–5].

Past inclinations to diagnose minor medical problems that were of no functional significance, yet might predict future higher absentee rates, have proven unnecessary. Current views support the provision of equal opportunities for individuals with a physical impairment that does not affect their job performance [6].

The yield of pre-employment examination of white-collar employees has been evaluated in several studies [7–10] which demonstrated that the cost of examinations was higher than the excess absence costs of high-risk employees.

Whitaker and Aw [11] analysed different methods for pre-employment assessment of applicants to the National Health Service of the United Kingdom and concluded that screening programmes should focus on specific
occupational groups. An additional study [12] analysed 101,754 pre-employment examinations of applicants for governmental functions in the Netherlands where most rejections were among those older than 40. The authors concluded that for those job categories with a low rejection percentage (e.g., <1%), the pre-employment medical examination adds little, if anything, to the recruitment selection of new personnel.

As pointed out by Serra et al. [13], although there seems to be a growing interest in research on prevention and cost-effectiveness of the assessment of fitness for work, the scientific evidence is still very scarce and rarely based on experimental designs. This may be due to the complexities of the assessment of fitness for work with regard to its conceptual constraints, ethical implications and difficulties relating to methodology of research.

In our study, we compared three different methods of pre-employment assessment.

Methods
A cross-sectional study was carried out to compare three pre-employment assessment protocols of white-collar workers and labourers, excluding occupations for which medical supervision was required by law.

Three groups were included in the study: Group A which comprised applicants examined by an occupational physician (OP) for the years 1997–2000; Group B comprised applicants examined by a general practitioner (GP) for the years 1997–2000 and whose medical records were later evaluated by an OP and Group C comprised applicants who completed an occupational health questionnaire (OHQ) between the years 2000 and 2003, subsequently evaluated by an OP. The OHQ was based on Botheroyd’s and McIver’s questionnaire [14] which was adjusted for Israeli applicants (Appendix A). The OHQ was piloted on 12 participants to ensure the clarity of the questionnaire.

The protocol of Group A for pre-employment assessment was that the OH service supplied the employer with blank medical questionnaires (different from the current OHQ). The employer filled in the applicant’s job description and potential occupational hazards. The applicant completed the rest of the questionnaire at the occupational health clinic servicing their work district, including a detailed occupational and medical history, and was examined by an OP. Each applicant underwent additional laboratory tests (blood tests and urinalysis). The OP determined whether the applicant was fit to perform the job, could perform the job with given restrictions or was unfit to perform the designated job.

The protocol of Group B was that the applicant underwent a basic physical examination by a GP and laboratory tests as specified for Group A. The medical records were later evaluated by an OP who determined whether additional assessment was needed (more laboratory tests or a referral to a medical specialist) or whether the applicant should be further examined by an OP.

The protocol of Group C involved completing the OHQ. Neither routine laboratory tests nor physical examinations were performed. The OH service supplied the employer with blank OHQs. The employer filled in the applicant’s job description and potential occupational hazards and the applicant completed the questionnaire, including a detailed occupational and medical history. The completed questionnaire was sent to an occupational clinic and evaluated by an OP.

Results
During the study period, we evaluated a total of 1940 pre-employment assessments, which were divided into groups A (618), B (256) and C (1066). Among the applicants, 723 (37%) were men and 1217 (63%) were women. A total of 41 (2.1%) applicants had work restrictions recommended following the assessments. There was no significant difference between the restriction rates for groups A, B and C: 2.1, 1.2 and 2.3%, respectively (Table 1).

We found the lowest restriction rate (1.4%) among applicants 29 years old and younger and the highest one (3.6%) for applicants ≥50 years old (Table 2). Although showing a trend, the differences between the age groups had only borderline statistical significance (Mantel chi-squared test for trend, \( P = 0.055 \)).

We found that restriction rates were influenced by both applicant occupation and medical diagnosis. There was a trend towards a higher restriction rate among health care workers, mainly medical doctors (5%; Table 3), as well as other health professionals (8% of the nurses, para-

<table>
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<tr>
<th>Evaluation protocol</th>
<th>Total applicants</th>
<th>Restricted applicants*</th>
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<tbody>
<tr>
<td>Group A: examination by an OP</td>
<td>618</td>
<td>13</td>
</tr>
<tr>
<td>Group B: examination by an appointed family physician and subsequently evaluated by OP</td>
<td>256</td>
<td>3</td>
</tr>
<tr>
<td>Group C: questionnaire only</td>
<td>1066</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>1940</td>
<td>41</td>
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* \( P < 0.506 \).
medics and therapists; Table 3). A higher restriction rate (7.5%) was also demonstrated for skilled industrial and construction workers.

A total of 41 applicants with 78 medical diagnoses were restricted. The highest percentages of restrictions were found for musculoskeletal disorders (15%), circulatory (12%) and respiratory disease (10%) (Table 4).

The cost in Group A (OP examination and laboratory tests) was more expensive than Group B (GP and laboratory tests) which was more expensive than Group C (questionnaire).

Discussion

We found no difference in restriction rates when comparing three pre-employment assessment methods in white-collar workers and labourers. The restriction rate found in our study (2.1%) was similar to other studies.

Whitaker and Aw [11] analysed different methods of pre-employment assessment of applicants to the National Health Service of the United Kingdom, including a questionnaire which was designed and completed for each pre-employment assessment. This produced 9139 questionnaire returns. The restriction rate was 1.3% and the rejection rate was 0.7%. The highest restriction rates were found in technicians (2.8–5.3%) and domestic staff (2.4%). The lowest restriction rate was found among clerical workers (1%). De Kort et al. [12] analysed 101754 pre-employment examinations of applicants for governmental functions in the Netherlands. A high rejection percentage (i.e. ≈3%) was found in job categories in which physical demands were higher than average. The rejection rate among administrative workers was very low (i.e. <1.0%). Lederer et al. [15] have published the findings and resulting number of rejections from 9043 medical examinations of candidates for civil servant postings along with a retrospective evaluation of 500 examinations at two large public health departments. The rejection rate for medical reasons was 0.6%. Schmid and Drexler [16] evaluated the medical examinations that were performed on 1795 biotechnology laboratory workers (701 baseline and 1904 follow-ups). The restriction rate was 0.2%. Waclawski et al. [17] examined 254 applicants for nursing studies of whom 246 (97%) were declared ‘fit for work’, four (1.6%) were restricted and four (1.6%) were rejected, mainly due to psychiatric problems. The low restriction rate in this study compared with other studies relates to the fact that most workers were posted in administrative (958/1940, 49%) and health care tasks (307/1940, 16%) and just a few were assigned to technical (106/1940, 5%) and laboratory tasks (27/1940, 0.01%).

De Kort et al. found that age also appeared to be a determinant for rejection. Applicants >50 years old had about a 4-fold increased risk of being rejected when compared with applicants in their 20s [12].

Comparing different occupational groups (Table 3), we have found that the restriction rates tend to be influenced by both the applicant's occupation and medical diagnosis. There was a tendency towards a higher restriction rate among health care workers, mainly medical doctors (5%), as well as other health professionals (nurses, paramedics and therapists; 8%). Higher restriction rates were also demonstrated for skilled industrial and construction workers (7.5%). Whitaker and Aw [11] found similar rates of restrictions among technicians (3–5%), nurses (1%) and domestic staff (2.4%). De Kort [12] found high rates of rejection in policemen (2.2%) and prison officers (3.1%). However, since the samples in

<table>
<thead>
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<th>Table 2. Applicant restriction rates within various age groups</th>
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<tr>
<td>Age (years)</td>
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<tr>
<td>-------------</td>
</tr>
<tr>
<td>≤29</td>
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<tr>
<td>30–39</td>
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<tr>
<td>40–49</td>
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<tr>
<td>≥50</td>
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<tr>
<td>Total</td>
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*P < 0.17.

<table>
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<tr>
<th>Table 3. Applicant restriction rates within different occupational groups</th>
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<tr>
<td>Job category</td>
</tr>
<tr>
<td>--------------</td>
</tr>
<tr>
<td>Academic professionals</td>
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<tr>
<td>Administrative and clerical staff</td>
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<tr>
<td>Teaching professionals</td>
</tr>
<tr>
<td>Medical doctors, dentists and veterinarians</td>
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<tr>
<td>Other health professionals</td>
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<tr>
<td>Institutional and home-based personnel, care workers, childcare workers</td>
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<tr>
<td>Technicians</td>
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<tr>
<td>Medical laboratory workers</td>
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<tr>
<td>Security officers and guards</td>
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<tr>
<td>Cashiers and salespersons</td>
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<tr>
<td>Warehousemen, porters and dock workers</td>
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<tr>
<td>Industry and construction skilled workers</td>
</tr>
<tr>
<td>Professional drivers</td>
</tr>
<tr>
<td>Other unskilled workers</td>
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<tr>
<td>Total</td>
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*P = NS.
our study were relatively small, further investigation is advised.

The most frequent restricting medical diagnoses in our study (Table 4) were musculoskeletal disorders (15%) and circulatory diseases (12%). In a study by De Kort et al., the main reasons for rejections were musculoskeletal (20%), psychiatric problems (13%) and visuoauditory (12%) [12]. In another study by Whitaker and Aw (11), the musculoskeletal (27%), skin conditions (15%), psychiatric (11%) and abnormal body mass index (11%) were the main reasons for restrictions. In our study, the leading categories associated with restrictions were musculoskeletal and circulatory diseases, as demonstrated in similar studies [11,12].

One of the drawbacks of our study is a small sample size. In contrast to previous studies [11,12], we were not able to achieve the figures required for statistical significance. We estimate that there are inter-observer variations in our study, since many physicians were involved in the pre-employment evaluation. However, these variations seem to be small since we did not find any difference between the study groups. Another drawback is our lack of knowledge regarding the homogeneity of the three study groups. We estimate that most of the candidates were white-collar workers since by law when workers are exposed to hazardous materials they are required to undergo periodical occupational examinations.

Occupational health professionals have a role to play in reducing the risk to employee health and safety and pre-employment assessment is one aspect of that role. However, the limited resources of the health care system oblige the physician and management to periodically re-evaluate the cost-effectiveness of any medical process since resource allocation is critical for maximal efficiency. This is especially true when pre-employment assessment becomes routine.

In 1972, Voelz and Spickard [18] published a pioneer study entitled ‘Pre-employment Medical Evaluation by Questionnaire’ in which they examined the results of using questionnaires in pre-employment evaluation. Their restriction rate was relatively high (33%; 650/1976) while the rejection rate was low (0.6%; 11/1976). Nevertheless, they concluded that the initial experience on the use of their questionnaire to evaluate employability was satisfactory. Since that study, many studies and reviews [13,19,20] have discussed the optimal method for pre-employment evaluation of workers.

We have demonstrated equivalent results using different methods for pre-employment evaluation and the questionnaire is probably the simplest and most economical device for effective pre-employment evaluation.

In our experience, a relatively high percentage of people completing a questionnaire have only minor medical problems, although we did not prove this point scientifically. Those people can be readily identified as being suitable for employment.

The questionnaire method has been used successfully since 2000 in Israel, saving medical resources and time
for employers and employees. This study supports the medical effectiveness of using the method of OHQ for pre-employment evaluation.

Key points
- The modern pre-employment evaluation, in contrast to previous ones, is legally restricted to only two determinations: whether the individual can perform essential job functions with or without accommodation and whether the individual represents a direct threat to himself or others.
- The restriction rate achieved by medical examinations either done by an OP or by a GP was the same as in OHQ.
- The use of a self-administered questionnaire evaluated by an OP is likely the preferred method of pre-employment evaluation for non-hazardous occupations.

Acknowledgements
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Conflicts of interest
None declared.

References

Appendix A

Occupational health questionnaire

1. **Employer:**
   Employer's details and information regarding the applicant's designated job and occupational exposures.

2. **General Questions:**
   (Answer each question by circling the right answer. Elaborate when prompted)
   2.1. Have you been hospitalized in a medical institution (excluding delivery hospitalization) over the past ten years? Yes / No
   State the place, date and reason for the hospitalization, treatment received and how the incident has affected your current health status.
   2.2. Have you undergone a surgical operation or an invasive medical procedure, or was a surgery or a medical procedure scheduled? Yes / No
State the type, place and date of surgery or procedure, and how the incident has affected your current health.

2.3. Have you been examined by a general physician or a medical specialist during the last two years? Yes / No
State the doctor’s name, medical specialty, reason for the examination, medical recommendations, treatment received and the treatment outcome.

2.4. Have you ever applied for medical insurance? Yes / No
Has the insurance company rejected your request or set restrictions, limitations or exclusions, and for what reasons? Yes / No

2.5. Are you currently suffering from any illness or are you aware of any other medical disorder (impairment, defect, medical condition, pain, ailment, physical or mental disorder)? Yes / No

2.6. Are you taking medications regularly? Yes / No
State the drug’s name and dosage (use capital letters).

2.7. Have you ever been injured in an accident? Yes / No
State the date and outcome of the injury.

2.8. Do you consider yourself to be in perfect health and fully fit to perform the job for which you apply? Yes / No
If your answer is ‘no’, please elaborate.

2.9. Have you ever filed a disability claim, when and to whom? Yes / No
Were you determined disabled and when?
What were the nature, degree and period of your disability?
Has your disability affected your fitness for work and in what manner? Yes / No

3. Specific questions regarding disease and symptoms:

(Mark an X in the appropriate box. If your answer is ‘yes’, circle the disease and/or the symptom and elaborate).

<table>
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<tr>
<th>Are you suffering</th>
<th>yes</th>
<th>no</th>
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<tr>
<td>or have you suffered before from the following diseases or symptoms?</td>
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3.1. Chronic headache, diseases of the brain, disorders of the nervous system, epilepsy, paralysis or paresis, dizziness, vertigo, syncope, loss of consciousness, depression or other mental disorder, a suicide attempt, sensory disturbance?

3.2. Pulmonary tuberculosis, bronchial asthma, persistent cough, recurrent pneumonia, chronic bronchitis, emphysema, pleural disease, hemoptysis.

3.3. Cardiovascular disease, palpitations, arrhythmia, chest pain or discomfort, hypertension, swelling of the lower limbs, leg pain while walking, coronary event of any kind?

3.4. Swallowing difficulty, heartburn, gastric or duodenal ulcer, intestinal disorders, intestinal bleeding, bladder disease, liver disease, recurrent vomiting, occult blood in stool, viral hepatitis A, B or C?

3.5. Sexually transmitted diseases, AIDS, HIV carrier?

3.6. Ocular diseases, visual disturbances, nasopharyngeal disorders, sinusitis, hearing loss, persistent hoarseness?

3.7. Hypersensitivity (allergy) to medications, food or other agents?

3.8. Urinary disease or infection, nephrolithiasis (‘kidney stones’), presence of blood, glucose or protein in the urine, prostate hypertrophy, difficulty urinating?

3.9. Skin disease, persistent ulcer, changed nevi, warts, breast lump, benign or malignant tumor, sensitivity to sunlight?

3.10. Endocrine diseases, diabetes, dyslipidemia, thyroid disorder, gout?

3.11. Joint disease, rheumatism, arthritis, limited mobility of the arms and legs, bone disease?

3.12. Hernia, anemia, clotting or bleeding disorders, hemolysis, polycythemia, hemophilia?

3.13. Backache, spine disease, neck pain, limited mobility of the spine, mobility disorders?

3.14. Other illnesses, disorders or medical conditions not elaborated above?

4. Occupational history:
(State prior jobs and workplaces, either self-employed or hired worker).

<table>
<thead>
<tr>
<th>From year</th>
<th>To year</th>
<th>Employer</th>
<th>Occupation</th>
<th>My job was:</th>
<th>Remarks</th>
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5. Other comments I’d like to make concerning my health status and my ability to perform my job: