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WEB PAPER

A core physical examination in internal medicine: What should students do and how about their supervisors?

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Abstract

Background: Performance of a focused physical examination will induce a high cognitive load for medical students in the early phase of the clinical clerkships.

Aim: To come to a workable and clinically applicable standard physical examination for medical students to be used in every new patient in the daily clinical practice of internal medicine.

Method: A questionnaire held among physicians that supervise students during the clerkship of internal medicine in one Dutch training region.

Results: Of the complete list of physical examination 55 items were considered to be an integral part of the standard general physical examination for medical students. Most emphasized were elements of the physical examination aimed at general parameters, thorax and abdomen, vascular status, lymph nodes, spinal column, skin and some parts of the neurological examination. The standard physical examinations performed by supervisors themselves contain fewer items than they expected from the students. The expectations a supervisor has towards the student correlates with the frequency with which they apply the various components in their own physical examination.

Conclusion: This study provides us with a 'core' physical examination for medical students that can be applied in the early phase of the clinical clerkships.

Introduction

Physical examination skills are a basic competence in clinical medicine. Next to the history of the present illness, it is a major tool to obtain the information necessary to formulate a differential diagnosis (Peterson et al. 1992). The main purpose of the physical examination is to find additional evidence and strengthen the differential diagnosis that has been conceived by taking the patient's history. When medical students start their clinical clerkships, clinical-reasoning skills are still rudimentary. In fact, in many curricula, the clerkship of internal medicine is the first in which students begin to practice history taking, do a physical examination and develop clinical reasoning skills in contact with real patients. But, at that time, most of them will not be ready to do a focused physical examination on the basis of the history as a part of the clinical reasoning process. This was demonstrated in a study among fourth year medical students showing that those who demonstrated competence in directed examination of organ systems during training sessions were not necessarily able to correctly apply those examination skills to the work up of clinical cases (Wilkerson & Lee 2003). This indicates that their clinical reasoning skills have not yet matured to a level that allows them to perform a focused physical examination after history taking.

Practice points

- Performing a focused physical examination after the phase of history taking in a new patient encounter is a very complex task for novice learners.
- Expectations regarding physical examination by medical students are related to the personal habits of their supervisors.
- A consensus on what physical examination medical students should perform while examining a new patient will reduce cognitive load and might enhance their learning.
- The results of a survey amongst physicians who supervise medical students during their clerkship internal medicine provides such a consensus.

According to the cognitive load theory, each educational activity contains an inherent degree of difficulty called intrinsic load (Sweller et al. 1998). A high unnecessary cognitive load, called extraneous load, may hamper learning complex tasks in novice learners (Sweller et al. 1998). Regarding complex tasks, instructions for novice learners should have a different design than instructions for more experienced learners (van Merriënboer & Sweller 2010). History taking, including the

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necessary clinical reasoning, is already a very complex task for novice learners. To perform a focused physical examination based on the data achieved from the history taking, makes the task even more complex. A high extraneous load can be reduced by replacing such a task with a goal-free task (van Merriënboer & Sweller 2010). Considering the latter, it would be preferable for students to perform a standard general physical examination in every new patient, instead of a physical examination focused on the basis of the provisional differential diagnosis. This would reduce the extraneous load for novice learners. In addition, it will give them more opportunities to improve their technique and may enhance the chance to discover pathological findings. So, by creating a standard, an important tool is provided for teaching, regular assessment of progress and feedback during the clinical clerkships. The basis of the mastering of the physical examination in clinical practice will, in many curricula, be established during the clerkship of internal medicine.

There might be a firm belief among clinical teachers that they already share a standard for a general physical examination and also teach it as such. We hypothesize that in reality the ideas on this topic are very divergent and will be colored by personal habits. These personal habits may have its origin in various factors, like subspecialty or academic workplace. It is already known that there is a great variability in expectations among clinical teachers and clerkship directors regarding the timing of the acquirement of physical examination skills during the clerkships (Corbett et al. 2008). Textbooks on physical examination describe every possible aspect that could be done while performing a physical examination, but they do not clearly identify a general standard procedure for medical students to use in new patient encounters. The description of the various aspects of the physical examination is generally so extensive and in depth that students will have no practical applicable idea of what is expected from them in patient encounters. Performing all possible items in every patient encounter will not be workable. Next to that, it will also refrain them from learning to integrate physical examination elements driven by their hypothesis as they become more and more experienced. As a result, clinical reasoning during the process of performing a physical examination may not develop as desired. While lacking a standard, medical students will now be confronted with the personal habits and opinions of their supervisors regarding the physical examination. Lack of agreement on what should be done will make them even more insecure and lessens their ability to learn from doing. There is ongoing evidence that many students do not master the basic aspects of the physical examination at the end of the clerkships or start of the internship (Mangione & Nieman 1997; Vukanovic-Criley et al. 2006; Sharma 2011). So, consensus should be reached in order to improve the mastering of the physical examination with a better chance of success in becoming proficient at it.

In this study, we intended to establish a 'core' physical examination that should be used by medical students as a standard general physical examination for new patient encounters. For that purpose, we explored the opinions of physicians regarding performance of medical students examining new patients. Next to that, their personal standard was

explored to strengthen the hypothesis that these opinions are related to personal praxis.

Methods and statistics

We designed a questionnaire comprising a list of 86 physical examination procedures frequently reported as basic elements of a general physical examination. The list of items was first distributed among the six principal clinical teachers in internal medicine in our university medical centre. These six teachers completed the list if they felt an essential element was missing. Hereafter, a survey was held among clerkship directors and physicians who supervise medical students during their clerkship of internal medicine in the university medical centre and its affiliated hospitals. Regional clerkship directors were asked to distribute the questionnaires within the affiliated hospitals among physicians that supervise students during this clerkship. In our training region, this clerkship takes place in the first year of the masterprogram (M1). This is the fourth year of the curriculum. The total duration of the curriculum is six years. To minimize socially acceptable answers respondents remained anonymous.

Two questions were posed:

Question 1:

Which parts of a general physical examination should a student perform during the clerkship of internal medicine when examining a new patient?

For each item of the physical examination the answer could be either 'yes' (should be included) or 'no' (should not be included). The answers were used to compile a list of items that should be included in the standard physical examination of a new patient. If more than 50% of the respondents agreed, the item was included.

Question 2:

Which parts of a general physical examination do you perform yourself, when you examine a new patient and at which frequency?

For each item of the physical examination the answer could be either 1, meaning 'always' (90–100%), 2 meaning 'regularly' (60–90%), 3 meaning 'sometimes' (40–60%), 4 meaning 'seldom' (10–40%) or 5 meaning 'never' (0–10%). Answers were used to get insight into the frequency with which the items of the physical examination are performed by supervisors. The average frequency-of-use scores, ranging from 1 to 5 were prepared for each item to compare the reported usage of the items. For this calculation, answers were used as a continuous variable. The percentage of the responses 'always' or 'never' to use a certain item of the physical examination were listed, in order to find out which items are seen as a standard physical examination by the supervisor and which items are rarely if ever performed. To analyze the hypothesis that there would be a positive correlation between answers to both questions for each physical examination item, one tailed Pearson Correlation coefficients were calculated. Finally, an independent samples *t*-test was used to analyze differences in mean scores between academic versus non-academic supervisors for their response to Question 1. Mean scores for each

physical examination item were generated by using answers as a continuous variable: No = 0, Yes = 1. A p value <0.05 was considered significant. Statistics were calculated using the SPSS 16.0 package program (Chicago, IL).

Results

The principal clinical teachers did not add additional components to the list of 86 physical examination procedures. A total of 106 questionnaires were distributed to the specialists at the affiliated hospitals, 99 questionnaires to those at the university medical centre. A total of 92 of the individuals surveyed completed the questionnaire (45%) of whom 47 (51%) were in the university centre and 45 (49%) were from the affiliated hospitals, 52 (57%) were male. On average, they completed their specialty training 19 years ago. About one third of the respondents were general internists. The others were engaged in the subspecialties of nephrology, oncology, gastroenterology, endocrinology, pulmonology, rheumatology, infectious diseases, vascular medicine and hematology (Table 1).

The 55 components of the physical exam listed in bold in Table 2 were considered an integral part of a complete physical examination by more than half of the respondents. The highest level of agreement was reached on including examination of the thorax and abdomen to the standard general physical examination for students. Next to that items that assess the general health of a patient were considered important. This also applies to examination of the mouth and throat, thyroid gland, skin, lymph nodes, global inspection of the extremities and palpation of arteries of the lower extremities. According to more than half of the respondents full assessment of the urogenital tract, as well as assessments of all joints and a complete neurologic examination should only be done by indication.

For 13 items, there was a significant divergence of opinion between academic supervisors versus those in affiliated hospitals (Table 3). Nine items were considered significantly more often by academic supervisors to belong to a standard

examination and four items were significantly more often expected by supervisors from the affiliated hospitals.

For most items there was a significant positive correlation in the frequency in which the items are part of the standard practice of the supervisor and their expectation of the performance of these items by the students (Table 2). The strongest significant positive correlation was found for examination of peripheral edema ($r=0.56$), palpation of the abdominal aorta ($r=0.54$), measuring jugular venous pressure ($r=0.52$), assessment of kidney tenderness ($r=0.51$) and inspection of the penis ($r=0.51$).

The standard physical examinations performed by supervisors consists of fewer items (items reported to performed 'always') than they expect from their students (Figure 1). Over 30% of respondents indicated, they never performed examinations like percussion of the heart, pelvic examination, percussion of the bladder, examinations of the joints and many elements of the neurological examination (Table 2).

Discussion

As a result of this study, a consensus was reached on a 'core' physical examination for medical students. In this study, we found that personal physical examination practices of physicians vary widely. And, so do their expectations of the extent of the physical examination that should be done by students. The usual physical examination of physicians has been studied before (Wildes & Anderson 2004). This is the first study in which expectations of supervising physicians towards students are explored and compared to their own physical examination practice. The existing idea of many physician teachers and clerkship directors that there is some kind of implicit standard physical examination, that is shared by those who teach students and residents, appeared not to be realistic.

We uncovered that the expectations a supervisor has towards the student often correlates with the frequency with which they apply the various components in their own physical examination. Thus, a supervisor is more likely to expect the student to assess for example the jugular venous pressure or kidney tenderness when he or she also regularly performs this. So, what is taught to and expected from the students during their clinical clerkship is not based on common vision, but on personal habit. We also show that local differences do exist. In addition to the confrontation with different expectations regarding physical examination, students will see their supervisors perform less extensive physical examinations. The gap between the frequency with which physical examination items are expected to be performed by students and are reported to be performed in practice by the supervisors may even be larger than is revealed in this study. The reported performance may be overestimated by the respondents, because they may have given socially accepted answers despite anonymization. Although the above-mentioned results might not surprise physicians who supervise students, our results stress that important differences in practice really exist. Next to that, certain components of the physical examination are no longer performed at all by a large number of supervisors. This may imply that certain skills will never be taught to students, depending on the practice of their

Table 1. Characteristics of the respondents.

Gender	$n = 92$
Male	52 (56.5%)
Female	40 (43.5%)
Work environment	
University centre	47 (51.1%)
Affiliated hospital	45 (48.9%)
Specialization	
General internal medicine	32 (34.8%)
Nephrology	17 (18.5%)
Oncology	11 (12.0%)
Gastroenterology	9 (9.8%)
Endocrinology	5 (5.4%)
Pulmonology	5 (5.4%)
Rheumatology	4 (4.3%)
Infectiology	3 (3.3%)
Vascular medicine	3 (3.3%)
Hematology	3 (3.3%)
Year of finishing specialization	
< 1980	7 (13.1%)
1980–1989	29 (31.5%)
1990–1999	34 (37.0%)
≥2000	20 (21.7%)
Unknown	2 (2.2%)

Table 2. Results of the questionnaire regarding the general physical examination in internal medicine.

Examination	Question 1*: Should be done by the medical student	Question 2†: Reported frequency of use by physicians who supervise medical students			Correlation questions 1 and 2
	Yes (%)	Always (%)	Never (%)	Average (1–5)‡	R
Assessment of skin turgor	81	22	3	2.5	0.39§
Counting pulse rate	100	78	0	1.3	0.36§
Measuring Blood pressure	100	83	3	1.3	NS
Measuring blood pressure on both arms	48	11	11	3.1	0.30§
Measuring blood pressure standing	52	15	8	2.8	0.45§
Counting breathing frequency	80	17	6	2.7	0.35§
Measuring height	96	75	4	1.5	NS
Measuring weight	99	90	0	1.2	NS
Measuring jugular venous pressure	74	25	13	2.6	0.52§
Assessment of sinus tenderness	52	7	11	3.2	0.40§
Assessment of nasal patency	35	2	32	3.8	0.42§
Inspection of the nasal cavity	14	2	51	4.2	0.42§
Inspection of the conjunctiva	91	36	4	2.2	0.36§
Inspection of the oral cavity and pharynx	93	44	3	2.0	0.35§
Examination of the thyroid gland	98	52	5	1.8	0.28§
Inspection of the chest	100	79	3	1.4	NS
Percussion of the lungfields	100	73	2	1.5	NS
Assessment of the level of diaphragmatic dullness	95	51	9	2.0	0.41§
Auscultation of the lungfields	100	90	2	1.1	NS
Evaluation of the tactile fremitus	33	2	33	3.8	0.27§
Auscultation of the heart	100	89	0	1.3	NS
Percussion of the heart	51	26	31	3.1	0.48§
Assessment of cardiac movements	78	26	19	2.8	0.44§
Inspection of the breasts	86	35	7	2.2	NS
Palpation of the breasts	82	30	8	2.4	0.18§
Inspection of the abdomen	100	90	0	1.1	NS
Auscultation of the abdomen	100	90	1	1.1	NS
Percussion of the liver	99	75	1	1.4	0.27§
Percussion of the spleen	91	67	4	1.7	0.37§
Percussion of the abdomen	97	84	1	1.3	0.29§
Palpation of the liver	100	91	1	1.1	NS
Palpation of the spleen	97	80	2	1.4	0.25§
Light and deep palpation of the abdomen	99	79	0	1.3	0.20
Assessment of kidney tenderness	76	36	7	2.4	0.51§
Palpation of the kidneys	36	14	32	3.5	0.45§
Percussion of the bladder	74	33	5	2.4	0.20
Inspection of the penis	35	6	19	3.4	0.51§
Inspection and palpation of the scrotum	35	7	15	3.3	0.40§
Rectal examination	46	6	4	2.8	0.23§
Inspection of the external female genitalia	20	4	23	3.7	0.27§
Pelvic examination	11	1	46	4.1	0.20
Palpation of the temporal artery	46	7	15	3.3	0.21
Auscultation of the carotid artery	91	43	8	2.3	0.33§
Palpation of the carotid artery	87	42	8	2.4	0.27§
Palpation of the abdominal aorta	84	38	3	2.3	0.54§
Auscultation of the femoral artery	90	47	8	2.2	0.43§
Palpation of the femoral artery	98	52	7	2.0	0.25§
Palpation of the popliteal artery	61	18	20	3.2	0.32§
Palpation of the dorsalis pedis artery	98	50	9	2.1	0.31§
Palpation of the posterior tibial artery	96	48	9	2.1	0.31§
Palpation of the lymph nodes of the head and neck	99	79	0	1.3	0.21
Palpation of the axillary lymph nodes	96	56	0	1.7	0.37§
Palpation of the inguinal lymph nodes	98	60	2	1.7	0.31§
Global inspection of the extremities	98	77	6	1.5	0.31§
Examination of the shoulder	19	3	32	3.9	0.36§
Examination of the elbows	16	3	36	4.0	0.31§
Examination of the wrists	19	3	31	3.9	0.25§
Examination of the hand joints	20	4	30	3.8	0.38§
Examination of the hips	19	3	30	3.9	0.33§
Examination of the knees	20	3	29	3.9	0.33§
Examination of the ankles	21	4	30	3.9	0.34§
Examination of the toe joints	16	4	35	3.9	0.30§
Examination of peripheral edema	96	79	3	1.4	0.56§
Bringing vertical pressure to the spine	55	22	19	3.0	0.42§
Percussion of the spine	75	36	9	2.5	0.35§
Assessment of the curvature and mobility of the spine	75	19	19	3.1	0.40§

Examination of the sacroiliac joint	24	7	31	3.7	NS
Total inspection of the skin	92	53	3	1.8	0.49§
Assessment of visual acuity	30	1	41	4.1	NS
Assessment of visual fields	30	2	32	3.8	NS
Testing pupillary light reflex	74	17	17	3.1	0.29§
Testing the near reflex	48	8	32	3.8	0.31§
Assessment of ocular motility	57	10	26	3.5	0.33§
Ophthalmoscopic examination	3	2	76	4.6	NS
Assessment of auditory acuity	11	3	70	4.5	NS
Tuning fork tests (Weber and Rinne test)	12	1	67	4.5	NS
Assessment of the remaining cranial nerves	18	7	47	4.1	NS
Testing strength of the lower extremities	53	7	16	3.3	0.42§
Testing strength of the upper extremities	52	7	15	3.3	0.47§
Assessment of sensibility	58	9	15	3.0	0.36§
Testing reflexes of the upper extremities	64	14	19	3.2	0.28§
Testing reflexes of the lower extremities	80	20	15	2.9	0.38§
Assessment of balance	18	4	50	4.2	NS
Assessment of the gait	34	7	38	3.9	0.28§
Assessment of coordination	20	2	40	4.0	NS
Barre test	14	2	63	4.5	NS

Parts of the physical examination highlighted in bold will be included in the standard physical examination for medical students in the clerkship internal medicine.

Question 1: Which parts of a general physical examination should a student perform during the clerkship of internal medicine when examining a new patient?

Question 2: Which parts of a general physical examination do you perform yourself, when you examine a new patient and at which frequency?

*Answers to Question 1: *n* ranges from 85 to 91 (missing survey items were not included in the analysis).

†Answers to Question 2: *n* ranges from 87 to 91 (missing survey items were not included in the analysis).

‡For generating an average score, frequency of use was used as a continuous variable (always = 1, regularly = 2, sometimes = 3, seldom = 4, never = 5).

§*p* < 0.01

||*p* < 0.05

Table 3. Significant differences in mean scores for Question 1 for academic versus non-academic supervisors of the clerkship internal medicine.

Examination	Question 1 Mean score (0–1)*		
	Academic	Non-academic	<i>p</i>
Measuring blood pressure standing	0.64	0.39	0.018
Assessment of sinus tenderness	0.65	0.40	0.016
Assessment of nasal patency	0.48	0.22	0.010
Inspection conjunctiva	0.98	0.84	0.027
Assessment of cardiac movements	0.89	0.68	0.020
Inspection of the breasts	0.78	0.93	0.043
Palpation of the kidney	0.47	0.26	0.042
Rectal examination	0.30	0.64	0.002
Inspection of the external female genitalia	0.11	0.29	0.036
Pelvic examination	0.04	0.18	0.041
Assessment of the curvature and mobility of the spine	0.85	0.64	0.026
Testing the near reflex	0.59	0.37	0.043
Assessment of ocular motility	0.70	0.44	0.016

Question 1: Which parts of a general physical examination should a student perform during the clerkship of internal medicine when examining a new patient? Italic indicates higher frequency among non-academic supervisors

*For generating a mean score, answers were used as a continuous variable: No = 0, Yes = 1.

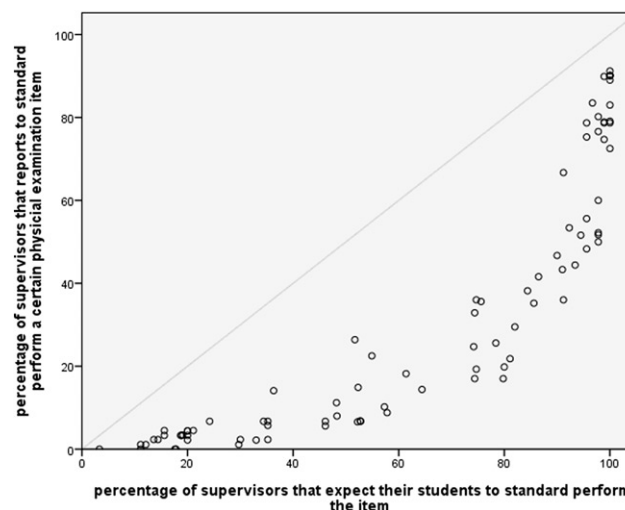


Figure 1. Expectations from supervisors towards student versus reported performance. For each physical examination item, the frequency with which supervisors expect their students to perform it in a new patient encounter is compared to the frequency in which the supervisors report to standard perform the physical examination item. In general, supervisors report to perform physical examination items less frequent than they expect from their students.

supervisors. That in the end students and also residents consider themselves to a certain level poorly skilled in physical examination even with increasing years of training should come as no surprise (McMahon et al. 2005).

A complicating factor in the clinical training of students is that they become uncertain as how to behave and act when it is not clear to them what they are expected to do (Prince et al. 2005). This is one of the reasons why the transition from the undergraduate medical education to the clinical clerkships is for most of them overwhelming (O'Brien et al. 2007). The entire process of history taking, physical examination and clinical reasoning in a patient contact, leads to a high cognitive load. It is probably too much for adequate learning to expect students to perform a focused physical examination at this stage of the training. From that basic assumption, it is preferable to encourage the students to perform the same standard physical examination in every patient and reduce the cognitive load. By introducing this standard, we also create clarity for both students and clinical teachers. By doing so the divergence of the clinical teachers they experienced before will be omitted and their learning needs will be addressed more properly. After they have mastered the clinical reasoning process more and are skilled in basic physical examination, they can proceed to the more focused physical examination, based on the clinical information obtained in the history. To facilitate this process other teaching methods for training hypothesis-driven physical examination are developed (Nishigori et al. 2011).

The physical examination remains one of the most accurate and efficient tools of the clinical physician. Studies continue to report serious deficiencies in basic physical examination skills (Wiener & Nathanson 1976; Wray & Friedland 1983; Wilson 2002). A careful construction of the clerkship curriculum is necessary in order to align expectations about physical examination. As a result of this study, we introduced a practical usable standard for students and teachers to use throughout the clerkships. We recommend to use one 'core' physical examination throughout the clinical clerkships. It can be supplemented with other physical examination elements depending on the character of the clerkship. The standard should serve as a starting point from which hypothesis-driven physical examination can gradually be mastered. It will be used in our training region during systematic clinical skills training as well as the clinical clerkships. Our standard can be used in other countries and training regions, but might not be fully applicable since it is based on the creation of a shared understanding in one region. We encourage clerkship directors to take a critical view on what they expect from their own students in the initial phase of the clinical clerkships. Our standard can serve as an entrance for discussion on this topic in other countries or training regions. Once a core physical examination is introduced, a careful construction of teaching a more hypothesis driven physical examination throughout the clerkships can be started. This design will lead to continuity in the process of teaching physical examination throughout the clerkships, prevent cognitive overload and eventually aim for better proficiency in physical examination. Setting up a continuous assessment program to determine the progress of students within each clerkship will be the next challenge.

Notes on contributors

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Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

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