Acute Respiratory Infections: Can a Non-Physician Practitioner Triage and Treat Patients by Using an Algorithm? Experience in a Military Primary Care Clinic

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Abstract

Background: Acute respiratory viral infections are minor self-limited diseases. Studies have shown that patients with ARVI can be treated as effectively by non-physician practitioners as by physicians.

Objectives: To examine whether a military medic, using a structured questionnaire and an algorithm, can appropriately triage patients to receive over-the-counter medications and refer more complicated cases to a physician.

Methods: The study group comprised 190 consecutive soldiers who presented to a military primary care clinic with symptoms of ARVI. Using a questionnaire, a medic recorded the patient's history and measured oral temperature, pulse rate and blood pressure. All patients were referred to a doctor. Physicians were "blind" to the medic's anamnesis and to the algorithm diagnosis. We compared the medic's anamnesis and therapeutic decisions with those of the doctors.

Results: Patients were young (21.1 ± 3.7 years) and generally healthy (93% without background illness). They usually had a minor disease (64% without fever) that was mostly diagnosed as viral ARVI (83% of cases). Ninety-nine percent were also examined by a physician. According to the patients' data, the medics showed high overall agreement with the doctors (83–97.9%). The proposed algorithm could have saved 37% of referrals to physicians, with a sensitivity of 95.2%. Had the medics been allowed to examine the pharynx for an exudate, the sensitivity might have been 97.6%.

Conclusions: Medics, equipped with a questionnaire and algorithm but without special training and without performing a physical examination, can appropriately triage patients and thereby reduce the number of referrals to physicians.

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Acute viral respiratory infection, also known as the "common cold," is a mild self-limited disease caused by a variety of respiratory viruses [1]. The disease is very common, with two to four episodes per year for an adult resulting in an annual average loss of 7 working days [1]. The symptoms of AVRI may include rhinorrhea, sore throat, hoarseness, cough, infection of the conjunctiva, headache, decreased appetite and general malaise. Illness may be accompanied by fever, which lasts 1–3 days and usually does not exceed 38.8°C. Symptoms peak within 3–5 days and resolve spontaneously within 7–14 days. Mild cough may persist, mostly at night, for an additional 2–3 weeks [2].

Treatment is symptomatic. In the Israel Defense Force primary care clinics the following medications are routinely supplied for the alleviation of "common cold" symptoms: analgesics and antipyretics (paracetamol, dipyrone), antitussives (bromhexine, codeine), decongestants (pseudoephedrine, naphasoline), and benzocaine lozenges for the relief of sore throat. Most of these medications are offered in Israel over the counter. In the IDF medical corps the only medications that can be provided by a non-physician medic are paracetamol, topical decongestants and benzocaine lozenges.

The current IDF medical corps rules require that the military medic refer a patient to a medical doctor in any case of fever above 37.5°C, presence of cough, or a return visit [3]. Because of these strict regulations as well as the poor assortment of medications, which can be provided independently by the medic, the majority of patients are referred to the physician.

The authors' impression was that most patients who visit the military primary care clinic because of AVRI have a very mild disease that can be safely treated with OTC medications without an examination by a physician. Previous studies have shown that non-physician practitioners deliver medical care in a manner that maintains both health outcome and patient satisfaction [4–7]. We hypothesized that a military medic who uses a structured questionnaire and an algorithm can take an accurate anamnesis and discriminate between those cases that require a physician encounter to rule out bacterial infection or for a prescription and those cases that are safe to treat with OTC medications.

Methods

Study participants

The study group comprised consecutive soldiers with symptoms of AVRI who visited a military primary care clinic in the winter of 2003–2004. There were no exclusion criteria.

Non-physician practitioners

Eight military medics participated in the study. They were instructed to interview the patients and complete a structured questionnaire on anamnesis. After administering the questionnaire to a few patients under supervision of a physician, they

ARVI = acute respiratory viral infection
IDF = Israel Defense Forces
OTC = over the counter

Table 1. Indications for an examination by a physician

Indication	Rationale	No. of patients
1. Complicating factors: Asthma, Heart disease, Malignancy, Immune suppression, Pregnancy.	Increased risk of complications.	8/190 (4%)
2. Oral temperature above 38.5°C on the day of visit/the day before.	To rule out bacterial infection.	19/190 (10%)
3. Fever (above 37.5°C) that lasts 48 hours or more.	To rule out bacterial infection.	22/190 (12%)
4. Pain in the ears	Physical examination of the ears is needed.	34/190 (18%)
5. Chest pain, which is not only during cough.	To rule out peri/myocarditis.	3/190 (2%)
6. Headache in the face or forehead for 4 days or more.	To rule out bacterial sinusitis.	21/190 (11%)
7. Headache in the face or forehead and a history of recurrent sinusitis.	To rule out bacterial sinusitis.	3/190 (2%)
8. Bad pain in the head together with any of the following: fever above 38°C, photophobia, vomit (unrelated to cough)	To rule out meningitis.	44/190 (23%)
9. Rash	To rule out alternative diagnoses.	5/190 (3%)
10. Sore throat without rhinorrhea and an oral temperature above 38°C	To rule out streptococcal pharyngitis.	7/190 (4%)
11. Dyspnea or tachypnea	To rule out asthma exacerbation/ acute bronchitis/pneumonia.	0/190 (0%)
12. Illness duration of 7 days or more	Exceeds the period in which a substantial relief is usually expected.	26/190 (14%)
13. A return visit	General precaution	29/190 (15%)

conducted the interviews independently. No further practice or tutoring was provided to the medics. The actual decision whether to refer the patient to a physician was taken based on the customary medical corps regulations [3], regardless of the study algorithm.

The questionnaire

The following details were included: age, known illnesses in general with specific question regarding asthma, cardiac disease, past treatment with chemotherapy or radiation, immune suppression, recurrent sinusitis, and pregnancy. Chronic medication usage, duration of current illness, presence of rhinorrhea, cough, sore throat, headache including its location and severity, photophobia, vomiting and if present whether associated with cough or regardless of cough, musculoskeletal pain, rash, fever before the visit including the number of days with fever, maximal temperature that was measured during the current illness, and temperatures on the day of the visit and the day preceding the visit. Also, the medic measured the pulse rate, oral temperature and blood pressure in all patients. If the medic detected a dyspnea he was instructed to record the respiratory rate. The medics did not perform a physical examination.

Algorithm

The indications that warrant examination by a physician are listed in Table 1 [2,8–10]. The data that had been collected with the questionnaires were sufficient for decision-making according to the algorithm.

Physicians

Six primary care physicians took part in the study. Their participation did not affect their work in any way and they continued to conduct their practice as usual. The physicians' anamnesis, findings on physical examination and treatment decisions were elicited from the patients' medical records.

Data analysis

We compared the medics' anamnesis, by means of the questionnaires, to that of the medical doctors' from the patients' medical records. We compared only cases in which the presence or absence of a characteristic was mentioned in both physician's and medic's records. In case of a missing record the characteristic was excluded from the comparison.

We also compared the therapeutic decisions of the physicians to that of the algorithm, based on the medic's data. If the physician's diagnosis was AVRI and he decided to treat with an OTC medication and concomitantly no indication was found in the algorithm for an examination by a doctor, we considered it as an agreement between the doctor and the algorithm. The Helsinki Committee of the Israel Defense Forces Medical Corps approved the study.

Statistical analysis

For each history detail we present three measures: sensitivity, specificity and overall agreement [11].

		Doctors' findings	
		Present	**Absent**
Medic's findings	Present	a	b
	Absent	c	d

Letting the doctors be the standard, the sensitivity of the medics is the proportion of "present" findings they detect, a/(a+c), while the specificity is the proportion of "true negatives" classified as negative by the doctors, d/(b+d). Overall agreement is the proportion of cases in which both medics and doctors agree on the presence and absence of a finding, (a+d)/(a+b+c+d). Sensitivity, specificity and overall agreement were calculated provided that the denominator (a+c, b+d, a+b+c+d, respectively) was greater than 20.

We also defined the sensitivity and specificity of the algorithm [11]:

		Doctors' decision	
		Bacterial disease / A complication of acute respiratory infection	**AVRI – OTC treatment**
Algorithm decision	Refer to a doctor	a	b
	OTC treatment	c	d

Letting the doctors' decisions be the standard, the sensitivity of the algorithm is the proportion of complications and bacterial diseases it detects, a/(a+c), while the specificity is the proportion of AVRIs it detects, d/(b+d).

Results

Overall, 190 patients were seen by a medic, of whom 188 (99%) were referred to a physician for further examination. Only two patients were discharged without seeing a physician, in line with the current IDF medical corps' regulations.

Clinical characteristics of study population

Some of the clinical data, symptoms, physical findings, diagnoses, and treatment decisions are presented in Table 2. The average age was 21.1 ± 3.7 and 93% were generally healthy. It was the first encounter for the current illness in 85% of the cases after an average duration of symptoms of 4 ± 3.5 days. More than 90% of patients presented with the classic symptoms of AVRI – sore throat, cough and rhinorrhea. Many patients (64%) sought medical care although they had no fever.

Table 2. Clinical characteristics of the study population*

Anamnesis and physical findings		Diagnosis (by a physician)		Treatment and extra tests (by a physician)	
Age	21.1 ± 3.7	Viral upper respiratory infection	156/188 (83%)	OTC medications	176/188 (94%)
No background illnesses	177/190 (93%)	Acute sinusitis	14/188 (7%)	Antibiotics	30/188 (16%)
Duration of illness (days)	4 ± 3.5	Bacterial pharyngitis	9/188 (5%)	Without any prescription	7/188 (4%)
A return visit	29/190 (15%)	Pneumonia	5/188 (3%)	Sinus X-ray	5/188 (3%)
Fever **	69/190 (36%)	Suspected infectious mononucleosis	4/188 (2%)	Chest X-ray	2/188 (1%)
Sinus tenderness	29/156 (19%)	External otitis	3/188 (2%)	Complete blood count	6/188 (3%)
Pharyngeal exudate	9/188 (5%)	Otitis media	2/188 (1%)	Throat culture	4/188 (2%)
Post-nasal drip	15/185 (8%)	Acute bronchitis	1/188 (1%)	ECG	3/188 (2%)
Tender/enlarged cervical lymph nodes	36/178 (20%)	Suspected meningitis	0/188 (0%)		
Normal pulmonary auscultation	163/170 (96%)				
Oral temp. > 37.5°C	27/190 (14%)				

* Data represent the number of records of either a physician or a medic in which a characteristic was recorded to be present divided by the number of records in which it was recorded to be present or to be absent.

** Oral temperature above 37.5°C on the day of visit or the day before according to anamnesis.

Usually, no signs of bacterial infection or respiratory infection complication were found on physical examination. Relatively frequent physical findings were tender or enlarged cervical lymph nodes (20%) and sinus tenderness (19%). Oral temperature above 37.5°C was detected in 14% of patients.

Laboratory tests and X-rays were rarely ordered. Only 2–3% of the patients underwent blood tests and 4% had a chest or sinus X-ray. The most common diagnosis was viral upper respiratory infection (83%) followed by acute sinusitis (7%). Ninety-four percent of the patients were treated with an OTC medication by the physician. An antibiotic was prescribed in 16% of the cases.

Comparison of the findings

Table 3 presents a comparison of physicians' and medics' findings. A marked difference in the completeness of anamnesis between medics and doctors is seen.

Due to the paucity of cases in which the presence of background illness and vomiting was documented by physicians in the medical records (fewer than 20 cases) we could not calculate medics' sensitivity regarding these characteristics. Similarly,

Table 3. A comparison of the findings of physicians and medics

Characteristic	Mentioned in medic's records as either existing or missing	Mentioned in physician's records as either existing or missing	Sensitivity	Specificity	Overall agreement
Relevant background illness	190/190 (100%)	69/188 (37%)	–*	95.4%	91.3%
Duration of illness of 7 days or more	189/190 (99.5%)	188/188 (100%)	89.3%	99.4%	97.9%
Rhinorrhea	190/190 (100%)	160/188 (85%)	97.2%	–*	93.7%
Cough	189/190 (99.5%)	169/188 (90%)	98.7%	–*	94.6%
Sore throat	189/190 (99.5%)	164/188 (87%)	97.5%	–*	96.9%
Headache	188/190 (99%)	130/188 (69%)	97.4%	–*	96.1%
Facial or forehead headache (if headache)	152/188 (81%)	56/130 (43%)	81.8%	85%	83%
Vomit	189/190 (99.5%)	50/188 (26.5%)	–*	100%	93.8%
Pain in the ears**	70/190 (37%)	31/188 (16%)	95.5%	–*	95.5%
Any oral temperature >37.5°C according to anamnesis.	190/190 (100%)	83/188 (44%)	79.5%	100%	86%

* Whenever the total number of "present" or "absent" findings according to physicians' records was less than 20, the sensitivity or specificity, respectively, was not calculated, as a result of a too small sample.

** Medics were instructed to record this detail only if it was mentioned by the patient

because of the scarcity of cases in which doctors documented the *absence* of rhinorrhea, cough, sore throat, headache or pain in the ears (fewer than 20 records) we could not calculate medics' specificity regarding these history details.

On anamnesis, medics showed high overall agreement with the doctors (83–97.9%). The specificity of medics' findings was also very high (85–100%). A very high sensitivity (>97%) was found regarding the classic symptoms of AVRI, i.e., rhinorrhea, cough, sore throat and headache. High sensitivity (89.3%) was found for the detection of illness duration of more than 7 days, and mediocre sensitivity (about 80%) for the presence of fever according to history and for the location of headache in the face or forehead. Noteworthy was the marked absence of the latter two characteristics from doctors' anamnesis (present in only 45% of the records).

Comparison of the decisions

According to the study protocol all the patients were referred to a physician, although only 119 of 190 (63%) had at least one indication for referral. The other 71 (27%) were referred to the physician without any indication according to the algorithm. The distribution of indications according to the proposed algorithm is shown in Table 1. The physicians found AVRI in 79 of these 119 (66%), while in 40 (37%) the referral was necessary since a bacterial infection was diagnosed, an antibiotic was prescribed or lab tests were ordered.

Of the 71 patients who were referred to a doctor not according to the algorithm, the physicians found AVRI in 65 participants. Individual checking of the other six patients revealed that in only two cases did the disagreement stem from erroneous triage by the algorithm. In four cases we found that the physician had swayed from the customary treatment guidelines of acute respiratory infections [Table 4]. Thus, the sensitivity of the algorithm, based on the medics' data, was 95.2% and its specificity 46.6%.

Table 4. Cases of disagreement between algorithm and physicians

	Case detail	Discussion
1	5 days of rhinorrhea, cough and sore throat. On examination without findings except for pharyngeal erythema. The physician ordered a throat culture, which was found to be sterile.	Throat culture was not obligatory
2	4 days of sore throat and cough. No fever. No findings on physical examination. The physician ordered a throat culture, which was found to be sterile.	Throat culture was not obligatory
3	The physician's diagnosis was viral URI and an antibiotic was prescribed	The prescription of an antibiotic by the physician was erroneous
4	One day of rhinorrhea, cough, sore throat, light headache. On examination sinus tenderness was found. The physician diagnosis was acute sinusitis and an antibiotic was prescribed.	It is customary not to commence antibiotic treatment for sinusitis before 7 days of illness [10]
5	The physician diagnosed otitis media	The medic did not record earache in his anamnesis
6	6 days of rhinorrhea, cough and sore throat. Oral temperature of 38°C was measured a day prior to his visit. On physical examination pharyngeal exudate was found and an antibiotic was prescribed.	Physical examination of the pharynx by the medic might have increased algorithm sensitivity

Discussion

A substantial portion of patient-doctor encounters in primary care, especially during the winter, is due to acute respiratory infections. Since AVRI is usually a minor self-limited illness, attempts have been made to reduce the proportion of visits to doctors by these patients. One strategy tested was the training of non-physician therapists to clinically evaluate and treat patients with AVRIs by using examination checklists and treatment algorithms [4–7].

Wilson et al. [4] examined the ability of army non-physician practitioners to care for a group of 3,802 pediatric patients with upper respiratory infections. They obtained a history and performed a physical examination as required to fill out a checklist, then referred to an algorithm. Agreement between the non-physicians and pediatricians on data and management decisions was then compared with agreement between pairs of pediatricians. The non-physicians demonstrated good (77–89%) overall agreement with pediatricians, and the agreement between the two groups did not differ significantly from the agreement on the same variables between pairs of pediatricians.

In another work by the same authors [5], the outcome and cost of care by the army medics were compared with those of pediatricians for 2,234 pediatric patients with upper respiratory infections. No significant differences were found in the status of the original symptoms, the number of patients reporting new symptoms, the number of return visits, or the reasons for return visits. Approximately 93% of both groups had no complaints about their care. Treatment costs by the medics were 15.5% lower, mainly due to lower labor costs.

Wood and colleagues [6] assessed the treatment of patients with a URI by military medics who used an algorithm. When compared to the treatment of 878 patients by internists, there was no significant difference in the percentage of return visits, symptoms duration, complications, or the rate of dissatisfied patients with medic-provided treatment. Total direct medical care costs were approximately 40% of costs generated by physicians, primarily because the algorithm determined an 80% reduction in diagnostic test costs.

Christensen-Szalanski et al. [7] investigated the care for 881 adults with URIs by using a system consisting of a checklist, an algorithm and a computer feedback to monitor the completeness of data collection and the precision of decision making. The care providers were physician assistants and nurse practitioners. The algorithm system significantly improved the completeness of the medical records, reduced the use of medical tests by 20–75%, and reduced non-provider costs by 36% per patient visit.

URI = upper respiratory infection

In the current study we found that most of the patients who visited the military primary care clinic due to acute respiratory infection were young (average age 21.1 ± 3.7) and generally healthy (93% without background illness). They usually had a minor disease (64% without fever) that was mostly diagnosed as viral URI without need for specific treatment (83% of cases). Nonetheless, 99% were referred to a physician in keeping with the current IDF medical corps policy. In line with the results of the above-mentioned works [4–7], we also found a high overall agreement (83–97.9%) between doctors and medics regarding the anamnestic details. Similar to what was shown by Christensen-Szalanski et al. [7], the completeness of anamnesis was markedly improved when a structured questionnaire was used.

The proposed algorithm could have averted 37% of referrals to medical doctors, even though it was based on history details alone and without the performance of a physical examination, with a sensitivity of 95.2%. This sensitivity might have been further improved if the medics had been allowed to examine the pharynx and check for exudate. This simple examination could have raised algorithm sensitivity to 97.6%.

It should be borne in mind that our patients were young and generaly healthy. It is possible that if our algorithm had been applied to an elderly population with chronic background ailments the outcome would have been different. Further investigatuon is needed to settle this issue before the proposed algorithm is implemented in clinics with different patient characteristics .

Interestingly, there was a high algorithm sensitivity and high agreement between doctors and medics in spite of the fact that the medics were not thoroughly trained to use the research questionnaire and no feedback was provided during the trial to improve medics' work.

The specificity of the algorithm was low (46.6%). This value could have been improved had the medics been taught, and allowed, to perform the part of the physical examination that is relevant to respiratory infections, as shown by the previously mentioned works.

The criterion with the lowest specificity was the one intended to exclude the possibility of meningitis. This criterion resulted in a 23% referral rate, even though there was no case of suspected meningitis in the study population according to the doctors [Table 4]. In another study, Van de Beek and team [9] detailed the clinical characteristics of 696 cases of bacterial meningitis. In 95% of cases at least two of the following were present: headache, fever, neck stiffness, and change in mental status. Therefore, it seems that despite the low specificity, careful examination of patients with fever and significant headache is required..

In conclusion, most of the patients who visit the military primary care clinic due to acute respiratory infections are young and generally healthy. They usually have a minor viral disease. Military medics, equipped with a structured questionnaire and an algorithm but without any special training and without performing a physical examination, can effectively triage patients, such that 37% of referrals to medical doctors can be avoided with a 95.2% sensitivity for the detection of bacterial infections and respiratory infection complications.

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All real living is meeting

Martin Buber (1878-1965), Austrian-born Jewish religious philosopher. His best-known and most influential book was *I and Thou*, which sets out his philosophy of religious faith in the form of a dialogue between man and God. A committed Zionist, he settled in Palestine in 1938 and advocated a joint Jewish-Arab state.