

The Ecology of Medical Care Among Israeli Military Aviators

Barak Gordon; Yuval Levy; Tal Yemini; Erez Carmon; Yifat Erlich; Doron Hermoni*

- BACKGROUND:** The ecology of medical care model has been used in various populations with varying results. We aimed to apply this model in the population of Israeli Air Force (IAF) aviators.
- METHODS:** An anonymous questionnaire was presented to all Israeli Air Force aviators during their mandatory yearly check-up over 1 yr starting on November 26th, 2012. The questionnaire contained items on demographic, personal, and military details, as well as items on the presence of clinical symptoms, and various health care contacts in the previous month. We assessed the differences between career and reserve personnel using a χ^2 test.
- RESULTS:** There were 325 aviators who completed the questionnaire (2 women, 132 reserves). Clinical symptoms were reported by 62.5% of the responders. Over half (52.6%) had any health care encounter: 23.7% with a dentist, 17.9% with non-MD therapists, 12.6% with a specialist, and 11.7% with a primary physician. A significant difference between reserve and career personnel was found only in primary care visits. Out of the aviators who reported having clinical symptoms, 70.9% did not visit a physician. Of those who did not seek medical care, 42.4% reported that the symptoms were viewed as unimportant, 41% thought they would disappear by themselves, 40.3% could not find time for treatment.
- CONCLUSIONS:** Aviators in the IAF have similar rate of clinical symptoms as in other unselected populations. Those who report symptoms usually do not visit a physician for treatment. When they do seek advice it is mostly from non-MD practitioners.
- KEYWORDS:** healthcare, aerospace medicine, medical symptoms.

Gordon B, Levy Y, Yemini T, Carmon E, Erlich Y, Hermoni D. *The ecology of medical care among Israeli military aviators*. *Aerosp Med Hum Perform*. 2016; 87(12):1036–1040.

In a landmark 1961 study, White and colleagues established the model of a medical care ecology study.¹² Succinctly, they have shown that in an average month 750 out of a 1000 people reported illness or injury, 250 visited their physician, of which 9 were hospitalized in general hospitals and 1 in an academic center. The study has revolutionized our understanding of the relationship between primary, secondary, and tertiary health care.

The model has since been revisited in various populations and in various methods with varying results. Some studies showed results that resembled the original article,⁶ others showed similar results in some, but not all, parameters,^{5,9} and others showed very different findings.^{3,8} The medical care services also varied between the studies, such mental health,² or native common practices, such as traditional Chinese medicine,⁸ or alternative and complementary care.^{5,6}

Various factors are implicated as explaining these observed differences.⁴ Some of these factors are population-based, such as age and age groups studied (e.g., pediatric), race or origin,

sex, and socio-demographic factors. Others are health-system based, such as type of health insurance or coverage, health care infrastructure, services availability, costs and payment methods. Yet other factors might be methodological in data gathering methods (retrospective, prospective, data-based, questionnaires etc).

The Israeli Air Force Aero-Medical Center (IAFAMC) allows for a unique view into health care services in a specific population. All IAF aviators go through a yearly medical examination at the IAFAMC clinic as part of their medical fit-to-fly determination. The ecology of medical care model was

*Posthumously

From the Medical Corps, Israeli Defense Forces, Tel Hashomer, Israel.

This manuscript was received for review in June 2015. It was accepted for publication in July 2016.

Address correspondence to: Dr. Barak Gordon, 38 Tarshish St. Shoham, Israel; drbarakgordon@gmail.com.

Reprint & Copyright © by the Aerospace Medical Association, Alexandria, VA.

DOI: 10.3357/AMHP.4406.2016

applied to this highly selected population in order to determine its health care practices.

METHODS

Study Population

All active IAF aviators (pilots, navigators, and flight engineers) go through a yearly medical examination at the IAFAMC. This population includes aviators 21 – 67 yr of age. The main subpopulations in this cohort are career military personnel, and reserve aircrew. All reserve aviators were once career personnel. Reserve personnel acquire most health care services through Israeli Health Maintenance Organizations or the private sector, while career military personnel obtain all their health care through the Israeli Defense Force Medical Corps.

Questionnaire

A questionnaire was handed to all IAF aviators during their yearly examination in a single year starting at the 26th of November 2012. This includes practically all IAF aviators except those who ceased their flying career or were abroad for the entire year. The precise number could not be disclosed due to national security issues. Answering the questionnaire was completely voluntary. From our experience, aircrew are very sensitive concerning the medical information they are willing to reveal, mainly because of fear of losing their flying status. Therefore, the questionnaire was maintained as strictly anonymous. No identifying data were written on it, and it was returned into a closed container with no human interface. The questionnaire contained items on demographic and

occupational information. An item on types of medical symptoms encountered was introduced. If a symptom was present the respondent was asked whether he made an appointment with a physician. If not, he was asked why. Multiple answers were possible on this item. The questionnaire also contained items on the actual contact with health care services during the previous month (not necessarily due to symptoms) including: primary physician encounters, consultant encounters, emergency room visits, other nonphysician medical professional encounters, dentist visits, hospitalizations, imaging studies performed, and medication use. The questionnaire was written in Hebrew, as all military aviators in Israel are fluent with it.

The study was approved by the Israel Defense Forces Medical Corps institutional review board with an exemption of the need for written consent due to strict anonymity maintenance.

Statistical Analysis

The study is descriptive in essence. The ecology of medical care for the population is presented as the percentile of the specific item (symptom or health-care use). Because there are fundamental differences in the delivery of medical care between career military personnel and reserve personnel, we compared the two subpopulations using a two-tailed X² test for the various health care services examined. Statistical significance was determined as $P < 0.05$.

RESULTS

The questionnaire was completed and returned by 325 participants. The demographic and military information of the responders is given in **Table I**. All but two respondents were males, most were married and had children, and more than half were career military personnel. Half were fighter-jet crew, most were of middle rank, and most were pilots. The ecology of medical care of the entire population (**Fig. 1**) indicates that 62.5% had symptoms. The most common health care encounter was with the dentist, followed by non-MD therapists (such as dietitian, chiropractor, etc.). There were more consulting encounters with specialists than primary care encounters.

The ecology of medical care in reserve and career personnel is presented in **Table II**. There were no significant differences except for fewer primary care encounters in career personnel. Of the respondents, 144 (54

Table I. Demographic and Occupational Characterization.

CHARACTERISTIC	COMPLETED		RESULTS	
	NUMBER	PERCENT	NUMBER	PERCENT
Average age in years (\pm SD)	323	99%	35.89 (10.1)	
Gender	325	100%		
Marital status	323	99%		
Single			109	34%
Married			210	65%
Divorced			4	1%
Offsprings	325	100%		
Offsprings reported			192	59%
Average, if present			2.76 (0.99)	
Military status	300	92%		
Reserve			132	44%
Flight platform	310	95%		
Jet fighter			154	50%
Helicopter			82	26%
Transport			74	24%
Rank	313	96%		
Junior (Lt-CPT)			86	28%
Middle (MAJ-LTC)			220	70%
Senior (COL and higher)			7	2%
Position	312	96%		
Pilot			260	83%
Navigator			46	15%
Flight engineer			6	2%
Duration of flying career (average) in years	312	96%	16.04 (10.36)	

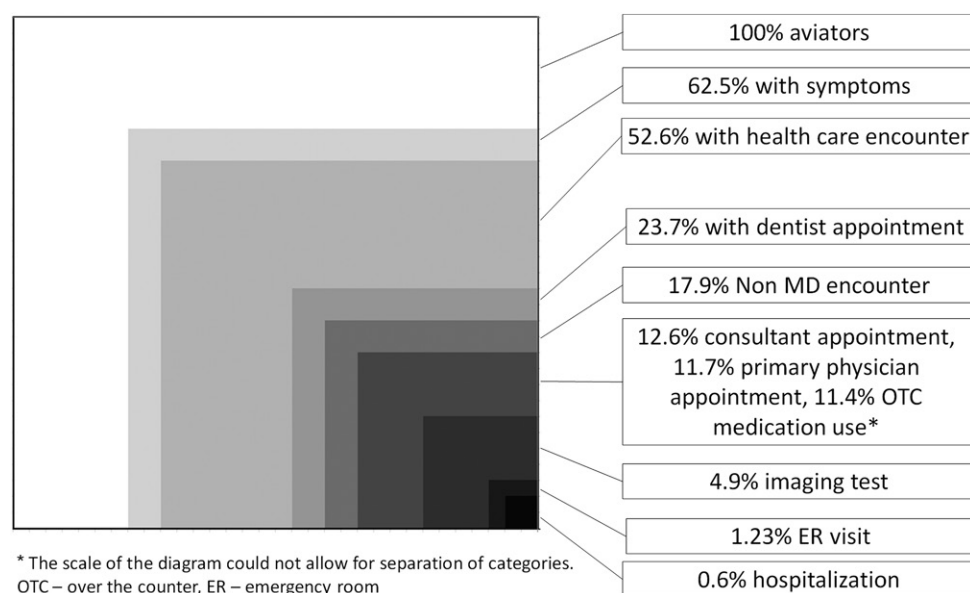


Fig. 1. The ecology of medical care in Israeli Air Force aviators.

reserve; 84 career aviators) reported not visiting the physician due to symptoms (70.9% of those reporting any symptom). Reasons for not visiting a physician are given in **Table III**.

The top reasons were: ascribing no significance to the symptom, the thought it would spontaneously disappear, and a lack of available time for the appointment. No respondent reported fear of further tests, and only 1.4% reported that they feared they would be disqualified from flying, or that they were too ashamed to consult.

DISCUSSION

We applied the ecology of medical care model in a unique population of aircrew in the Israeli Air Force. We found that 62.5% of the 325 aviators who completed the anonymous questionnaire suffered from some symptom in the previous month, and that 70.9% of them did not go to see the doctor for these symptoms. Participants had contact with the health care system in the following capacities in descending frequencies: a dentist, a non-MD therapist, a specialist, a primary care physician, over the counter medication, imaging, emergency room visit, and

hospitalization. We found that career personnel who are insured by the military had a similar pattern of health care use as reserved personnel who are insured by civilian HMOs, except for fewer primary care encounters. This is the first time, to our knowledge, that health-care seeking behaviors in aircrew were investigated.

Various studies concerning the ecology of health care in the general population have been published. They differ in the population studied, methods of data acquisition, and types of medical services inquired. Some studies examined the ecology of medical care in the pediatric population,³ some in adults,¹² and some in both.^{5,6,8} Some studies

investigated specific population such as patients with a mental disorder.² Some studies utilized information from national or local databases,^{2,9} and some used questionnaires or interviews,^{5,6,8} or a combination of both.^{3,4} Some studies investigated contacts with health care services only,^{2,3,9} and others added presence of symptoms.^{5,6,8} The duration of recall time for the presence of symptoms also vary between studies ranging from 2 wk to 3 mo. Because there is such a variety of studies, it is difficult to compare ecology pattern between the investigated populations.

In our study we investigated a specific population of military aviators. Research on military aircrew health-status, health seeking behaviors, and health-services consumption is lacking. Nevertheless, military aviators are usually considered at the top level of health. This is due to both preflighting career screening, and regular examinations, detection of medical problems and disqualification of unhealthy subjects. It is interesting to note that in this fit population the incidence of medical symptoms is similar to other investigated populations. As mentioned above, the rate of medical symptoms in the previous month in our cohort was 62.5%. White *et al.* estimated the rate of reported illness or injury in a single month in the English and American

Table II. The Ecology of Medical Care.

	TOTAL		RESERVE AVIATORS		CAREER AVIATORS		P-VALUE
	NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT	
Symptoms present	203	62.5%	77	58.3%	110	65.5%	0.441
Health care encounter	171	52.62%	61	46.2%	96	57.1%	0.160
Dentist appointment	77	23.69%	28	21.2%	41	24.4%	0.480
Non-MD encounter	58	17.85%	22	16.7%	32	19.0%	0.868
Consultant appointment	41	12.62%	16	12.1%	23	13.7%	0.691
Primary physician appointment	38	11.69%	25	18.9%	12	7.1%	0.004
Over the counter medication use	37	11.38%	15	11.4%	20	11.9%	0.839
Imaging test	16	4.92%	6	4.5%	9	5.4%	0.921
Emergency room visit	4	1.23%	1	0.8%	3	1.8%	0.613
Hospitalization	2	0.60%	0	0.0%	2	1.2%	0.393

Table III. Number of Respondents Not Visiting the Doctor for Present Symptoms and Reasons Given as to Why.

REASONS FOR NOT SEEING THE DOCTOR	RESERVE		REGULAR		TOTAL	
	N	PERCENT	N	PERCENT	N	PERCENT
The symptoms didn't have any significance in my view	24	44.4%	32	38.1%	59	41%
I thought the symptom would go away by itself	21	38.9%	36	42.9%	58	40.3%
I couldn't make the time	14	25.9%	41	48.8%	57	39.6%
I self-treated the problem	12	22.2%	14	16.7%	26	18.1%
The symptom resolved before I got to the doctor	2	3.7%	15	17.9%	17	11.8%
I planned to report on the routine examination	0	0%	5	6%	5	3.5%
I consulted friends (nonphysicians)	0	0%	4	4.8%	4	2.8%
There was no available appointment	1	1.9%	1	1.2%	2	1.4%
I was ashamed to consult	1	1.9%	1	1.2%	2	1.4%
I was afraid I would be disqualified from flying	1	1.9%	1	1.2%	2	1.4%
I was afraid a disease would be found	0	0%	1	1.2%	1	0.7%

adult general population to be 75% in 1961.¹² Green *et al.* reported a rate of 80% in the general population (including pediatric population) in 2001.⁶ Fukui and colleagues reported a higher rate of symptoms (86.2%) in the Japanese general population,⁵ and Danielle and colleagues reported on a similar rate of 86% in a community based study in the Netherlands.¹⁰ The lower rate of symptoms in our cohort might stem from their lower average age, and the fitness of the population, which consists of active military aircrew. It is interesting to note, however, that Leung and colleagues reported even lower rate of symptoms in a general Chinese Hong-Kong based population in 2005 (56.7%).⁸

It is important to note that all these studies did not report on the severity of symptoms, illness, or injury. It is possible that the fitness of the population in our study is manifest in a milder character of the symptoms reported. This might be supported by the reasons our aircrew reported for not going to see the doctor even if they had symptoms, mainly because they thought the symptoms were unimportant or that they would go away by themselves. Previous studies reported on similar rates of nonattendance even though the patients suffered from various symptoms. In a study from the Netherlands 14.7–32% of patients suffering from various symptoms consulted a physician,¹⁰ but the reasons for not going to the doctor were not described. Verbrugge and Ascione reported that seeking medical care is the least sought for practice in handling symptoms, preceded by using prescription and nonprescription drugs, lay consultation, and restricted activity.¹¹ It is interesting to note that there are some differences between career and reserve personnel in the reasons they give for not going to the doctor. These should be further investigated. We are not aware of a study that described the reasons patients with symptoms report for not visiting their doctors. Laubach and Brohler reported that in a German population, 8–10% would not go to see the doctor even if they had clear and somewhat ominous symptoms such as blood in the urine or fainting.⁷ They reported that women and the elderly tended more to see the doctor than men and younger persons. Our cohort consisted almost entirely of young males. This might explain the low rate of physician visits due to symptoms. Al Windi reported that the tendency to consult

the physician is influenced both by the type of the symptom and the number of symptoms present.¹ Because our cohort is young and usually fit, this might also explain the low rate of physician visits.

Another restriction on generalizing the results of ecology of medical care studies is the differences in the characteristics of the health system. Costly services would logically curtail the contact frequency with the health care system. On the other hand, free access to certain services might increase the frequency of people in contact with these services. In our study we compared two subpopulations with different health care systems. Career personnel in the military are insured by the Medical Corps and acquire all their medical services free of charge. Reserve personnel are insured by the Israeli HMOs. Primary care is free of charge, as well as most emergency room visits and all hospitalizations. Other services contain a modest copayment (specialists, imaging) and others might encompass significant payment (dentistry, non MD-consultations). Surprisingly we did not find significant differences between these subpopulations, except in primary care, which in both cases is free of charge. We therefore can conclude that in our population costs are not an issue in utilizing health care services.

There are several limitations to our study. First, because aviators are usually suspicious of medical questionnaires, as mentioned above, there might be a reporting bias. We believe that our effort to achieve complete anonymity were sufficient to negate this issue. The rate of symptom-reporting, which is higher than expected, is in favor of our opinion. Other possible biases are response bias and recall bias. Second is the relatively small sample size. Both these limitations should put a restriction on interpretation of the statistical differences between career and reserve personnel. Third, is the fact that we investigated a highly specific population, which hinders generalization of the results. Nevertheless, as we stated above, the similar rate of symptoms reported in our study compared to previous studies in the general population might hint at the opposite opinion, that our population, although preselected, is similar to the general population in the aspect of the ecology of medical care. To our knowledge, no study reporting the ecology of medical care in the general Israeli population has been concluded for comparison.

To conclude, in a cohort of Israeli military aviators the rate of symptom-reporting is similar to other unselected populations previously reported in the medical literature. Aviators, both career and reserve personnel, had more encounters with non-MD therapists and specialists than with primary care physicians. When experiencing symptoms, most aviators did not seek medical advice, mainly because they did not think the symptom was of concern, or they thought it would go away by itself. Our study is important in describing the interaction of military aviators and the health system, both military and civilian. Our results might be used to plan the provision of medical care in order to meet this specific population medical needs.

The authors believe this is the first report of the ecology of medical care in any Israeli population, and to our knowledge, the first report of such a study in military settings. Further study is warranted to compare our results with ecology of medical care in the Israeli population and other military populations.

ACKNOWLEDGMENTS

Authors and affiliations: Barak Gordon, M.D., M.H.A., Tal Yemini, M.D., Erez Carmon, M.D., and Yifat Erlich, M.D., Medical Corps, Israel Defense Forces, Tel Hashomer, Israel, and Chief Medical Officer Headquarters, Israeli Air Force, Tel Hashomer; Barak Gordon, M.D., M.H.A., and Doron Hermoni, M.D. (posthumously), Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv; Yuval Levy, M.D., M.H.A., Wolfson Medical Center, Holon; and Doron Hermoni, M.D. (posthumously), Sharon-Shomron District, Clalit Health Services, Kfar Saba, Israel.

REFERENCES

1. Al-Windi A. The influence of complaint symptoms on health care utilization, medicine use, and sickness absence. A comparison between retrospective and prospective utilization. *J Psychosom Res.* 2005; 59(3): 139–146.
2. Chou LF. The ecology of mental health care in Taiwan. *Adm Policy Ment Health.* 2006; 33(4):492–498.
3. Dovey S, Weitzman M, Fryer G, Green L, Yawn B, et al. The ecology of medical care for children in the United States. *Pediatrics.* 2003; 111(5, Pt. 1):1024–1029.
4. Fryer GE Jr., Green LA, Dovey SM, Yawn BP, Phillips RL, Lanier D. Variation in the ecology of medical care. *Ann Fam Med.* 2003; 1(2): 81–89.
5. Fukui T, Rhaman M, Takahashi O, Saito M, Shimbo T, et al. The ecology of medical care in Japan. *Japan Med Assoc J.* 2005; 48(4):163–167.
6. Green LA, Fryer GE Jr., Yawn BP, Lanier D, Dovey SM. The ecology of medical care revisited. *N Engl J Med.* 2001; 344(26):2021–2025.
7. Laubach W, Brohler E. Bodily symptoms and utilization of medical care. *Dtsch Med Wochenschr.* 2001; 126(7):T1–T7 [German].
8. Leung GM, Wong IO, Chan WS, Choi S, Lo S-V, Health Care Financing Study Group. The ecology of health care in Hong Kong. *Soc Sci Med.* 2005; 61(3):577–590.
9. Shao CC, Chang CP, Chou LF, Chen TJ, Hwang SJ. The ecology of medical care in Taiwan. *J Chin Med Assoc.* 2011; 74(9):408–412.
10. Van der Windt DA, Dunn K, Spies-Dorgelo MN, Mallen CD, Blankenstein AH, Stalman WA. Impact of physical symptoms on perceived health in the community. *J Psychosom Res.* 2008; 64(3):265–274.
11. Verbrugge LM, Aschione FJ. Exploring the iceberg. Common symptoms and how people care for them. *Med Care.* 1987; 25(6):539–569.
12. White KL, Williams TF, Greenberg BG. The ecology of medical care. *N Engl J Med.* 1961; 265:885–892.