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Antimicrobial Resistance and Irrational Prescribing: Primary Healthcare Physicians' Knowledge and Perceptions in Greece

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Abstract

Background: Antimicrobial Resistance (AMR) is a growing serious global public health issue in both inpatient and outpatient health care.

Aim: The aim of this study was to evaluate primary health care physicians' knowledge and perceptions on antimicrobial resistance and irrational prescribing.

Methods: A cross-sectional study was conducted in all Primary Healthcare settings (PHC) of the Peloponnese district from May to October 2020. For data collection an updated and adjusted questionnaire was used based on previous Greek studies. Statistical analysis was based on descriptive and inductive statistics.

Results: Overall, 306 out of 404 physicians responded to the questionnaire, reaching a 75.8% response rate. The majority (96%) considered antimicrobial resistance as a major public health problem in Greece. Irrational prescribing (95.4%), self-medication (95.4%) and antibiotic administration from pharmacists without a prescription (94.7%) were declared as the most important causes of AMR. Also, diagnostic uncertainty (68.9%) and patient/parent satisfaction (55.4%) were reported as the main causes of irrational prescribing. Physicians' perception on the causes of AMR and irrational prescribing were related with physicians' demographic and occupational characteristics ($p \leq 0.05$).

Conclusion: Primary healthcare physicians in Greece seem to recognize AMR as a major health threat and irrational prescribing among the most significant causes. Therapeutic protocols/guidelines and continuing education are illustrated as the measures needed for the AMR control to decrease diagnostic uncertainty and improve prescribing practices.

Keywords: Antibiotics; Antimicrobial resistance; Irrational prescribing; Primary health care; Physicians

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Introduction

Antimicrobial Resistance (AMR) is a growing global public health issue in both hospital and primary health care [1]. AMR limits the number of therapeutic options, increases morbidity and mortality, lengthens hospitalization and treatment, and places a tremendous burden on healthcare systems and society in general. Annual direct and indirect costs reach approximately €1.5 billion in the EU [2-4]. In 2019, the World Health Organization (WHO) outlined AMR as one of the 10 top threats to global health, alongside air pollution and climate change, non-communicable diseases, vaccine hesitancy and others [5]. In 2014 the magnitude of the attributable to AMR threat corresponded to 700,000 deaths per year worldwide and is estimated to reach 10 million by 2050 [6].

Inappropriate prescribing is recognized as the factor contributing the most to the development of AMR, especially in primary healthcare [7-9]. Moreover, irrational use of antibiotics is driven by several influential factors such as fear of complications, lack of information, excessive and unnecessary antibiotic prescribing, incorrect dosage or route of administration, antibiotic prescribing for non-bacterial infections, patient demands and self-prescribing [8-10]. Therefore, antimicrobial resistance is an emerging health threat worldwide, making rational antibiotic use an urgent necessity [11,12].

Physicians are responsible for making prescribing decisions as well as for the selection of

the type of antibiotic. Their knowledge, attitudes, believes and perceptions towards antibiotics' use and resistance are likely to influence their prescribing behavior. Studies have indicated that the fear of complications from infections, the complacent attitude towards patients and the insufficient knowledge regarding AMR are the most significant factors related to antibiotics' prescribing by physicians [13-15]. It is worth noting here that several studies have shown that physicians generally consider AMR to be a serious global and/or national problem, but not a problem that they are facing in their everyday practice [16,17]. In order to contain the antimicrobial resistance issue, changes in the physicians' prescribing behavior would be required regarding their knowledge, awareness and considerations on AMR. Any changes introduced in the physicians' clinical practice and prescribing behavior would obviously contribute to the development of more effective interventions on AMR containment [18,19].

Both antimicrobial consumption and resistance are very high in Greece, ranking the country among the highest in Europe. More specifically, Greece is among the top three European countries at the greatest risk and is expected to experience the highest mortality rates by 2050 [20]. Several regulatory measures for the control of antibiotic use and physician prescribing have been implemented by the government at the outpatient and inpatient care, such as e-prescribing, antibiotic prescription guidance and inspection, patient electronic health record, publication of therapeutic protocols and guidelines, ban of over-the-counter antibiotic dispensing from pharmacists [21-24]. However, it seems that no progress has been achieved and the problems still remain. Thus, the aim of this study was to evaluate primary health care physicians' knowledge and perceptions on antimicrobial resistance and irrational prescribing.

Methodology

A cross-sectional study was conducted in all Primary Healthcare settings (PHC) of the Peloponnese district. The district includes 34 healthcare settings and specifically, Health Centers (HC), Rural Health Centers (RHC), and Local Health Units (TOMY), providing explicit primary health care to 1.046.897 residents [25]. Outpatient private physicians and consultation offices were excluded from the analysis, given that they do not belong to the NHS. At the period of the study 404 physicians were employed. Before the initiation of the survey, permission was given by the 6th regional health authority as well as by the ethics committee of the University of Peloponnese. The survey was conducted from May to October 2020.

An anonymous, self-administered and updated questionnaire was structured based on previous Greek studies focused on hospital care [26-29]. The tool was distributed to PHC physicians and included questions related to their' demographic and occupational characteristics as well as on their attitudes, knowledge and beliefs towards AMR and irrational prescribing. The answers are given at a four-point Likert scale, where 1 corresponds to "very important" and 4 to "not important", while the remainder of the questions was multiple-choice.

Statistical analysis

Mean values and Standard Deviation (SD) for the quantitative and percentages for qualitative variables were used in the descriptive analysis. The data was not normally distributed, so nonparametric tests were used. The Chi-Square test was performed in order to investigate whether there is any relation between the categorical variables. The Mann-Whitney U test was performed in order to compare statistically significant differences between two independent groups and the Kruskal-Wallis test for comparing among three or more groups. Levels of significance were two-tailed and statistical significance was set to p=0.05. The SPSS 25.0 software was used for statistical analysis.

Case Presentation

Overall, 306 out of 404 physicians (Table 1) responded to the questionnaire, reaching a 75.8% response rate. The majority (52.6%) was male with a mean age of 40.7 ± 11.1 years and 60.8% were General Practitioners (GPs). In addition, 24.5% of participants had a postgraduate degree and 53.8% more than 11 years of work experience. As shown in Figure 1, the majority of respondents (96%) stated that antimicrobial resistance is a major public health problem in Greece. Also, irrational prescribing, self-medication, antibiotic administration from pharmacists without prescription and the extended use of broad-spectrum antibiotics were declared as the most important causes of AMR.

According to our results, statistically significant differences were found between participant's socio-demographic and occupational data and their perceptions on AMR. As shown in Table 2, women were more likely than men to consider that bad hand hygiene and antibiotic administration from pharmacists without a prescription were important causes of AMR. Moreover, internal medicine physicians and GPs were more likely to believe that bad hand hygiene was an important cause of AMR compared to physicians with other specialties.

As far as antibiotic abuse is concerned, physicians were asked to prioritize the implications observed, as shown in Figure 2. As first implication was reported the antimicrobial resistance followed by the destruction of beneficial bacteria and weakening of immunity as well as the allergic reactions and last common events, such as diarrhea,

Table 1: Physicians' socio-demographic characteristics.

Sample characteristics	No	Percentages (%)
Gender		
Male	160	52.6
Female	144	47.4
Age group		
≤ 40 years	117	40.2
≥ 41 years	174	59.8
Physicians' Specialties		
General Practitioners (GPs)	186	60.8
Pediatricians	32	10.5
Neurologists, pneumonologists, cardiologists	25	8.2
Internal medicine physicians	14	4.6
Rural physicians (non-specialized)	49	16
Total No. of Physicians	306	100
Postgraduate qualifications		
None	231	75.5
MSc/PhD	75	24.5
Years of work experience		
≤ 10 years	133	46.2
≥ 11 years	155	53.8

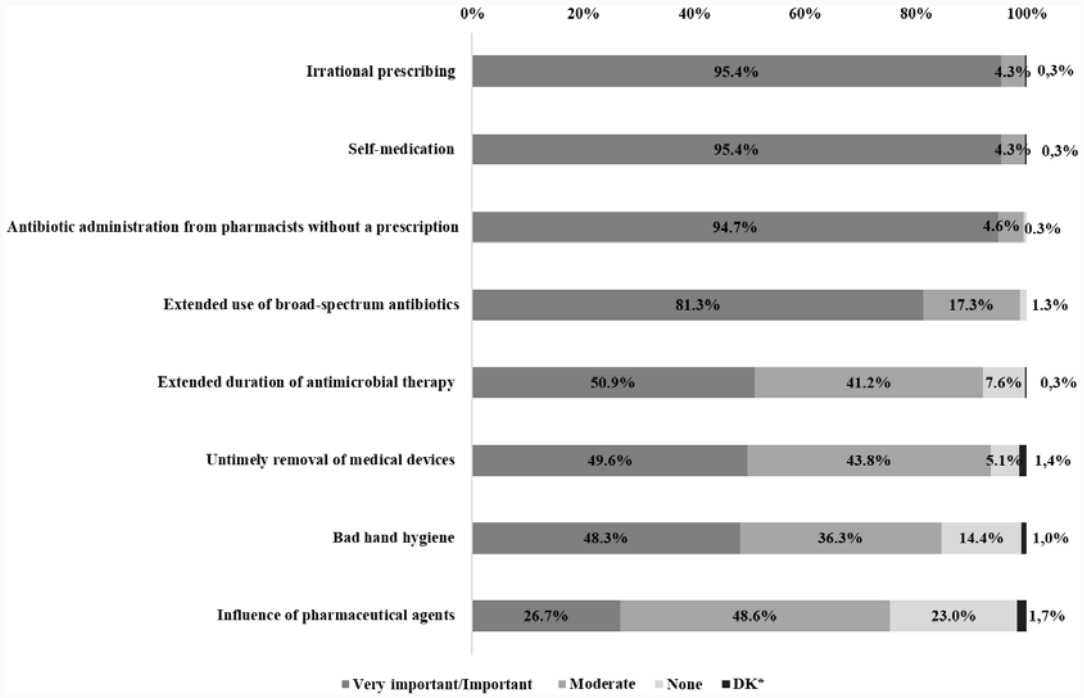

Figure 1: Physicians' perceptions on the causes of AMR.
*DK: Don't Know

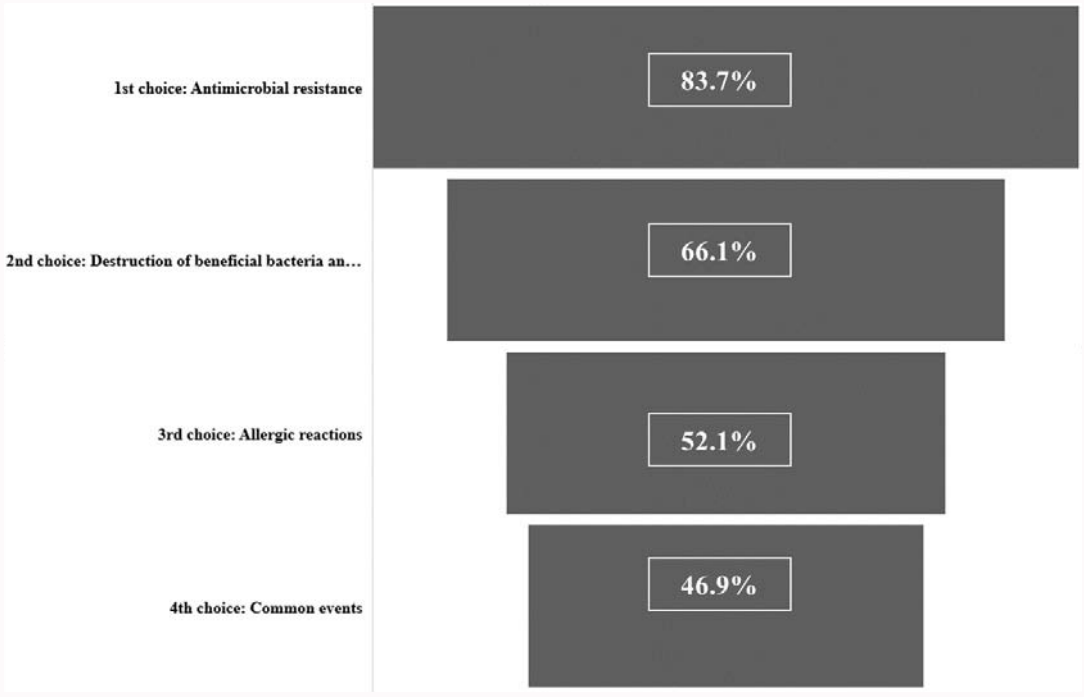

Figure 2: Physicians' perceptions related to antibiotic abuse implications.

vomiting, etc.

Diagnostic uncertainty stated by 68.9% of respondents, followed by patient/parent satisfaction (55.4%), lack of inspection upon prescribing (21.4%), workload (20.8%) and guided prescribing (17.0%) were reported by PHC physicians as the main causes of irrational prescribing. Also, 65% of men declared the workload of higher importance of irrational prescribing than 35% of women (p=0.031). Furthermore, GPs considered that the lack of inspection was a significant cause of irrational prescribing, as already shown in Table 2.

In Figure 3, participants' perceptions on the measures that should be taken to control irrational prescribing are presented. The use of therapeutic protocols and international guidelines was found to be of highest importance, followed by the prescription-focused education

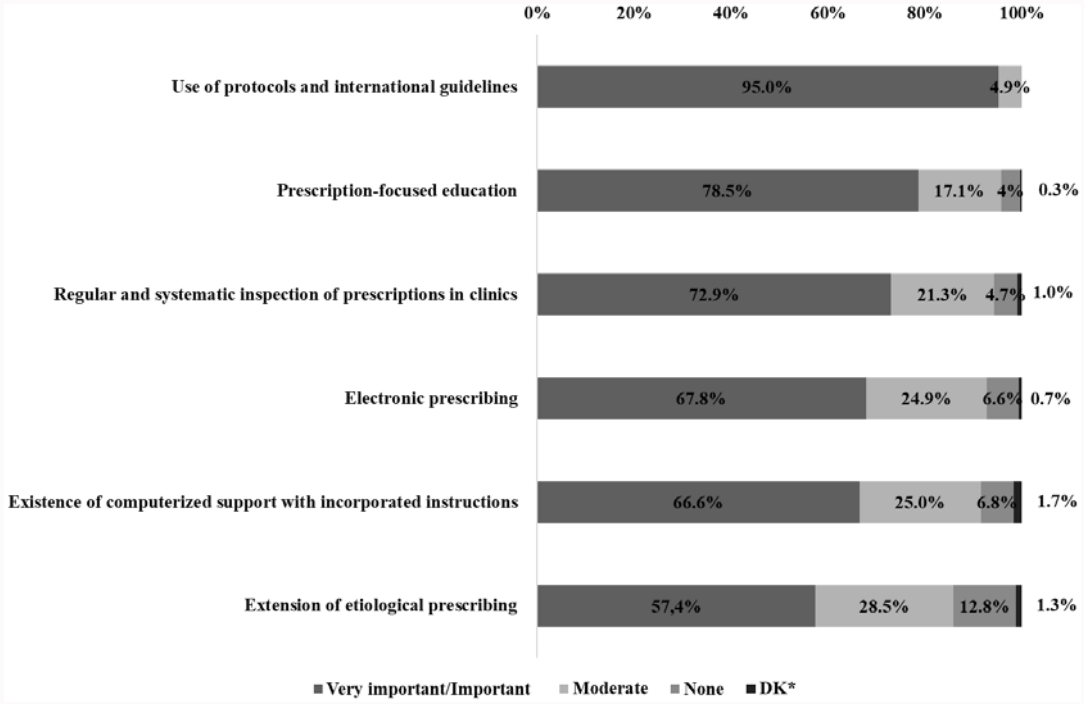

Figure 3: Physicians' perceptions of measures to decrease irrational prescribing.
*DK: Don't Know

Table 2: Physicians' perception on the causes of AMR and irrational prescribing.

	Bad hand hygiene	Antibiotic administration from pharmacists without a prescription	Lack of inspection upon prescribing	Prescription-focused education
	mean (S.D)		%	mean (S.D)
Gender				
Male	2.6 ± 0.9	1.5 ± 06		
Female	2.3 ± 0.9	1.3 ± 05		
P value	*0.042*	*0.011*		
Physicians' Specialty				
General practitioners (GPs)	2.4 (0.9)		47.50%	1.7 (0.7)
Pediatricians	2.6 (1.0)		18.00%	2.1 (0.8)
Neurologists, pneumonologists, cardiologists	3.0 (1.0)		13.10%	1.9 (0.6)
Internal medicine physicians	2.2 (1.1)		6.60%	2.0 (1.0)
Rural physicians (non-specialized)	2.5 (0.9)		14.80%	2.1 (1.0)
P value	*0.048*		*0.032*	*0.033*

as well as the regular and systematic inspection of prescriptions. As far as the economic burden of irrational prescribing, 55.5% of respondents highlighted its high cost, 35.7% moderate, while 5.2% reported it as low and 3.6% didn't know.

In addition, it should be noted that the causes of irrational prescribing were related with physicians' demographic and occupational characteristics. More specifically, women (1.2 ± 0.5, p=0.004) were more likely than men (1.4 ± 0.6 and 2.5 ± 1) to believe that the use of therapeutic protocols and international guidelines as well as the extension of etiological prescribing (2.1 ± 1, p=0.002) could contribute to the decrease of irrational prescribing. Furthermore, GPs were more likely to consider that prescription-focused education could significantly contribute to the decrease of irrational prescribing than physicians of other specialties (Table 2).

Discussion

The aim of the study was to assess the PHC physicians' knowledge and perceptions on antibiotic resistance and irrational prescribing in the region of Peloponnese.

According to our results, the majority of PHC physicians highlighted AMR as a serious public health problem in the country. They reported irrational prescribing, self-medication, antibiotic administration from pharmacists without a prescription and the extended use of broad-spectrum antibiotics, as the main causes of

antimicrobial resistance. However, it seems that they are not well informed about the other AMR contributors, such as the extended antimicrobial therapy and bad hand hygiene. In addition, they declared the existence of therapeutic protocols and guidelines as well as the prescription focused education as the most effective measures for the reduction of irrational prescribing.

Physicians' high levels of AMR awareness and recognition as a serious public health issue are also reported in the study of Zetts et al. [30] conducted in primary health care settings in the United States, as well as in other studies focused on hospital care [27,31-33]. On the contrary, lower levels were found in the study of Nicholson et al. [34], where as hospital physicians' recognition of AMR as a serious public health problem reached 70%. Also, in the survey of Labi et al. [35], conducted in a tertiary care hospital, physicians' AMR awareness was estimated at 9%. It seems that the misconception toward the severity of the impact of AMR leads to complacency and distancing from this public health threat that obviously influences physicians prescribing attitudes.

In addition, the influence of widespread and inappropriate use as well as the overuse of broad-spectrum antibiotics, are also reported by physicians as major AMR drivers in several studies in primary and secondary health settings [34,36,37]. Furthermore, antibiotics' self-medication and dispensing from pharmacist without a prescription are also reported as significant AMR factors by Rather [38]. It should be noted that in Greece, dispensing from pharmacists of any over the counter antibiotic substance is forbidden [24], in an effort to restrict self-medication practices.

Bad hand hygiene as a less important cause of AMR seems to be another common finding in the international literature [10,39,40], despite the fact that hand hygiene WHO guidelines, are provided to health-care workers and stakeholders with a thorough review of evidence on hand hygiene contribution to reduce transmission of resistant pathogenic [40]. Hand hygiene as a significant AMR prevention measure is identified by almost one out of two respondents in several studies [34,37]. Therefore, the slow endorsement of poor hand hygiene as an AMR contributor may also reflect the lack of physicians' awareness on the effectiveness of this simple and yet underused practice. Thus, the elimination of such misconceptions might be a prerequisite for effectively combating resistance.

Diagnostic uncertainty as the main cause of physicians' irrational prescribing in the primary and secondary healthcare settings, is also demonstrated by studies of Kotwani & Holloway and Geitona et al. [28,41]. The fear of treatment failure could be minimized using Point of Care (POC) tests which can significantly contribute to the decrease of diagnostic uncertainty through ruling out the possibility of viral infections and consequently, the administration of antibiotic therapy [42,43]. Furthermore, patient demand and parents' satisfaction are documented as important factors of irrational prescribing in the international literature [28,44-46]. In these studies, the inappropriate use of antibiotics was found to arise from the behavior of both patients and physicians, indicating that prescribers are sometimes influenced by patient's request, especially on the ground of workload and lack of time. Also, another factor contributing to the irrational prescribing, widely documented in the internationally literature, is the influence that the industry can impose on physicians [47,48].

Finally, our findings are also consistent with several surveys regarding the measures that could mostly contribute to the control and decrease of irrational prescribing [34,41,46]. These studies report that interventions such as protocols and international guidelines, prescription-focused education and conferences, promote voluntary changes in prescribing behavior and offer the additional advantage of prescribing support to physicians who are insecure about optimal antibiotic use.

Study Limitations

In the current study, there are some limitations that should be discussed. Despite the fact that our sample is representative to Peloponnese region, our findings cannot be generalized in the country. Thus, further similar studies are needed, also extended in other regions of Greece. Additionally, subjective response and recall bias, inherent in all questionnaire-based researches, should be considered as limitations.

Conclusion

Primary healthcare physicians in Greece seem to be aware of AMR as a public health problem and recognize irrational prescribing, self-medication, the over-the-counter antibiotic administration as well as the extended use of broad-spectrum antibiotics as the main contributors to antimicrobial resistance. However, important infection control measures like hand hygiene, tend to be underestimated. Therapeutic protocols/guidelines and continuing education are illustrated as the most significant measures needed for the AMR control in order to decrease diagnostic uncertainty and improve prescribing practices.

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