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FAILED ATTEMPTS TO REDUCE INAPPROPRIATE LABORATORY UTILIZATION IN AN EMERGENCY DEPARTMENT SETTING IN CYPRUS: LESSONS LEARNED

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☐ **Abstract—Background: Laboratory test ordering is a significant part of the diagnosis definition and disease treatment monitoring process. Inappropriate laboratory test ordering wastes scarce resources, places unnecessary burden on the health care delivery system, and exposes patients to unnecessary discomfort. Inappropriate ordering is caused by many factors, such as lack of guidelines, defensive medicine, thoughtless ordering, and lack of awareness of costs incurred to the system. Objectives: The purpose of this study is to assess two successive measures, which were introduced in a Cyprus emergency department (ED) for the purpose of synergistically reducing inappropriate laboratory ordering: the introduction of a copayment fee to reduce nonemergent visits, and the development of a Web-based protocol defining the tests emergency physicians could order. Methods: An autoregressive integrated moving average model for interrupted time series analysis was constructed. Data include number and type of tests ordered, along with number of visits for a period of 4 years from an ED in Cyprus. Results: Copayment fee and introduction of a revised Web-based protocol for a test ordering form did not reduce the number of ordered tests in the ED unit. Copayment fee alone resulted in a statistically significant reduction in ED visits. Conclusions: The implementation of two consecutive measures resulted in an increase of ordered tests per patient. Laboratory ordering is a multidimensional process that is primarily supplier induced, therefore, all underlying possible causes must be scrutinized by health authorities. These include lack of guidelines, defensive medicine and thoughtless prescribing. To attain significant gains, an integrated approach must be implemented.** © **2016 Elsevier Inc.**

☐ **Keywords—emergency department; inappropriate laboratory ordering; co-payment; Cyprus; Web-based test panel algorithm**

INTRODUCTION

Laboratory ordering assists in defining accurate diagnosis, monitoring disease progression, and assessing efficacy of treatment. This has made laboratory ordering susceptible to inappropriate ordering, which is defined as:

- Excessive ordering
- Ordering of tests that are not likely to change treatment or are not relevant to the condition
- Nonordering of appropriate tests
- Ordering for the wrong patient, and
- Use of wrong test or at the wrong time (1,2)

It is also important to underline the fact that there is no clear correlation between volume of laboratory-ordered tests and clinical outcomes, or quality of care (3–5). Inappropriate use of laboratory tests is imputed to imperfection of tests and existence of uncertainly, lack of accessible guidelines, lack of awareness of costs incurred to the system, fear of litigation expressed as defensive medicine, lack of experience, and even practical difficulties in accessing previous results (6,7). In some cases, inappropriate ordering is a manifestation of deep-rooted issues such as insufficient knowledge of doctors, a fact that should urge caution because it poses significant dangers for public health (8). It was also

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proved that the use of request cards providing multiple tick boxes tends to increase orders because their simplicity encourages excessive ordering, the "thoughtless/impulsive ordering" process (9). Apart from the impact on expenditure, inappropriate/unnecessary test ordering increases the risk for false-positive test results, thus placing additional burden on the patient. This can also lead to missing diagnoses, as in the case of the non-ordering of appropriate tests (4).

CYPRUS

In 2011, Cyprus entered a prolonged financial recession and, as an aftermath, signed a financial conditionality agreement with a team of international lenders (better known as Troika), in the form of a Memorandum of Understanding (MoU). A task force of the Troika assessed health care sectors and concluded that absence of demand- and supply-side measures had led to inappropriate laboratory ordering on all health care levels, significant occurrence of non-emergent/avoidable emergency department (ED) visits, and polypharmacy (4,10–12). Therefore, in the context of reducing waste and enhancing the efficiency of public governance, these findings, along with related corrective measures, were delineated in the MoU as prerequisites for disbursement of financial aid.

The extent of inappropriate lab test ordering in the ED was significant due to the lack of restrictive measures in laboratory ordering—as attested by the availability of tests predominantly for diagnosis and monitoring of chronic conditions (such as prostate-specific antigen test, thyroid-stimulating hormone test, and hemoglobin A1c test)—but also due to the high volume of non-emergent visits attributed to the absence of any demand-side measures (10–12). To tackle this issue, concerted efforts have been undertaken in the form of implementation of two corrective measures. Firstly, a co-payment fee was applied to all users of EDs, aiming primarily to reduce non-emergent visits, which are defined as follows:

- Non-urgent conditions treatable within 12 or 24 h
- Ambulatory conditions that do not require special equipment for their treatment (e.g., computed tomography scan, magnetic resonance imaging)
- Ambulatory-sensitive conditions that sufficient patient monitoring and follow-up should be able to reduce or eliminate
- Preventable health conditions, whose exacerbations and manifestations are usually caused by lack of timely and proper primary care and are treatable in primary health care (13–16)

The rationale of co-payment lies in the well-documented misuse and overuse of health resources when patients incur little or no cost (17). Six months later, measures were stepped up with the introduction of a Web-based protocol, which was the output of the Committee for Clinical Guidelines for laboratory tests. The deliverables of this Committee included the elaboration of a test protocol for the ED, based on available evidence. This measure was implemented in the form of a tick box-driven graphical user interface, which curtailed available laboratory tests, which could be ordered by ED doctors (Table 1), from approximately 200 to 50 (18). Consequently, many laboratory tests were excluded from this electronic database, as they were assessed to be more appropriate for non-emergent and avoidable conditions that are not supposed to be referred to the ED.

The purpose of this study is to assess the impact of these two measures in reducing the rate of inappropriate utilization of ED-ordered laboratory tests. To this end, we used information gathered from the country's largest hospital ED, which serves the emergency care service needs of the capital city and greater region, serving approximately 250,000 people. Nicosia General Hospital is publicly owned and operated, and it is funded by the Ministry of Health through a fixed budget, which is not related to its output. Its personnel are tenured public servants, who are remunerated through defined monthly salaries.

MATERIALS AND METHODS

Data

We registered all visits to the ED department in Nicosia General Hospital and all laboratory tests that were ordered from January 2011 until August 2014. During this period, 434,787 visits to the ED were registered. Relevant demographic data are presented in Table 2.

These visits resulted in 5,234,973 laboratory tests being ordered, which brings the actual average number of lab tests to 12.04 per patient, per visit. It is noted that laboratory tests were ordered for approximately 50% of all persons admitted to the ED. Tests per patient increased from an average of 10.6 in 2011, to 15.6 tests per patient in 2014 (in 2012 and 2013, tests per patient were 12.3 and 13.2, respectively). During this period, we defined two landmark interventions: in August 2013 a fixed co-payment fee of 10 euro, paid up front, was introduced (for better interpretation of co-payment, it is noted that annual gross domestic product per capita is 23,533 euro, which is equivalent to 25,249 USD), aiming to reduce non-emergent and thus, avoidable, visits (11,12,19). This measure applied to all users of the