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Higioka, Angela S.; Martins, Jéssica M.; Martinello, Flavia
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Evaluation of the clinical analysis service provided to an emergency department

Avaliação do serviço de análises clínicas prestado a uma unidade de emergência

Angela S. Higioka; Jéssica M. Martins; Flavia Martinello

Universidade Federal de Santa Catarina (UFSC), Florianópolis, Santa Catarina, Brazil.

ABSTRACT

Introduction: Time for releasing test results and critical value communication by the clinical laboratory are considered important determinants of patients' length of stay in the Emergency Department (ED). As well as physician satisfaction, they are used as quality indicators of the Clinical Analysis Service (CAS). **Objective:** The aim of this study was to evaluate the time to return a test result, the communication of critical values and the level of satisfaction of the ED physicians of a university hospital with the CAS. **Material and methods:** A physician satisfaction survey was conducted using a questionnaire. The test turnaround time for emergency requests was analyzed by observation of the pre-analytical phase and monitoring the analytical and post-analytical phases through the laboratory information system. In order to evaluate the communication of critical values by the CAS, a document analysis of the process was performed. **Results:** Physicians' overall satisfaction with the CAS was considered average. Greater satisfaction was observed with reliability of the results and the staff courtesy and lesser with the delivery time of results. The test turnaround time exceeded clinicians' expectations and the average described in the literature. No experience with critical-value communication was perceived. **Conclusion:** The results show several opportunities for progress in the relationship between ED and CAS. The improvement of laboratory quality indicators also depends on the involvement of ED physicians and nurses and embraces monitoring, planning, education and investment in system computerization.

Key words: hospital laboratories; clinical laboratory services; hospital emergency service; laboratory critical values; health care quality indicators; time.

RESUMO

Introdução: O tempo de liberação de exames e a comunicação de valores críticos pelo laboratório clínico são considerados importantes determinantes do tempo de permanência do paciente no Serviço de Emergência (SE). Portanto, assim como a satisfação dos médicos, esses dados também são utilizados como indicadores de qualidade do Serviço de Análises Clínicas (SACL). **Objetivo:** Avaliar o tempo de liberação de exames, a comunicação de valores críticos e o nível de satisfação dos médicos do SE de um hospital universitário em relação ao SACL. **Material e métodos:** Foi realizada uma pesquisa de satisfação dos médicos, utilizando um questionário. O tempo de liberação dos resultados de exames de emergência foi analisado por meio de observação presencial da fase pré-analítica e monitoramento no sistema informatizado das fases analítica e pós-analítica do laboratório. Para avaliar a comunicação de valores críticos pelo SACL, foi realizada análise documental do processo. **Resultados:** A satisfação geral com o SACL foi considerada regular pelos médicos participantes, com maior satisfação quanto à confiança nos resultados e à cortesia dos servidores e menor quanto ao tempo de entrega de resultados. Os tempos de liberação de resultados dos exames ultrapassaram as expectativas dos médicos e a média descrita na literatura. Não foi observada cultura de comunicação de valores críticos. **Conclusão:** Os resultados demonstraram várias oportunidades de progresso na relação entre o SE e o SACL. A melhoria dos indicadores da qualidade laboratorial avaliados depende também do envolvimento dos médicos e dos enfermeiros do SE e inclui monitoramento, planejamento, educação e investimento em informatização do sistema.

Unitermos: laboratórios hospitalares; serviços de laboratório clínico; serviço hospitalar de emergência; valores críticos laboratoriais; indicadores de qualidade em assistência à saúde; tempo.

RESUMEN

Introducción: El tiempo de entrega de pruebas y la comunicación de valores críticos por el laboratorio clínico son considerados factores determinantes del tiempo de permanencia del paciente en la Sección de Urgencias (SU). Por lo tanto, así como la satisfacción de los médicos, estos datos también son utilizados como indicadores de calidad del Servicio de Análisis Clínicos (SAC). **Objetivo:** Evaluar el tiempo de entrega de pruebas, la comunicación de valores críticos y el grado de satisfacción de los médicos de la SU de un hospital universitario con el SAC. **Material y método:** Se realizó una encuesta de satisfacción de los médicos, utilizando un cuestionario. El tiempo de reporte de resultados en la SU ha sido analizado por medio de observación presencial de la fase preanalítica y monitoreo en el sistema computarizado de las fases analítica y postanalítica del laboratorio. Para evaluar la comunicación de valores críticos por el SAC, un análisis documental del proceso ha sido realizado. **Resultados:** La satisfacción general con el SAC fue considerada regular por los médicos participantes; hubo mayor satisfacción con la confianza en los resultados y con la atención del personal, y menor con el tiempo de entrega de resultados. Los tiempos de reporte han sido más largos que las expectativas de los médicos y la media descrita en la literatura. No se ha observado una cultura de comunicación de valores críticos. **Conclusión:** Los resultados han enseñado varias oportunidades de progreso en la relación entre SU y SAC. La mejoría de los indicadores de calidad de laboratorio evaluados depende también del involucramiento de los médicos y enfermeros del SU e incluye monitoreo, planeamiento, educación e investimento en informatización del sistema.

Palabras clave: laboratorios clínicos hospitalarios; servicios de laboratorio clínico; servicio de urgencias hospitalario; valores críticos de laboratorio; indicadores de calidad en asistencia sanitaria; tiempo.

INTRODUCTION

The Adult Emergency Department (AED) of the University Hospital (UH) has a staff of 76 nursing professionals, 35 permanent physicians (22 duty doctors and 13 of the day shift) and nine residents of general medicine and surgery, a psychologist, a social worker, a dietitian, a pharmacist, administrative and pharmaceutical agents, security guards, kitchen assistants, and cleaning auxiliaries. According to data from the UH direction, in the year of 2017, 71,048 emergency room visits occurred in the AED. In that same period, the Clinical Analysis Service (CAS) of the institution performed approximately 93,727 tests for that department.

Emergency departments (EDs) operate 24 h a day and work as entry points to the health system, receiving patients from urgency itself, patients with conditions perceived as urgency, those lost for primary and specialized attention, besides social urgencies. Such demands mix in EDs, overloading them, what compromises quality of assistance delivery⁽¹⁾. In this context, successful interaction with other areas of the health system is necessary so as to optimize service rendering⁽²⁾. This optimization is important when one considers the short time for decision making, typical of an ED, what does not allow the existence of doubts and requires maximum reliability on laboratory results^(3,4). These play a key role in the clinical decision-making process, and can influence up to 70% of diagnoses and medical treatments⁽⁵⁾.

Follow-up and the opportunity to be in tune with users' satisfaction, turnaround time (TAT) of laboratory results, and communication of critical values are crucial to improve quality in the relationship between clinical laboratory-emergency service-patient care.

The quality of a service, defined as its conformity to users' need, can be assessed by users' satisfaction questionnaires as tools⁽⁶⁾. However, as they must not be considered a single quality assessment criterion⁽⁷⁾, just one-fourth of the laboratories conduct client satisfaction surveys⁽⁶⁾. Moreover, lower satisfaction indices are related to poor communication between the involved parts⁽⁸⁾.

Test releasing time by the clinical laboratory is considered one of the major determinants of a patient's time of permanence in the ED, although the length of stay is influenced by several factors. In order to achieve the goals of ideal test releasing time, all aspects of the process must be considered, namely, from test order to result release in the system or its direct communication to the ordering physician – the TAT⁽⁹⁾.

The current concern of health institutions to enhance patient security has renewed interest in the establishment and communication of critical laboratory values⁽¹⁰⁾. This communication can be reflected in both logistic efficiency of the laboratory and clinical efficacy⁽¹¹⁾. Therefore, to ensure adequate medical care, as well as to avoid damage caused by treatment delays, opportune, precise, complete and unequivocal communication of those critical values is essential.

Due to scarcity of evidence, the objective of this study is to evaluate some aspects of the relationship between the AED and the CAS of a UH as regards physicians' level of satisfaction with result releasing time and communication of critical values by the laboratory.

MATERIAL AND METHODS

This study was approved by the Ethics Research Committee of the institution (CAAE 01423412.4.0000.0121), followed the recommendations of Resolution no. 466/2012 of the National Council of Health and was conducted from August to October, 2017, at the EAS and CAS of the UH.

The survey was carried out in four steps. The first one measured physicians' satisfaction with the day shift at the EAD in relation to the service rendered by the CAS of the UH, using a questionnaire (**Table 1**).

The next step was data acquisition of the average time consumed between laboratory test orders for EAD patients,

specimen collection by the laboratory personnel, and specimen registry in the laboratory information system (LIS) of CAS/UH. The moment of test order was considered that in which the physician puts test request on the specific place for requests on the assistance counter of EAD. Eighty orders were monitored for varied tests along three months, in alternate days from Monday to Friday, from 8 a.m. to 6 p.m. Time was monitored by just one investigator, using a chronometer, without other involved professionals knowing about the evaluation, and without intervention by the observer in the procedures. The tests monitored in the investigation were: blood count, coagulation tests (prothrombin time, and partially activated thromboplastin), troponin and biochemical tests [sodium, potassium, calcium, urea, creatinine, magnesium, creatine kinase (CK), CK fraction MB (CK-MB), transaminases, gamma glutamyl transferase, lactic dehydrogenase, amylase, and lipase].

In the third step, monitoring was carried out, by the LIS, of the average elapsed time between registry of the specimen come from EAD and result release, which corresponds to the computerized phase of the process. In this phase, it was possible to monitor the average time of the analytical phase of a larger number of

TABLE 1 – Satisfaction questionnaire applied to EAD doctors users of CAS/UH

1. What is your satisfaction degree with the following services rendered by CAS?					
Service rendered by CAS	Outstanding	Excellent	Good	Fair	Poor
Elapsed time between test order and specimen collection at CAS					
Elapsed time between test order and result release in the CAS system					
Courtesy of CAS technicians who render services in this department					
Courtesy of other CAS workers					
Overall satisfaction with CAS					
2. What deadline do you consider acceptable for result release by CAS to EAD?					
Tests	15 minutes	30 minutes	45 minutes	60 minutes	90 minutes
Urinalysis					
Biochemical analysis					
Blood count					
Coagulation test					
				Yes	No
Has delayed test result release slowed down patients' therapy or discharge?					
Would you adopt an electronic test order in case it could expedite result deliver?					
Do you trust test results released by CAS/UH?					
If not, why not?					
	Most times	Some times	Few times	Never	
How often has test result release caused delay in patients' therapy or discharge?					
How often have you been notified of critical values by CAS?					
How important is early notification of critical values for EAD?	Very important	Important	Slightly important	Not important at all	
In your opinion, what is CAS major problem?					
Do you have any suggestion for CAS improvement?					

EAD: Adult Emergency Department; CAS: Clinical Analysis Service; UH: University Hospital.

tests ordered in the same period of the second phase, including urinalysis. Releasing times of 311 blood counts, 113 coagulation, 325 biochemical, 54 troponin and 215 urine tests were analyzed.

Data were tabulated in Excel spreadsheets and analyzed at GraphPadPrism 5.0.

In the last step, the laboratory verified registries of critical value communications to EAD. This process of communication was evaluated in the departments of biochemistry, hematology, urinalysis, and microbiology. Besides that, based on documental analysis, we examined: a) which are the values considered critical; b) how they were defined; c) if there was consensus within the medical team; and d) how communication is recorded in the laboratory.

RESULTS

First step – EAD physicians' satisfaction with the CAS

Among 13 doctors of the effective board of EAD and nine resident doctors for which the questionnaires were sent, 10 (45%) answered it, being five permanent doctors and five residents. Doctor satisfaction with CAS is described in **Table 2**.

For 30% (three) of the doctors, the acceptable deadline for urinalysis release (from collection) in case of emergency patients is 45 minutes; 40% (four) consider it 60 minutes, and 30% (three), 90 minutes (**Table 3**). Regarding blood count, biochemical analysis and coagulation tests, the acceptable deadline for result release from collection is 45 minutes for 60% (six) of the doctors (Table 3).

All the physicians (10) answered that they trust the results released by the CAS and would adopt an electronic test order, in case it could expedite result reporting.

Most (90% – nine) doctors answered that “most times”, the delay in test release has slowed down patients' treatment or discharge, and that the early notification of critical values to the EAD is “very important”.

As to the frequency with which doctors have received notification of some critical values by the laboratory, 10% (one) answered “most of times”; 20% (two), “sometimes”; 50% (five) “few times”; and 20% (two), “never” were notified.

In general, these were cited as the major CAS problems: 1. collections ordered urgently many times are not conducted with due urgency; 2. result release time; 3. delay in collection and conduction of tests; 4. prolonged time between test request and result reporting; 5. delay to collect, especially on duty hours.

TABLE 2 – EAD doctors' opinions about CAS

Doctor's opinions about:	Outstanding <i>n</i> (%)	Excellent <i>n</i> (%)	Good <i>n</i> (%)	Fair <i>n</i> (%)	Poor <i>n</i> (%)
Elapsed time between test order and specimen collection by CAS	1 (10)	0 (0)	1 (10)	8 (80)	0 (0)
Elapsed time between test order and result release by CAS in the system	2 (20)	0 (0)	1 (10)	7 (70)	0 (0)
Courtesy of CAS lab technicians who render services in this department	0 (0)	2 (20)	7 (70)	1 (10)	0 (0)
Courtesy of other workers at CAS	0 (0)	0 (0)	8 (80)	2 (20)	0 (0)
Overall satisfaction with CAS	0 (0)	0 (0)	4 (40)	6 (60)	0 (0)

AED: Adult Emergency Department; CAS: Clinical Analysis Service.

TABLE 3 – Time for releasing test results considered acceptable by most doctors in the study, found for tests of the AED and described in the literature

Tests	Acceptable by most doctors in the study	Time between order and result release		Time between specimen registry/receipt and result release	
		Found	Literature	Found	Literature
Biochemical analysis	45	158 ± 51	45 to 69 ^(2, 12)	69 ± 34	29 to 45 ^(2, 13)
Troponin test	-	179 ± 29	58 to 61 ^(12, 14)	90 ± 30	39 to 60 ^(14, 15)
Coagulation test	45	164 ± 48	90 ^{*(16)}	75 ± 32	37 ^{*(17)}
Blood count	45	176 ± 60	-	87 ± 40	12 to 27 ⁽¹³⁾
Urinalysis	60	-	-	87 ± 42	13 ⁽¹³⁾

Results are expressed as mean ± standard deviation in minutes. *Data regarding routine TAT, not specifically as emergency test such as the other presented literature data. AED: Adult Emergency Department; TAT: turnaround time.

As suggestions for CAS improvement, the following measures were proposed: 1. keep a professional just for urgency tests, besides the routine technicians; 2. streamline all procedures; 3. hire a larger number of workers, or optimize the time of those who already work in the institution to expedite the work flow; and 4. set up a collection center with staff members in the ED.

Second step – analysis of time spent in the pre-analytical phase

Figure 1A presents time spent in each step of the pre-analytical phase of laboratory tests requested at EAD, in other words, time between test order and specimen collection and between specimen collection and its registry at LIS.

Third step – analysis of time spent in the analytical and post-analytical phases

Average time of analytical phase, that is, time between sample receipt/registry and result release of each studied test is represented

in Table 3. The average time between specimen collection and result release, and between test order and result release are represented in **Figure 1B** and Table 3, respectively.

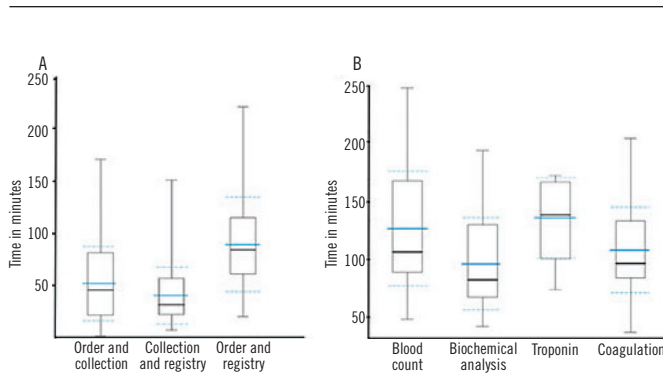


FIGURE 1 – Time involved in the different steps of laboratory process

A) time of steps in the pre-analytical phase; B) time between specimen collection and result release. The blue continuous and dotted lines represent mean and standard deviation, respectively; the black lines, median; the error bars, minimum and maximum quartiles.

Fourth step – analysis of critical value communication

Just the hematology department has a list of critical values, which were obtained from the literature. The biochemistry department also has a list obtained from the literature, containing parameters of several areas, but with no routine use. The department of urinalysis does not have a list of critical values. Although the microbiology department does not have a standard operational procedure, the communication of critical values is done whenever positive blood culture occurs in any unit of the hospital. The communication of some critical values is also done as a non-systematized form by the hematology department. The biochemistry and urinalysis departments, in their turn, do not perform the communication of critical values.

Communication is made by telephone in the sectors of hematology and microbiology, although in this one both communication and preliminary result release are done in the computerized system. For both sectors, critical values are reported to each individual that answers the phone, with no obligation of registry in the hospital records. The recorded communication of critical value in the sector of microbiology is carried out in the work map of each test, where the critical value, the name and the function of who received the information are recorded, as well as the date, time, and the name of who reported the result. This map is discarded after a year. The communication registry is not entered by the hematology sector.

DISCUSSION

Aiming to improve the health system, users' satisfaction is considered a goal to be achieved^(7, 18, 19). The use of a satisfaction questionnaire as a tool is just a form to receive a feedback from professionals who use the service^(18, 19); in the case of this work, the CAS/UH, it cannot be considered the only criterion for evaluation of service quality.

In our study, although the number of participants in the satisfaction survey seems small – 45% of those in a position to answer –, in similar researches, the mean rate of responding doctors was 40.8% and 57.3%^(20, 21).

Courtesy is important for a good relationship among team professionals. In this context, laboratory personnel courtesy was considered good by approximately 75% of the doctors. A similar result was observed in studies conducted in hospitals of Ethiopia, where, on average 76% doctor satisfaction was observed in the area of laboratory personnel courtesy^(22, 23). However, this range is below average satisfaction (96%) reported in a study conducted by the College of American Pathologists (CAP) with 81 laboratories⁽²⁴⁾.

The high percentage of doctors who consider that many times delayed TAT has slowed down patients' treatment or discharge is worrying, because in general delays in diagnosis and/or treatment extends permanence of patients at EAD, contributing to its overcrowding and increasing hospital costs.

All the satisfaction survey participants answered they trust the tests results released by CAS/UH. In other studies, the reliability rate was 80%-98%^(22, 24). Trust in results is important to expedite patient care and avoid costs of test repetition. Besides, all participating doctors answered that they would make an electronic test order, if that could streamline result release, what demonstrates an opportunity for process improvement.

While general satisfaction with CAS was considered fair for 60% of doctors, in other studies the rate ranged from 51% to 84%^(7, 22-24). However, differently from what was exposed in our survey, another study reported 86% satisfaction with getting urgent results on time⁽²²⁾.

The complaints and suggestions to CAS described by participants were very different from those cited in the study by Mengesha⁽²³⁾, what demonstrates diverse organizational realities of laboratories and hospitals.

The use of open-ended questions at a customer satisfaction questionnaire can be very useful, as answers can indicate problems unknown to the laboratory⁽¹⁸⁾. Monitoring customer satisfaction is

invaluable for a program to improve laboratory quality, because it allows a feedback about quality of the offered service⁽²⁵⁾. However, monitoring itself does not increase quality when corrective actions are not adopted⁽¹⁸⁾.

The CAP requires laboratories to measure users' satisfaction (doctors, clients and patients) at least once every two years, as a vital component for evaluation of the laboratory performance⁽²⁴⁾.

Among doctors who answered the satisfaction questionnaire, most (80%) considered time between order and specimen collection fair at EAD. Average time between order and specimen collection was verified to be 50 minutes, what can in fact be excessive when it comes to patients in critical state. This excessive time of the pre-analytical phase at CAS can be due to several factors, including failure in making the test request to CAS, no exclusivity of laboratory technicians for EAD, great number of collection requests, time it takes laboratory technicians to go from CAS to EAD and time for order registry, besides eventual variables.

For 70% of the participants of the satisfaction survey, the total time between test order and result release in the system was considered fair. In other studies, similar satisfaction was observed (61%-80%)^(7, 22). In general, the CAP states that TAT is an area of dissatisfaction, with no significant association with general satisfaction regarding laboratory service. This paradigm highlights the need laboratories have to remain watchful about TAT⁽²⁴⁾.

Although the measure of time for result release is a common method in clinical analyses, comparing studies is complex, because there are different definitions of TAT being used. Some authors consider that TAT begins with test order; others, with sample collection; others, still, with specimen entry in the analysis sector⁽²⁶⁾. Considering TAT the time between test order and result release, we observe that the time desired by most doctors participating in the study is in agreement with that described in the literature^(2, 12-14, 16, 17). However, time of result release at CAS was approximately three times that desired by doctors at EAD.

Likewise, considering TAT as time between specimen registry/receipt and result release, also called laboratory TAT, CAS demonstrated performance below that described in the literature^(2, 13, 15). We can notice that laboratory TAT (time of analytical and post-analytical phases) of CAS/UH (for the investigated tests) is close to that found in other institutions as total TAT (time between order and result release). We can also note that laboratory TAT was approximately 50% of total TAT. This percentage was also observed by Goswami *et al.* (2010)⁽²⁷⁾, although they have found a total TAT for all emergency tests much lower (60-90 minutes) than that found in our study. In our case, data suggest that the pre-analytical phase must be the main target for improvement.

Guidelines recommend that time for troponin result release, from sample collection, is 30 minutes⁽¹⁵⁾, what is four times shorter than the observed in our study; when it is longer than 1 hour, a remote laboratory test must be implemented in the place⁽¹⁵⁾.

In this survey, lack of process computerization made collection of test releasing times difficult. This fact was the reason for the reduced number of monitored orders, which cannot represent CAS as a rule. Difficulty to obtain data reinforces even more the need to computerize all the process steps, from electronic test order and automatic receipt of collection order, registry, label print, and identification of specimens at collection up to registry (bar code reading) at the moment of specimen entry in the analysis sector, so as to have control over each of the steps.

Early notification of critical values for EAD was considered important by all doctors participating in the investigation and very important by 90% of them. This result confirms the opinion described in the literature⁽²⁸⁾ and probably demonstrates the possibility of immediate action in the presence of a risky situation for the patient. Even so, half of the participants refer that few times they received notifications of critical values by the laboratory, a result similar to other studies, which reported doctors' dissatisfaction of about 39%-56% because of lack of communication of critical values^(7, 22). On the other hand, the study conducted by the CAP presented a rate of 95% satisfaction with the performed notifications, demonstrating this culture in the relationship of laboratories and doctors⁽²⁴⁾. It also stated that critical value notification is an area of dissatisfaction with no association with general satisfaction regarding laboratory service⁽²⁴⁾.

When there is real-time monitoring of critical results, by a computerized alert system and/or professionals are motivated to perform effective notification, communication of critical values provides information that can accelerate therapeutical decisions and, potentially, improve patient care. Yet, it was verified that there is no culture of critical value notification at CAS in the analyzed sectors. We did not observed standardization in the way to establish a list of results considered critical, the communication procedures, and collaborators (both from the laboratory and from EAD) training, as recommended in the literature⁽²⁸⁾.

So that active communication of critical values can occur, systematization of the process is necessary. The ideal is that critical values be established according to the disease or medical specialty, and there is a consensus among medical staff, laboratory and bibliographies about these values and the best form to report them⁽²⁸⁻³⁰⁾. Technology must be an ally, so that the information system itself, fed with the values considered critical, emits an alert when it detects a relevant value during result interfacing^(28, 31).

Just like laboratories must be organized to communicate critical values efficiently, EDs must be prepared to receive and record information. Some criteria must be set – such as who is apt to receive the critical value and where to record it – and are fundamental for the success of the system⁽²⁸⁾.

CONCLUSION

The degree of doctor satisfaction with the laboratory service was acceptable, but several opportunities for improvement were

observed, especially regarding time to release test results and communication of critical values. Our survey reveals that to enhance the process of prompt acquisition of a laboratory test result, from request to critical value reporting, participation of doctors and nurses is necessary to provide quality services. With this in mind, reducing time for test release is a complex task that involves monitoring, planning, education, and investment in system computerization. Further studies are recommended, with larger sample sizes, use of other quality indicators, and comparison of the relationship between EAD and CAS during the day shift with the relationship during night shifts and weekends.

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CORRESPONDING AUTHOR

Flavia Martinello  0000-0002-6073-3404
e-mail: flaviamartinello@gmail.com.



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