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Implications of medical screenings of patients arriving for dental treatment: The results of a comprehensive laboratory screening

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Abstract

Background—The authors conducted medical laboratory screenings in a dental setting to determine the relationships between the laboratory test results and self-reported medical health findings.

Methods—The authors collected serum, urine and medical histories from 171 patients (116 [68 percent] women; mean age, 43.4 years) who arrived for dental treatment as a component of a clinical trial and performed complete blood cell counts, standard blood chemistry panels and urinalysis on the samples.

Results—The authors found 414 abnormal laboratory test results (an average of 2.42 per patient). Eighty-three percent of participants had one or more abnormal test results, 83 percent had abnormal test results and did not indicate a relevant disease in their medical history, and 18 percent had laboratory test results outside the 99 percent reference range (that is, > three standard deviations from the mean). Abnormal test results were significantly associated with sex, age, race and medical history ($P < .05$). Abnormal test results associated with kidney disease were related to patients with cardiovascular disease and diabetes, as well as those who tended to be on average older than 50 years..

Conclusions—The high frequency of significant abnormal laboratory test results detected in this study suggests that many patients may be unaware of their medical statuses.

Practical Implications—Abnormal laboratory test results are detected frequently in the serum and urine of patients arriving for dental treatment, which could indicate undiagnosed disease and less than optimal medical management.

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Keywords

Mass screening; clinical laboratory techniques; laboratory screening; medical history taking; blood; serum; urine

Paients can have various medical conditions that may affect their dental treatment. These medical conditions may be recognized or may be unrecognized and may or may not be medically controlled by physicians. Accordingly, the contemporary medical screening process includes completion of a medical questionnaire and dialogue history as part of the risk assessment process.[1,2] However, greater insight into the patient's overall health can be gained by obtaining and analyzing biological fluids (for example, serum, saliva, urine). Yet, general dentists seldom obtain biological fluids despite the fact that the results of a 2012 study showed that patients are supportive of chairside medical screening in the dental office,[3] dentists appear willing to incorporate medical screening tests into their dental practice,[4–7] and undiagnosed conditions can be identified by conducting screenings in the dental setting.[8]

Although the authors of a few studies have evaluated screening for diabetes in the dental office setting,[6–8] there are a limited number of studies in which investigators have examined the use of multiple medical laboratory tests in the screening of patients who arrive for care in the dental office setting. We identified only one study in the literature that was conducted by Thompson and colleagues[9] who reported abnormal blood and blood chemistry test results in 39 consecutive dental patients. The results of their study showed that many patients were unaware of their medical statuses when they arrived for dental treatment. The results of this small sample–sized study, along with the fact that people are living longer and experiencing more complex medical conditions,[10,11] suggests that additional studies of the medical statuses of dental patients are needed. Thus, we conducted a study to examine the health statuses of a large group of people who arrived for dental treatment in an outpatient dental clinic setting on the basis of their medical histories and laboratory screening test results.

METHODS

Participants

Our investigation was a substudy of a prospective, randomized, placebo-controlled clinical trial that was performed in an outpatient dental clinic setting. Four sites participated: the College of Dentistry, University of Kentucky; School of Dental Medicine, University at Buffalo, The State University of New York; the School of Dental Medicine, University of Pittsburgh; and a private family dentistry practice in Norwich, N.Y. The study protocol was standardized across the four sites. We recruited from the four sites participants who had a history of recurrent herpes labialis and were due to undergo a routine dental procedure. We enrolled only participants who had a history of recurrent herpes labialis (who averaged > two outbreaks of herpes labialis per year), who experienced prodromal symptoms during at least 75 percent of previous herpes labialis episodes, who had a history of at least one-half of herpes labialis episodes producing classical lesions, and who needed to undergo a routine dental procedure. Our inclusion criteria were that participants had to be able to provide

written informed consent and be asymptomatic, immunocompetent and herpes simplex virus (HSV) seropositive. The dental procedure that needed to be performed had to be a general dentistry procedure that might induce herpes labialis, such as routine and invasive periodontal procedures (that is, prophylaxis, root scaling or surgery); the initial placement of orthodontic bands, brackets or wires; a restorative procedure involving the placement of a rubber dam clamp; or oral surgical procedures (for example, tooth extraction, implant placement, biopsy, bony resection, cosmetic surgery). The dental procedure had to be performed at an appointment subsequent to the medical screening appointment.

The study population was composed of men and women who volunteered, reported having good general health and were at least 18 years old. We excluded people if they weighed less than 100 pounds; were immunosuppressed or taking immunosuppressant medication; regularly developed other types of oral lesions (that is, aphthous stomatitis); were HSV seronegative; had clinical evidence of an active oral HSV lesion at the beginning of the study; had used antiviral therapy (topical or oral) within one week before study enrollment; had participated in an investigational clinical trial in the preceding three months; were pregnant or breastfeeding or were not taking oral contraceptives and were of childbearing age and had not used two concurrent different forms of contraception for two months before the start of the trial; or were allergic to study medication (to be given after dental treatment) as determined from information recorded on a standardized medical history form, followed by dialogue history obtained by clinicians whose techniques were calibrated at each site. We obtained informed consent from each participant before he or she participated in the study, and all participants were financially compensated for their time. The institutional review board of each site approved the study, which was conducted between Jan. 1, 2011, and Oct. 30, 2012.

Sample analysis

At the screening appointment, we collected venous blood and urine by using standard methods. We processed serum and urine samples and sent them to University of Rochester Medical Center laboratory (Rochester, N.Y.), where they underwent complete blood cell counts, standard blood chemistry panels and urinalyses (n = 35 tests per patient) (Table 1). The University of Rochester Medical Center laboratory has received a Clinical Laboratory Improvement Amendments certificate, is accredited by the College of American Pathologists and has standardized adherence to quality assurance. We advised participants if they had any abnormal laboratory values and advised them to contact their physicians regarding any necessary intervention.

Data analysis

Most of our statistical analyses focused on categorical associations. Owing to small percentages that were observed in multiple analyses, we conducted two-sided Fisher exact tests. We conducted two-sample *t* tests to compare mean ages for participants with and without abnormal laboratory test results. For analyses in which the mean number of abnormal test result values was predicted by means of sex and medical history, we performed *t* tests from linear regression models with robust standard errors. We performed analyses by using statistical software (SAS Version 9.3, SAS Institute, Cary, N.C.). All tests

were two-sided with a 5 percent significance level. As this was an exploratory study in which multiple statistical tests were conducted, we report both *P* values (*P*) and adjusted *P* values (*P*a), which we adjusted based on a 0.05 false discovery rate by using Benjamini and Hochberg's method.[12]

RESULTS

Patient characteristics

The study population consisted of 171 participants: five from Family Dentistry (Norwich, N.Y.), 92 from the University at Buffalo, 47 from the University of Kentucky and 27 from the University of Pittsburgh. Sixty-eight percent were women, 42 percent were dental patients of record at the dental facilities, and all received dental treatment. Ages ranged from 19 to 77 (mean 43.4) years. Twenty-seven percent were younger than 30 years, 13 percent were aged between 30 and 40 years, 22 percent were aged 41 to 50 years, 27 percent were aged 51 to 60 years, and 12 percent were aged 61 to 77 years. Most participants identified their race as white (79.5 percent), 17.5 percent as African American and 3 percent as Asian. The mean (standard deviation [SD]) body mass index was 29.0 (7.3), indicating the overweight status of the group. Seventeen percent of patients did not report having any medical conditions, 20 percent reported having one medical condition, and 63 percent had two or more medical conditions. We did not obtain information regarding participants' smoking and alcohol consumption statuses.

Abnormal laboratory test results

There were 414 abnormal laboratory test results in the 171 patients (that is, an average of 2.42 abnormal test results per patient). Women had 254 abnormal laboratory test results, and men had 160. Relative to the participants' self-reported medical histories, we were interested in the mean number of abnormal laboratory values for men and women with and without a medical condition. From our regression model in which we used sex and medical history as predictors of the number of abnormal values, we found that the effects of these variables did not appear to interact ($P = .84$, $P_a = 1.00$). Controlling for sex, we found that patients with a medical condition had an estimated 0.68 (95 percent confidence interval [CI], 0.03–1.32; $P = .040$; $P_a = .217$) more abnormal laboratory values on average than did those who did not report having any medical conditions. In addition, controlling for medical history, we found that men had an estimated 0.80 (95 percent CI, 0.18–1.43; $P = .012$; $P_a = 0.142$) more abnormal values on average than did women.

Sex, race, age and specific abnormal laboratory test results

Table 1 shows the relationships between sex and abnormal laboratory test results. Female sex was associated with high aspartate aminotransferase (AST) levels in serum and red blood cell (RBC) counts in their urine ($P \leq .023$; $P_a \leq .175$), and male sex was associated with low hemoglobin (HGB) and abnormal test results for white blood cell (WBC) count and lymphocyte, monocyte and neutrophil counts ($P \leq .047$; $P_a \leq .224$). Blacks (n = 30) were more likely to have low HGB, as well as glucose in their urine ($P \leq .043$; $P_a \leq .217$), and Asian Americans (n = 5) were more likely to have high total protein in serum ($P = .019$;

P_a = 0.175; data shown in the eTable in the supplemental data to the online version of this article [found at http://jada.ada.org/content/145/10/1027/suppl/DC1]).

Age was associated with abnormalities in kidney function and percentage of eosinophils and neutrophils (Table 2, page 1032). In addition, participants with elevated levels of creatinine in serum, urea nitrogen in serum and urine glucose tended to be on average 50 years or older.

Medical history and abnormal laboratory test results

Table 1 shows the percentage of participants who had an abnormal laboratory test result above or below the laboratory cutoff and were unaware of having a medical condition associated with that abnormal test result. Abnormal laboratory test results for AST, glucose and hematocrit (HCT) were common among people who were unaware that a medical condition potentially could be associated with these abnormal test results.

When we also analyzed the data for associations between self-reported medical conditions and the frequency of abnormal laboratory test results according to disease category, we observed several associations. People who self-reported having gastrointestinal (GI) and endocrine disorders had the most abnormal test results (Table 3, page 1032). GI disease was associated with abnormal results for alkaline phosphatase (ALP), HCT, HGB, RBC count, total protein and urine ketones tests. Endocrine disease was associated with abnormal results for AST, ALP, glucose, HGB, urine glucose and protein tests. Musculoskeletal conditions were associated with abnormal results for ALP, urine glucose and WBC count tests. Abnormal results for monocytes and eosinophils were associated more commonly with dermatologic disease and allergies, respectively. Cardiovascular disease (CVD) was associated with protein in the urine, and psychological disorders were associated with abnormal test results for HCT.

Associations between multiple abnormal laboratory test results and systemic disease

Thirty-five (20 percent) of the 171 participants had one abnormal laboratory test result (six men and 29 women), and 108 (63 percent) had multiple abnormal test results (41 men and 67 women). Forty-one participants (24 percent) had two abnormal laboratory test results, 23 participants (13 percent) had three abnormal test results, 13 participants (8 percent) had four abnormal test results, 14 participants (8 percent) had five abnormal test results, 14 participants (8 percent) had six abnormal test results, and three participants (2 percent) had seven or more abnormal test results. Table 3 shows that people with a history of GI, endocrine or psychological conditions were significantly more likely to have multiple abnormal laboratory test results than were people who did not have a history of these conditions ($P \leq .025$; $P_a \leq .175$). Men also were significantly more likely to have multiple abnormal test results than were women ($P = .042$; $P_a = .217$). Forty-eight percent of patients who reported having CVD, diabetes or both had abnormal test results consistent with kidney disease (that is, creatinine and blood urea nitrogen tests).

Laboratory test result values outside the 99 percent reference range

Laboratory test results above the 99 percent reference range (that is, ≥ three SD from the mean) or that cluster with abnormal laboratory test results related to similar biological processes are more likely to be clinically significant. In our study population, 30 participants (18 percent; 19 [16 percent] women and 11 [20 percent] men) had laboratory test results outside the 99 percent reference range as detailed in Table 4 (page 1033). The most frequently observed abnormal test results for women were high serum glucose and AST. In men, we observed abnormal test results for total bilirubin, platelet count and monocyte percentage more frequently. With respect to having more than one related test that had values more than three SDs from the mean, two people had abnormal test results for both alanine transferase and AST, three people had significantly abnormal test results for multiple serum electrolytes, and one person had significantly abnormal test results for both neutrophil level and WBC count. None of the participants who had multiple abnormal test results in one category had multiple abnormal test results in another category.

DISCUSSION

Only a few studies have been published on the topic of medical laboratory screening of dental patients,[6–9] despite the fact that that both patients and dentists are supportive of chairside medical screening in the dental office setting.[3–5] Our analysis of 171 adults who arrived for dental treatment in a clinical trial dental setting and underwent a large number of laboratory tests is the largest study to date regarding this topic. The results of our study showed that approximately 83 percent of participants had at least one abnormal blood or urine laboratory test result and that participants had on average 2.42 abnormal test results. Twenty percent of participants had one abnormal test result, 18 percent had significant abnormal test results (that is, > three SDs from the mean), 63 percent had multiple abnormal test results, and 83 percent had abnormal test results and were unaware of having any medical issues potentially associated with these abnormal test results.

Our findings show a greater prevalence of abnormal laboratory test results in dental patients than in the only study in which investigators reported results from a multianalyte panel.[9] In the 1999 study by Thompson and colleagues,[9] 39 consecutive dental patients received medical laboratory screenings. The number and type of biochemical studies and urinalyses performed were similar as to those in our study; however, the main abnormal test results reported by Thompson and colleagues[9] involved blood lipids, blood glucose, RBC count and WBC count. In contrast, we detected a higher prevalence of abnormal test results for AST, ALP, chloride, HGB, HCT, potassium and total bilirubin, as well as abnormal urine test results. These differences may be attributed to the fact that our sample was larger and more geographically diverse. In addition, we did not analyze blood lipid levels, so a comparison with Thompson and colleagues'[9] findings was not possible. However, epidemiologic data support the fact that a large percentage of the U.S. population has elevated serum lipid levels with accompanying poor control of hypercholesterolemia.[13,14] Thus, the addition of these tests would likely have produced an even greater set of abnormal laboratory test results.

Our results show that the frequency of abnormal laboratory test results was linked to sex, age and reporting a medical condition. For example, men were more likely to have abnormal

test results for WBC count and HGB and more abnormal laboratory test results. Women were more likely to have abnormal test results for AST and urine RBC count. People with abnormal test results for serum creatinine, blood urea nitrogen and urine glucose tended to be older on average (that is, ≥ 50 years) than were people with normal results. In addition, reporting a medical condition was a greater predictor of having an abnormal laboratory test result than was not reporting a medical condition. Yet, the latter was not predictive for not having an abnormal test result. An example of this is that 22 participants (13 percent) had abnormal AST, alanine transferase or total bilirubin test results, which were suggestive of liver dysfunction, and five participants (3 percent) had a combination of two or more abnormal values in this group, yet only three participants (2 percent) reported having liver problems. Cumulative totals from the 35 laboratory tests show that 83 percent of participants had abnormal test results consistent with an associated disorder but did not report that disorder on their medical histories. Thus, although patients who reported having medical conditions were at risk of having unrecognized abnormal laboratory test results, so were patients who did not.

We found that race was associated with specific abnormal laboratory test results. A high percentage of Asian Americans (60 percent) had high total protein, and 30 percent of blacks had low HGB. It is difficult to interpret the reason for the high total protein in Asian Americans because only three participants had high levels of total protein. However, blacks are known to have naturally occurring low HGB[15–17] and a higher prevalence of anemia, which can be associated with chronic kidney disease, CVD, chronic inflammation, sickle cell disease and other causes of blood loss/shortened RBC count life span.[18] Health care providers routinely are called on to identify the cause of anemia, and anemia is important in dentistry with respect to the administration of general anesthetic, antibiotics or analgesics[19] and when the reasons for oral pain, osseous changes and periodontal disease progression are being considered.[20] However, practitioners also should realize that blacks frequently have HGB values approximately 4 to 5 percent lower than those of whites. Additional diagnostic tests may not be necessary unless this threshold is exceeded, other signs or symptoms are present or dental factors as mentioned above are being considered.

Approximately 13 percent of black participants in our study had glucose in their urine, which may be suggestive of poor metabolic control, kidney disease or both. Consistent with this finding, epidemiologic data support the fact that about 13 percent of the population have laboratory signs (blood and urine) that are indicative of kidney disease but are unaware of the condition.[21]

A key finding of our study was the relationships we observed between self-reported medical conditions and abnormal laboratory test results. For example, a history of allergies was associated with abnormal test results for eosinophils, endocrine disturbances were associated with several metabolic and liver-associated abnormal test results, and CVD was associated with protein in the urine. CVD has established associations with diabetes and kidney disease. In this study, 48 percent of patients who reported having CVD, diabetes or both had abnormal laboratory test results consistent with kidney disease (that is, abnormal creatinine, blood urea nitrogen). In addition, abnormal laboratory test results consistent with kidney disease were identified in 36 percent of those who had a history of CVD and 13 percent of

those who had a history of diabetes. Thus, patients who have CVD, diabetes or both should be asked in the dental practice setting about their knowledge of their kidney function.

Our data suggest that conducting a medical laboratory screening in a dental setting could lead to earlier identification of a potential problem and referral of the patient for medical treatment if needed. However, there are a few limitations to the interpretations of our findings. First, in our study we used single laboratory measures. It is not uncommon for patients' daily variations in test results and differences between test results from different laboratories to explain the abnormal results, especially when multiple test results are being considered.[22] Second, although the study sites were geographically diverse, no Hispanics were enrolled in our study and only a few Asian Americans participated; thus, we caution against generalization of our findings. Third, information was not recorded regarding current smoking, alcohol use or drug use. Each of these factors could have influenced some of the abnormal laboratory test results. Finally, it is possible that the people who participated in our clinical trial were in some ways different from patients who arrive for care in other dental settings (private, public, university). However, the participants seemed to be representative of patients who arrived for dental care, because 42 percent of them were dental patients of record at study sites, and most of the U.S. population arrives for dental care at least once every 10 years.

CONCLUSIONS

Our findings indicate that abnormal laboratory test results are common in patients who arrive for dental treatment. Many of the abnormal test results were several SDs from the normal reference values and clustered with related tests, which suggests that medical issues or disease may be unrecognized in many patients. The fact that relationships were identified between abnormal laboratory test results and sex, race, age and a medical condition provided insight into the types of dialogue history questions a dentist should ask during the medical screening of dental patients. Furthermore, the fact that most people in the United States visit the dentist at least once annually, the dental office is an ideal setting to consider conducting medical screenings of patients for referral into the medical health care system.[23] These actions can help identify occult diabetes or renal disease, particularly in those who are 40 years or older.

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Abbreviation Key

ALP Alkaline phosphatase

AST	Aspartate aminotransferase
CVD	Cardiovascular disease
F	Female
GI	Gastrointestinal
HCT	Hematocrit
HGB	Hemoglobin
HSV	Herpes simplex virus
M	Male
RBC	Red blood cell
WBC	White blood cell

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TABLE 1

Associations between participants' sex and abnormal laboratory test results (N = 170).[*]

LABORATORY TEST	RANGE	REFERENCE (RANGE, NORMAL LOW TO HIGH)	FEMALE[†] (%)	MALE[‡] (%)	*P* VALUE [§]	ADJUSTED *P* VALUE [§]	UNKNOWN MEDICAL CONDITION,[¶] (%)
Alanine Transferase, U [#]/L[**]	8–105	0–35 (F[††]) 0–50 (M[‡‡])	8/116 (6.9)	2/54 (3.7)	.506	.853	Female: 5/8 (63) Male: 1/2 (50)
Aspartate Aminotransferase, U/L	13–80	0–35 (F) 0–50 (M)	15/116 (12.9) [15 values were high {range, 36–63; median, 42}]	1/54 (1.9) [1 value was high {80}]	.023	.175	Female: 14/15 (93) Male 1/1 (100)
Albumin, g[§§]/dL[¶¶]	3.7–5.4	3.5–5.2	0/116 (0.0)	1/54 (1.9)	1.000	1.000	Male: 1/1 (100)
Alkaline Phosphatase, U/L	21–137	35–105 (F) 40–130 (M)	7/116 (6.0)	1/54 (1.9)	.438	.846	Female: 2/7 (29) Male: 0/1 (0)
Basophils, No. (10^3 per μL[##])	0.01–0.11	0–0.1	1/115 (0.9)	0/55 (0.0)	1.000	1.000	Female: 0/1 (0)
Basophils, %	0.01–0.11	0–0.1	1/115 (0.9)	0/55 (0.0)	1.000	1.000	Female: 0/1 (0)
Carbon Dioxide, mmol[***]/L	17–30	20–28	9/116 (7.8)	4/54 (7.4)	1.000	1.000	Female: 4/9 (44) Male: 3/4 (75)
Calcium, mg[†††]/dL	8.5–10.4	8.6–10.2	1/116 (0.9)	1/54 (1.9)	.536	.853	Female: 1/1 (100) Males 1/1 (100)
Chloride, mmol/L	83–108	96–108	1/116 (0.9)	1/54 (1.9)	.536	.853	Female: 0/1 (0) Male: 0/1 (0)
Creatinine, mg/dL	0.25–1.40	0.51–0.95 (F) 0.67–1.17 (M)	14/116 (12.1)	11/54 (20.4)	.168	.482	Female: 3/14 (21) Male: 7/11 (64)
Eosinophil, No. (10^3 per μL)	0.01–0.64	0–0.4 (F) 0–0.5 (M)	2/115 (1.7)	0/55 (0.0)	1.000	1.000	Female: 1/2 (50)
Eosinophils, %	0.1–10.1	0.7–5.8 (F) 0.8–7.0 (M)	6/115 (5.2)	6/55 (10.9)	.206	.525	Female: 3/6 (50) Male: 2/6 (33)
Glucose, mg/dL	58–462	74–106	29/116 (25.0)	17/54 (31.5)	.459	.846	Female: 18/29 (62) Males 14/17 (82)
Hematocrit, %	24.6–50.9	34–45 (F) 40–51 (M)	19/115 (16.5)	4/55 (7.3)	.149	.463	Females 18/19 (95) Male: 4/4 (100)
Hemoglobin, g/dL	6.3–16.9	11.2–15.7 (F) 13.7–17.5 (M)	7/115 (6.1) [7 values were low {range, 6.3–10.8; median, 10.2}]	9/55 (16.4) [9 values were low {range, 12.4–13.6; median, 13.0}]	.047	.224	Female: 5/7 (71) Male: 9/9 (100)
Lymphocyte, No. (10^3 per μL)	0.86–3.75	1.2–3.7 (F) 1.3–3.6 (M)	7/115 (6.1) [5 values were low {range, 0.94–	13/55 (23.6) [11 values were low	.002	.053	Female: 2/7 (29) Male: 9/13 (69)

LABORATORY TEST	RANGE	REFERENCE (RANGE, NORMAL LOW TO HIGH)	FEMALE† (%)	MALE‡ (%)	*P* VALUE §	ADJUSTED *P* VALUE §	UNKNOWN MEDICAL CONDITION,¶ (%)
			1.14}; 2 values were high {range, 1.18–1.27; 1.14}; 2 values were high {range, 1.71–1.72}]	[range, 3.71–3.72}; 2 values were high {range, 3.63–3.75}]			
Lymphocytes, %	14.4–54.7	19.3–51.7 (F) 21.8–53.1 (M)	3/115 (2.6)	6/55 (10.9)	.060	.252	Female: 1/3 (33) Male: 5/6 (83)
Monocyte, No. (10^3 per μL)	0.18–1.45	0.2–0.9 (F) 0.3–0.8 (M)	3/115 (2.6) [2 values were low {range, 0.18–0.19}; 1 value was high {1.45}]	8/55 (14.6) [5 values were low {range, 0.19–0.28; median, 0.26}; 3 values were high {0.85, 0.96, 0.99}]	.006	.105	Female: 0/3 (0) Male: 3/8 (38)
Monocytes, %	3–22.4	4.7–12.5 (F) 5.3–12.2 (M)	6/115 (5.2)	6/55 (10.9%)	.206	.525	Female: 2/6 (33) Male: 5/6 (83)
Neutrophil, No. (10^3 per μL)	1.43–7.77	1.6–6.1 (F) 1.8–5.4 (M)	5/115 (4.4) [1 value was low {1.43}; 4 values were high {range, 6.53–7.77; median, 7.06}]	8/55 (14.6) [2 values were low {1.71–1.78}; 6 values were high {range, 5.45–6.67; median, 6.09}]	.029	.179	Female: 2/5 (40) Male: 3/8 (38)
Neutrophils, %‡‡	32.1–77.7	34–71.1 (F) 34–67.9 (M)	4/114 (3.5) [1 value was low {32.1}; 3 values were high {71.2, 71.3, 71.7}]	8/55 (14.6) [8 values were high {range, 68.6–77.7; median, 69.4}]	.020	.175	Female: 1/4 (25) Male: 6/8 (75)
Platelet Count (10^3 per μL)‡‡‡	133–524	160–370 (F) 163–337 (M)	5/114 (4.4)	6/55 (10.9)	.179	.482	Female: 5/5 (100) Male: 4/6 (67)
Potassium, mmol/L	2.8–5.3	3.3–5.1	2/116 (1.7)	0/54 (0.0)	1.000	1.000	Female: 0/2 (0)
Red Blood Cell Count (10^6 per μL)	3.18–5.78	3.9–5.2 (F) 4.6–6.1 (M)	8/115 (7.0)	6/55 (10.9)	.385	.809	Female: 2/8 (25) Male: 2/6 (33)
Sodium, mmol/L	123–144	132–145	1/116 (0.9)	1/54 (1.9)	.536	.853	Female: 0/1 (0) Male: 0/1 (0)
Total Bilirubin, mg/dL	0.1–1.4	0–1.2	1/116 (0.9)	1/54 (1.9)	.536	.853	Female: 1/1 (100) Male: 1/1 (100)
Total Protein, g/dL	5.6–8.3	6.3–7.7	13/116 (11.2)	8/54 (14.8)	.617	.922	Female: 3/13 (23) Male: 2/8 (25)
Urea Nitrogen, mg/dL	6–37	6–20	8/116 (6.9)	7/54 (13.0)	.246	.601	Female: 2/8 (25) Male: 5/7 (71)
Urine, pH	5–8	5–8	0/115 (0.0)	0/55 (0.0)	1.000	1.000	NA§§§
White Blood Cell Count ($\times 10^{19}$ per L of blood)	3.4–11.3	4–10 (F) 4.2–9.1 (M)	6/115 (5.2) [2 values were low {range, 3.7–	10/55 (18.2) [5 values were low {range, 3.4–4.1; median, 3.6}; 5	.011	.142	Female: 2/6 (33) Male: 4/10 (40)

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LABORATORY TEST	RANGE	REFERENCE (RANGE, NORMAL LOW TO HIGH)	FEMALE† (%)	MALE‡ (%)	*P* VALUE §	ADJUSTED *P* VALUE §	UNKNOWN MEDICAL CONDITION,¶ (%)
			3.9}; 4 values were high {10.3, values were high 3.9}; 4 values were high {10.3, range, 10.7–10.3	10.3, values were high 10.3, range, 10.7–10.3 median, 9.8}]			
Urine Glucose, mg/dL	NA	0	4/115 (3.5)	3/55 (5.5)	.683	.936	Female: 1/4 (25) Male: 0/3 (0)
Urine Ketones, mg/dL	NA	0	16/115 (13.9)	8/55 (14.6)	1.000	1.000	Female: 6/16 (38) Male: 3/8 (38)
Urine Protein, mg/dL	NA	0	4/115 (3.5)	1/55 (1.8)	1.000	1.000	Female: 0/4 (0) Male: 0/1 (0)
Urine Red Blood Cell Count per High Power Field	NA	0	33/115 (28.7)	2/55 (3.6)	< .001	.008	Female:16/33 (48) Male: 1/2 (50)
Urine White Blood Cell Count per High Power Field	NA	0	6/115 (5.2)	0/55 (0.0)	.179	.482	Female: 5/6 (83)

*Test results were not available for at least one participant.

†The number of women who had abnormal test results of the total number of women for whom results were available.

‡The number of men who had abnormal test results of the total number of men for whom results were available.

§The *P* value was based on differences between sexes with respect to the probability of observing an abnormal laboratory test result.

¶The number of participants who did not indicate they had a medical condition of those who had abnormal laboratory test result.

#U: Unit.

**L: Liter.

††F: Female.

‡‡M: Male.

§§g: Grams.

¶¶dL: Deciliter.

##µL: Microliter.

***mmol: Millimole.

†††mg: Milligram.

###Only 169 assays were performed, as test results were not available for all participants.

§§§NA: Not applicable.

TABLE 2

Laboratory test results abnormalities associated with age.

LABORATORY TEST	MEAN (SD*) AGE OF PARTICIPANTS WHO HAD ABNORMAL LABORATORY TEST RESULTS, IN YEARS	MEAN (SD) AGE OF PARTICIPANTS WHO HAD NORMAL LABORATORY TEST RESULTS, IN YEARS	*P* VALUE	ADJUSTED *P* VALUE
Creatinine, mg†/dL‡	50.7 (11.5)	42.0 (14.3)	.005	.101
Eosinophils, %	34.6 (13.5)	44.0 (14.1)	.028	.179
Neutrophils, %	35.1 (11.1)	43.9 (14.3)	.037	.215
Urea Nitrogen, mg/dL	54.4 (11.4)	42.2 (14.0)	.001	.046
Urine Glucose, mg/dL	49.9 (6.1)	43.0 (14.4)	.024	.175

*SD: Standard deviation.

†mg: Milligram.

‡dL: Deciliter.

TABLE 3

Associations of reporting a medical condition with multiple abnormal laboratory test results.

VARIABLE	OBSERVED, NO. (%)	*P* VALUE	ADJUSTED *P* VALUE
Medical History		.020	.175
Gastrointestinal			
History (n = 29)	24 (83)		
No history (n = 142)	84 (60)		
Endocrine		.012	.142
History (n = 31)	26 (84)		
No history (n = 140)	82 (59)		
Psychological		.025	.175
History (n = 32)	26 (81)		
No history (n = 139)	82 (59)		
Demographic		.042	.217
Sex			
Male (n = 55)	41 (75)		
Female (n = 116)	67 (58)		

TABLE 4

Prevalence of significant laboratory test result abnormalities and their values, according to sex (N = 170).*

LABORATORY TEST	ABNORMAL LABORATORY TEST RESULT CUTOFFS, MEAN (3 SD†)	FEMALE,‡ ≥ 3 SD (%) [VALUE]	MALE,§ ≥ 3 SD (%) [VALUE]
Alanine Transferase, U¶/L#	0 (63)	2/116 (1.7) [80, 105]	1/54 (1.9) [76]
Aspartate Aminotransferase, U/L	0 (53.7)	3/116 (2.6) [54, 56, 63]	1/54 (1.9) [80]
Albumin, g/dL††	3.55 (5.35)	0/116 (0.0)	1/54 (1.9) [5.40]
Alkaline Phosphatase, U/L	10 (126)	0/116 (0.0)	1/54 (1.9) [137]
Chloride, mmol‡‡/L	94 (111)	1/116 (0.9) [83]	1/54 (1.9) [92]
Creatinine, mg§§/dL	0.29 (1.37)	1/116 (0.9) [0.25]	1/54 (1.9) [1.40]
Eosinophil, No. (10^3 per µL¶¶)	0 (0.46)	2/115 (1.7) [0.54, 0.64]	1/55 (1.8) [0.47]
Eosinophils, %	0 (7.2)	2/115 (1.7) [7.6, 10.1]	0/55 (0.0)
Glucose, mg/dL	0 (253)	3/116 (2.6) [255, 270, 447]	1/54 (1.9) [462]
Hematocrit, %	30.3 (54.9)	1/115 (0.9) [24.6]	0/55 (0.0)
Hemoglobin, g/dL	9.1 (18.1)	1/115 (0.9) [6.3]	0/55 (0.0)
Monocyte, No. (10^3 per µL)	0 (0.99)	1/115 (0.9) [1.45]	0/55 (0.0)
Monocytes, %	0.1 (15.1)	1/115 (0.9) [22.4]	2/55 (3.6) [15.7, 16.6]
Neutrophil, No. (10^3 per µL)	0.1 (7.3)	1/115 (0.9) [7.8]	0/55 (0.0)
Platelet Count (10^3 per µL)##	91 (446)	0/114 (0.0)	2/55 (3.6) [510, 524]
Potassium, mmol/L	3.1 (5.2)	2/116 (1.7) [2.8, 5.3]	0/54 (0.0)
Red Blood Cell Count (10^6 per µL)	3.3 (6.0)	1/115 (0.9) [3.2]	0/55 (0.0)
Sodium, mmol/L	132 (146)	1/116 (0.9) [123]	1/54 (1.9) [129]
Total Bilirubin, mg/dL	0 (1.1)	1/116 (0.9) [1.4]	3/54 (5.6) [1.2, 1.2, 1.3]
Urea Nitrogen, mg/dL	1.3 (27.7)	1/116 (0.9) [37.0]	0/54 (0.0)
White Blood Cell Count ($\times 10^{19}$ per L of Blood)	1.59 (11.25)	1/115 (0.9) [11.30]	0/55 (0.0)

*Test results were not available for at least one participant.

†SD: Standard deviation.

‡The number of women who had abnormal test results of the total number of women for whom results were available.

§The number of men who had abnormal test results of the total number of men for whom results were available.

¶U: Unit.

#L: Liter.

**g: Gram.

††dL: Deciliter.

‡‡mmol: Millimole.

§§mg: Milligram.

¶¶µL: Microliter

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