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Daily Life Hour by Hour, With and Without Cocaine: An Ecological Momentary Assessment Study

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Abstract

Rationale—Effects of an intervention cannot be understood without precise knowledge of the baseline behavior on which the intervention is superimposed. For misusers of illicit drugs, patterns of daily activities and moods have not been studied in a way that is amenable to statistical aggregation.

Objective—To compare hour-by-hour daily activities in cocaine-dependent outpatients during urine-verified periods of use and abstinence.

Methods—In a cohort design, a volunteer sample of 112 methadone-maintained cocaine- and heroin-abusing outpatients provided ecological momentary assessment (EMA) data on handheld computers for 10,781 person-days. EMA responses to questions about current location, activities, companions, moods, and recent exposure to putative drug-use triggers were compared across periods of use and abstinence using SAS Proc Glimmix (for binary outcomes) and Proc Mixed (for continuous outcomes).

Results—Periods of cocaine use were associated with idle, solitary, affectively negative afternoons, but, unexpectedly, were also associated with a greater likelihood of early-morning or late-evening work. The whole-day concomitants of cocaine use were often distinct from the acute predecessors of use seen in prior analyses from the same sample. Several measures of negative mood increased during abstinence.

Conclusions—Weeks of cocaine use and abstinence in outpatients are associated with distinct patterns of mood and behavior; the detailed hourly data reported here should help inform treatment interventions aimed at changing daily activities. The findings also argue against the contention that cocaine abstinence symptoms decrease monotonically from the day of cessation.

Keywords

cocaine; abstinence; addiction; behavior; human; Ecological Momentary Assessment

A central tenet of psychology is that the effects of an intervention cannot be understood without precise knowledge of the baseline behavior on which the intervention is superimposed (Sidman 1960; Skinner 1938). This knowledge is achieved fairly straightforwardly in laboratory settings, but is more elusive in clinical practice. In the case of disorders involving illicit drugs, it would be useful to know what a typical day is like for patients seeking treatment, or how periods of drug use differ from periods of drug abstinence. Such information could guide the

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development of behavioral interventions for drug dependence and may offer clues to relapse prevention.

There is a body of literature that addresses such questions in illicit-drug misusers from various walks of life; it is ethnographic work, typically involving fieldwork and interviews. This work is invaluable in that it gives study participants a voice, helping to ensure that future hypothesis-driven studies are addressing issues that are salient to the population. Nonetheless, daily behavior should also be characterized in quantitative studies, with data collected in a more standardized way that is amenable to statistical aggregation. To our knowledge, only one quantitative study has been published on the hourly and daily activities of cocaine-abusing outpatients (Palij et al. 2003). In that study, 18 inner-city methadone-maintained misusers of heroin and cocaine used pen-and-paper grids to report their hourly activities across nine consecutive days. The reports were collected in the clinic at two-day or three-day intervals, requiring recall of hourly activities across those intervals. The results provided previously unavailable information about the patients' daily lives—for example, that they spent a mean of 2.98 hours per day using drugs or alcohol, and another 0.72 hours obtaining them, and that the most frequent activity besides sleeping (9.82 hours per day) was watching TV or videos (4.95 hours per day). However, very few of the reported activities seemed to be associated with drug use: "Total drug use was significantly related to the amount of time spent socializing [$r(152) = .39$, $p < .001$] but not to the amount of time spent watching TV or videos, time spent in food preparation or eating, or to the time spent at the methadone clinic" (Palij et al. 2003).

We suspect that more associations would have been detected if a more sensitive technique had been used. Delayed recall of day-to-day events can be startlingly inaccurate (Shiffman et al. 1997). In cigarette smokers and other types of outpatients, the biases associated with recall have been effectively circumvented by the use of ecological momentary assessment (EMA), in which participants use handheld computers to provide time-stamped reports of their moods and behaviors throughout the day (Shiffman et al. 2008). Palij and colleagues (2003) were understandably pessimistic about the application of EMA to questions of illicit-drug misuse: "The diary study or life experience sampling methodology that seems to work well in other contexts...is not appropriate for a large number of chronic drug abusers, mainly because of the chaos and disruption in their lives caused by drug use."

Despite the seeming improbability of success, our group has completed an EMA study of over 100 cocaine- and heroin-using methadone-maintained outpatients, some results from which have been reported in three previous publications (Epstein et al. 2010; Epstein et al. 2009; Preston et al. 2009). Additional results, reported here, complement and extend the ethnographic literature and the findings of Palij and colleagues by providing real-time, in-the-field, first-person reports of behaviors and moods, collected in a manner that permits statistical aggregation. In the analyses presented here, we describe how these reports differ during urine-verified periods of cocaine use and cocaine abstinence and discuss how they may relate to a cocaine-withdrawal syndrome.

Methods and methods

Participants and Setting

Participants were cocaine- and heroin-using individuals seeking outpatient treatment for opioid dependence. Inclusion criteria were: (1) age between 18 and 65 years; (2) evidence of physical dependence on opioids (by self-report and physical examination); and (3) evidence of cocaine and opiate use (by self-report and urine drug testing). Exclusion criteria were: (1) current psychotic disorder (by DSM-IV criteria); history of bipolar disorder; current major depressive disorder; (2) current dependence on alcohol or any sedative-hypnotic (by DSM-IV criteria);

(3) cognitive impairment severe enough to preclude informed consent or valid self-report; and (4) medical illness that would compromise study participation.

Upon enrollment, participants began methadone maintenance at a treatment-research clinic in Baltimore, MD. All participants received the same treatment, including daily oral methadone (target dose 100 mg/day), weekly individual drug counseling, and 12 weeks of abstinence reinforcement. Participants attended clinic 7 days a week for up to 28 weeks; urine drug screens were conducted three times per week. During the abstinence-reinforcement portion of treatment (weeks 7–18), all participants received vouchers in exchange for urine specimens negative for cocaine, opiates, or both; up to $2310 in vouchers were available for participants continuously abstinent from cocaine and opiates, as described previously.

The Institutional Review Board (IRB) of the NIDA Intramural Research Program approved this study. Each participant gave written informed consent before being enrolled.

Study Design

The study was designed to assess the natural history of craving and lapse against a background of methadone maintenance and abstinence reinforcement. At the end of the third week of the study, each participant was trained to use and was issued a PDA (personal digital assistant, i.e. Palm Zire or Palm Zire 21, Palm, Inc., Sunnyvale, CA) running our Transactional Electronic Diary (TED) software (Vahabzadeh et al. 2004). Participants were instructed to make two types of entries: randomly prompted and event-contingent entries. At each entry, participants reported where they were, whom they were with, and what they were doing and answered questions about their mood. Random prompts were triggered 5 times per day for 5 weeks, then 2 times per day for 20 weeks, and were timed to occur only during each participant's typical waking hours, which were programmed separately for each day of the week. Event-contingent entries were initiated by participants whenever they craved drug without using or used cocaine or heroin or both drugs. All data used in the present analyses were from randomly prompted entries, not event-contingent entries.

At each random prompt, participants answered the following questions, among others: "Who were you with when the beep occurred?"; "Where were you with when the beep occurred?"; and "What were you doing when the beep occurred?" For the "who" and "where" questions, response options consisted of "radio buttons" (i.e., multiple-choice options in which only one choice could be selected); the "where" question also had an "other" option for which participants could enter text. For the "what" question, response options consisted of checkboxes (i.e., participants could endorse multiple answers) and were based on the responses most frequently given by participants in the study by Palij and colleagues (2003); there was also an "other" option for which participants could enter text. Participants also answered a series of questions beginning with, "In the past hour...," which were designed to assess exposure to putative triggers of drug craving or drug use; these items were adapted from triggers reported by participants in prior studies (Heather et al. 1991; Marlatt and Gordon 1985) and were the focus of one of our previous papers (Epstein et al. 2009). Mood was assessed with six adjectives (happy, relaxed, tired, irritated, stressed, and bored) in six items worded "Right now, do you feel..." and rated on a four-point scale.

A total of 130 participants (84 men, 46 women) enrolled in the study; 112 (71 men, 41 women) attended clinic long enough to be issued a PDA and provided sufficient data for the main analyses reported here. These 112 participants did not differ significantly demographically from the other 18 in terms of demographic characteristics or drug-use history. Their mean age was 40.7 (SD 8.1, range 20–58). Employment status was 38% unemployed, 34% employed full-time, and 27% employed part-time; mean total income in the 30 days before study intake was $2260 (SD $1,460, range $350 to $8,150, median $1,900), of which a mean of 33% was

from illegal sources (SD 39, range 0% to 100%, median 1%). Marital status was 63% never married, 28% separated, divorced, or widowed, and 9% married. Living arrangements at intake were 45% with parents or other family, 17% with spouse/partner alone, 10% with spouse/partner and children, 14% with friends, 11% alone, and 2% with children only; the remaining participant had no stable arrangements. Only 13% of participants had a functioning car available for personal use. Race/ethnicity was 61% African-American, 37% European-American, and 2% Hispanic. All participants met DSM-IV criteria for cocaine dependence by structured interview (Robins et al. 1995) at study intake, though this was not an inclusion criterion; they reported having used cocaine a mean of 20.0 days out of the past 30 (SD 9.2, range 4–30); primary routes of administration were smoking (48%), intravenous (42%), and intranasal (8%).

Data analysis

Thrice-weekly urine drug screens were used to identify periods of sustained abstinence (1 or more weeks of consecutive cocaine-negative specimens) or of sustained use (1 or more weeks or more weeks of consecutive cocaine-negative specimens) or of sustained use (1 or more weeks of consecutive cocaine-positive specimens). Any week that did not fall into one of these two categories was excluded from analysis. To compare periods of abstinence versus periods of use, we examined random-prompt entries in repeated-measures regressions (SAS Proc Glimmix for the binary outcomes in figures 1–4; SAS Proc Mixed for the continuous outcome in figure 5). Only entries from 6:00 AM to midnight were included due to sparsity of data from postmidnight hours; data were divided into 18 time bins (6:00–7:00 AM and so on; if a bin was empty, its data were treated as missing). Each model had one dependent variable and three independent variables: Abstinence (a time-varying predictor that could repeatedly alternate between present and absent within each participant), Time of Day (an 18-level categorical variable), and a control variable for the number of records the participant contributed. The control variable was included to reduce potential bias associated with differences in protocol compliance. No random intercept was included, because models with a random intercept either failed to converge or failed to provide an estimate for the Cocaine x Time interaction. A first-order autoregressive error structure (applied uniformly across all data points for each participant) provided the best fit to the data when compared to a compound-symmetry structure or a variance-components structure using the Akaike and Bayseian Information Criteria. The “slice” option in SAS’s mixed-models procedures was used to generate post hoc F tests between the use and abstinence conditions during each time bin (6:00–7:00 AM, 7:00–8:00 AM, and so on) regardless of omnibus F values; the 18 resultant p values were Bonferroni-corrected.

The criterion for significance was $p \leq .05$, two-tailed.

Results

During periods of abstinence and use, EMA data were collected on 3,476 participant-days (mean 31.0, SEM 4.7 days) and 7,305 participant-days (mean 65.2, SEM 5.1 days), respectively. Of the 112 participants, 64 consistently tested positive and, thus, contributed data only during periods of cocaine use; 14 consistently tested negative and contributed data only during periods of cocaine abstinence, and 34 contributed data during periods of both use and abstinence. That number, 34, is reflected in the denominator degrees of freedom for abstinence (the time-varying predictor), which was determined using the between-within method and thus does not reflect the full sample size, even though all 112 participants were included in the analyses.

To increase our confidence that we were looking at within-subject effects of use and abstinence (rather than merely differences between individuals who provided mostly one or the other type of data), we plotted each of our main results from the total sample alongside results from the

subset of 34 who contributed data during periods of both use and abstinence (Supplementary Figures). Because cells sizes became small as we divided data into hourly bins, the data from the subset were not sufficient for statistical analyses, but, with very few exceptions, the pattern of results in the subset was highly consistent with the pattern of results in the total sample.

The rate of missed random prompts was slightly greater during periods of cocaine use (mean 23% per participant, SEM 2%, median 19%, range 0% to 63%) than during periods of abstinence (mean 19%, SEM 2%, median 18%, range 1% to 49%). This difference did not quite reach statistical significance in a mixed regression [$F(1,32) = 3.50$, $p = .07$] and we consider it unlikely to have biased the data appreciably.

Companions during periods of use and abstinence

During periods of cocaine use, participants were *more* likely to be: alone (especially in the early morning and the afternoon) or with coworkers (especially in the early morning and at 5:00–6:00 PM) (Figure 1, panels A–B). Participants were *less* likely to be with their spouse/partner (especially in the evening) or their child(ren) (especially from 1:00 to 8:00 PM) (Figure 1, panels C–D). Other concomitants of cocaine use on the "Who were you with?" measure varied across time. For example, when using, participants were more likely to be with friends or extended family in the evening, but less likely to be with them in the morning (Figure 1, panels E–F). There was a tendency for participants to be with strangers or acquaintances during periods of cocaine use (especially in the early morning), but it did not reach statistical significance, probably due to the low number of early-morning data points (Figure 1, panel G–H).

Participants' reports of being with clinic staff or patients (Figure 1, panel I) enabled some external assurance of the quality of the EMA data, because the peaks closely matched the hours of the clinic (11:00 AM to 1:00 PM and 4:00 to 6:30 PM, with earlier openings on weekends).

Locations during periods of use and abstinence

During periods of cocaine use, participants were *more* likely to be at work (especially from 7:00 to 9:00 AM and from 3:00 to 6:00 PM), at another person's house, or waiting for a bus or a ride (Figure 2, panels A–C). Participants were *less* likely to be at a store or at the clinic (Figure 2, panels E–F), and were also less likely to be at a restaurant or a bar/club (data not shown because endorsement rates never exceeded 5%). The association between using cocaine and being at home varied with time: during periods of cocaine use, participants were less likely to be at home from 6:00 AM to 8:00 AM, but more likely to be at home from 11:00 AM to 2:00 PM (Figure 2, panel F). During periods of use, participants were more likely to be in a vehicle from 9:00 AM to 1:00 PM and from 3:00 to 5:00 PM (Figure 2, panel G).

There was a nonsignificant tendency to report being in "other" locations during periods of cocaine use, especially early in the morning (Figure 2, panel H). When fill-in responses were given for "other" locations during periods of cocaine use, they frequently indicated outdoor locations (39% of fill-ins: "walking," "outside," "in the hood," "park," "bicycling"); other responses given by more than one participant included "church," "hospital," "social services," and "playing ball." Fill-in responses for "other" locations during periods of cocaine abstinence indicated many of the same types of locations (22% of fill-ins indicated outdoor locations), but also included "NA meeting" and "my kid's school" (each from one participant only) and "court / lawyer's office" (three participants).

Activities during periods of use and abstinence

During periods of cocaine use, participants were *more* likely to be watching TV/DVDs/videos, working (especially from 7:00 to 9:00 AM and from 4:00 to 7:00 PM), or walking (Figure 3,

panels A–C), as well as copping (buying drugs), engaging in illegal activities, engaging in legal hustling for money, or using the Internet (data not shown, as endorsement rates never exceeded 5%). Participants were *less* likely to be engaging in shopping/errands (Figure 3, panel D) during periods of use.

Periods of use were also statistically associated with a reduced likelihood of engaging in "other" activities, but, as can be seen in Figure 3, panel E, that association seems to be reversed during early-morning hours, when there were fewer data points. Most of the participants who reported "other" activities did not provide fill-in responses. The few fill-in responses present indicated chores/hygiene ("going to the bathroom," "doing hair," "watering plants"), church-related or funeral-related activities ("worship," "viewing the body"), medical activities ("seeing doctor"), court-related activities, resting/sleeping, and shopping/errands; the data were insufficient to permit comparison across use and abstinence conditions.

Other concomitants of cocaine use varied across time. For example, during periods of use, participants were less likely to be thinking from 9:00 AM to 2:00 PM (Figure 3, panel F), more likely to be resting or sleeping from 10:00 AM to 2:00 PM rather than in the late evening (Figure 3, panel G), and more likely to be talking/socializing from 8:00 to 9:00 AM and from 6:00 to 10:00 PM rather than in the afternoon (Figure 3, panel H)). Similarly, chores/hygiene tended to shift to later hours (Figure 3, Panel I), and eating tended to shift from 6:00 PM to 3:00 PM (Figure 3, panel J). Reading and listening to music were low-frequency activities overall, but pairwise comparisons suggested that the periods of cocaine use were associated with more music-listening and less reading in the evening (Figure 3, panels K–L).

Past-hour exposure to putative triggers of craving and lapse during periods of use and abstinence

During periods of cocaine use, participants were *more* likely to report the following in the past hour: having seen cocaine or been offered cocaine, having wanted to see what would happen if they tried just a little cocaine, having felt "tempted out of the blue" to use cocaine, and having been in a good mood and felt like celebrating (Figure 4, panels A–E). Participants were *less* likely to report having felt angry/frustrated or having felt that others were being critical (Figure 4, panels F–G). Reports of having felt sad took a more complex pattern; they were less likely in the morning but (nonsignificantly) more likely in the evening (Figure 4, panel H). Reports of having felt ill or worried also seemed to be more likely in the evening (Figure 4, panels J–K), and reports of having felt bored followed a similar pattern, though it was not reflected in a significant interaction with time (Figure 4, panel L).

Reports of having handled $10 or more in cash were less likely overall during periods of use, but only from 10:00 AM to 8:00 PM; the likelihood of handling cash seemed elevated in the early morning (though this was not statistically significant in pairwise comparisons, probably due to the low number of early-morning data points; Figure 4, panel I).

Mood at the moment of assessment during periods of use and abstinence

During periods of cocaine use, participants were *more* likely to report feeling bored or tired at the moment of assessment, with tiredness especially prominent from 10:00 AM to 1:00 PM (Figure 5, panels A–B). Participants were *less* likely to report feeling relaxed at the moment of assessment (Figure 5, panel C). Reports of feelings stressed, irritated, or happy suggested a pattern of worsening mood throughout the day during periods of cocaine use, but this was not reflected in significant interactions between cocaine use and time (Figure 5, panels D–F).

Discussion

The main finding of this study was that daily patterns of activities and moods were remarkably different during periods of cocaine use and abstinence in outpatients undergoing addiction treatment. On a technical level, the findings are encouraging because the periods of use and abstinence were defined by an external biological criterion, so that their association with different patterns of EMA reports is a form of external validation of the EMA data. The findings are also inherently interesting in that they were a mixture of expected and unexpected associations.

Among the expected, or at least unsurprising, findings was that periods of cocaine use were associated with spending the afternoons home alone watching TV or resting/sleeping (Figure 1, panel A; Figure 2, panel F; Figure 3, panels A and G), feeling tired (Figure 5, panel b), and "not thinking" (that is, not reporting that "thinking" was among one's current activities; Figure 3, panel F). Chores and self-care were delayed (Figure 3, panel I); the timing of meals was altered (Figure 3, panel J).

More surprising was that these solitary, idle afternoons during periods of cocaine use seemed to be bookended by morning and/or evening stints at work (Figure 1, panel B; Figure 2, panel A; Figure 3, panel B). One possibility is that our participants were using cocaine to stay awake for shift work. An ethnographic study of the reasons for cocaine use among heavy users included working as one of ten reasons cited, but added the caveat that cocaine use "at or for work" was not the norm (Waldorf et al. 1992). The users in that study were mostly middle-class and steadily employed, whereas most of ours were neither; thus, the association of cocaine use with work might vary across socioeconomic groups.

Another aspect of our findings adds nuance to what we have previously reported on the acute predecessors of individual episodes of cocaine use. The best example is participants' handling of cash. We previously reported that the likelihood of handling cash increases in the hours preceding an episode of cocaine use (Epstein et al. 2009); this effect probably reflects transactions needed to obtain cocaine, but is also consistent with the belief that handling cash can trigger temptations to use drugs. Yet on the whole-day level examined here, participants actually spent less time handling cash during periods of use than during periods of abstinence. Hour-by-hour examination of the data (Figure 4, panel I) suggests an explanation: during periods of cocaine use, cash was handled—and perhaps depleted—very early in the day.

Differences between acute predecessors and whole-day concomitants of use can also be seen in our mood data. We previously reported that episodes of cocaine use are preceded by increases in reports of past-hour boredom, anger/frustration, worry, sadness, discomfort, or feelings of having been criticized (Epstein et al. 2009). On the whole-day level examined here, reports of past-hour anger/frustration, worry, sadness, or feelings of having been criticized were associated with periods of abstinence (Figure 4, panels F–H and J). To some degree, this overall effect obscured what seemed to be a pattern of steadily worsening mood across the day during cocaine-using periods (Figure 4, panels F, H and J; Figure 5, panels D–F). Nonetheless, mood during abstinent periods was worse on the whole than mood during cocaine-using periods. This could reflect the absence of cocaine-induced euphoria; it could also reflect an abstinence syndrome. Although criteria for a cocaine-abstinence syndrome are now listed in the DSM-IV (American Psychiatric Association 2000), the nature and timing of the syndrome are still debated. Our findings do not resolve the issue, but they do add to the data. The basic question is whether the syndrome comprises several phases of fluctuating symptoms (Foltin and Fischman 1997; Gawin and Kleber 1986) or whether it is a mostly monotonic decline in symptoms that are already present by the time abstinence begins (Coffey et al. 2000; Satel et al. 1991; Weddington et al. 1990). We did not specifically assess abstinence symptoms, but

our findings seem consistent with a worsening of mood during the first week or two of abstinence rather than with a monotonic decline.

Our study has several limitations. The data, though temporally precise and ecologically valid, are still correlational and should not be interpreted causally. As mentioned in the Results section, of the 112 participants studied, only 34 provided data during periods of both use and abstinence, so we relied on statistical modeling to ensure that we were examining within-person changes and not merely between-person differences. We tried to perform additional analyses using only the subset of 34 participants who had contributed both types of data, but most of these analyses would not converge (i.e. there were not enough data to permit a mathematical solution). However, side-by-side comparison of the subset data with the total-sample data persuasively suggests that our findings reflect within-person changes (Supplementary Figures). Also, we were able to run subset analyses for outcome measures we reported elsewhere, and for those measures, results in the subset of 34 were similar to results for the total sample (Preston et al. 2009).

Another limitation is that most of the randomly prompted entries occurred between 9:00 AM and 11:00 PM; when we examined event-contingent entries, we found that 12% of cocaine-use reports occurred outside those hours (data not shown). Thus, our random-prompt data did not cover the entire waking (or cocaine-using) day.

Because we studied cocaine-dependent methadone-maintained polydrug users, our results might not generalize to people who use cocaine only. However, prior studies have shown that the mood changes associated with early cocaine abstinence are very similar in methadone-maintained and non-opioid-using individuals (Foltin and Fischman 1997; 1998).

In the only previous quantitative report of daily activities in cocaine-using outpatients, the authors noted the “apparent social impoverishment” of their lives (Palij et al. 2003). Our findings seem consistent with that assessment, though a strong conclusion about it would require direct comparison with a control group. Use of the Internet, which could be regarded as an increasingly important component of full participation in US society, was reported as a current activity by only 34 of the 112 participants (30%)—but this proportion seems no smaller than expected for a low-income sample, based on data from 2006 (Fox 2006), the year most of our data were collected. Surprisingly, we found that Internet use was greater during periods of cocaine use than during periods of abstinence, but the overall frequency of Internet use was so low (accounting for only 145 of 27,162 random-prompt entries, or 0.5%) that we caution against any dire interpretation of this result pending further research.

What is most clear from our data is that differences in users’ daily activities and moods can be reliably detected when short periods of use are compared with short periods of abstinence. The detailed data reported here should help inform treatment interventions aimed at changing behavior.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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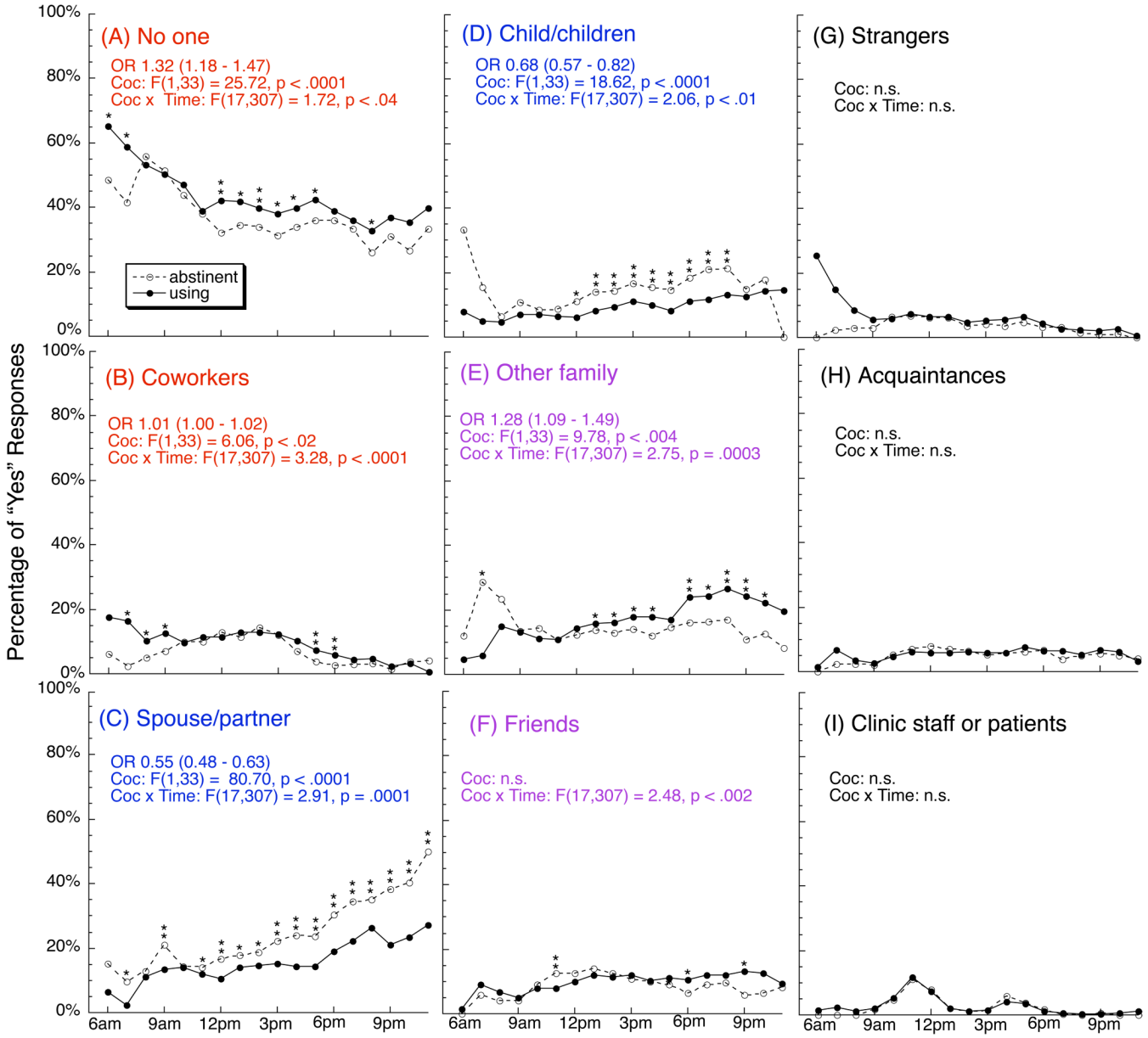

Figure 1.

Time course of responses to the multiple-choice question "Who were you with when the beep occurred?" from 6 AM to 12 PM in 112 participants during periods of cocaine use or abstinence. Abstinence/use was a time-varying predictor; thus, 34 of the 112 participants contributed data to both the "abstinence" line and the "use" line, and this number is reflected in the denominator degrees of freedom, though all 112 participants were included in the analyses (see Methods section for details). For cocaine abstinence, the median number of data points per symbol is 496 (range 24 to 789; all values over 100 from 8:00 am through 9:00 pm); for cocaine use, the median number of data points per symbol is 1,058 (range 63 to 1,579; all values over 100 from 7:00 am onward). F values, p values, and odds ratios (ORs) are from SAS Proc Glimmix; ORs greater than 1.0 reflect concomitants of cocaine use. Red indicates concomitants of cocaine use; blue indicates concomitants of abstinence; purple indicates interactions between cocaine-

use status and time of day. *Significant difference between use and abstinence at this time point in Bonferroni-corrected post hoc F tests (“slice” option in SAS Proc Glimmix).

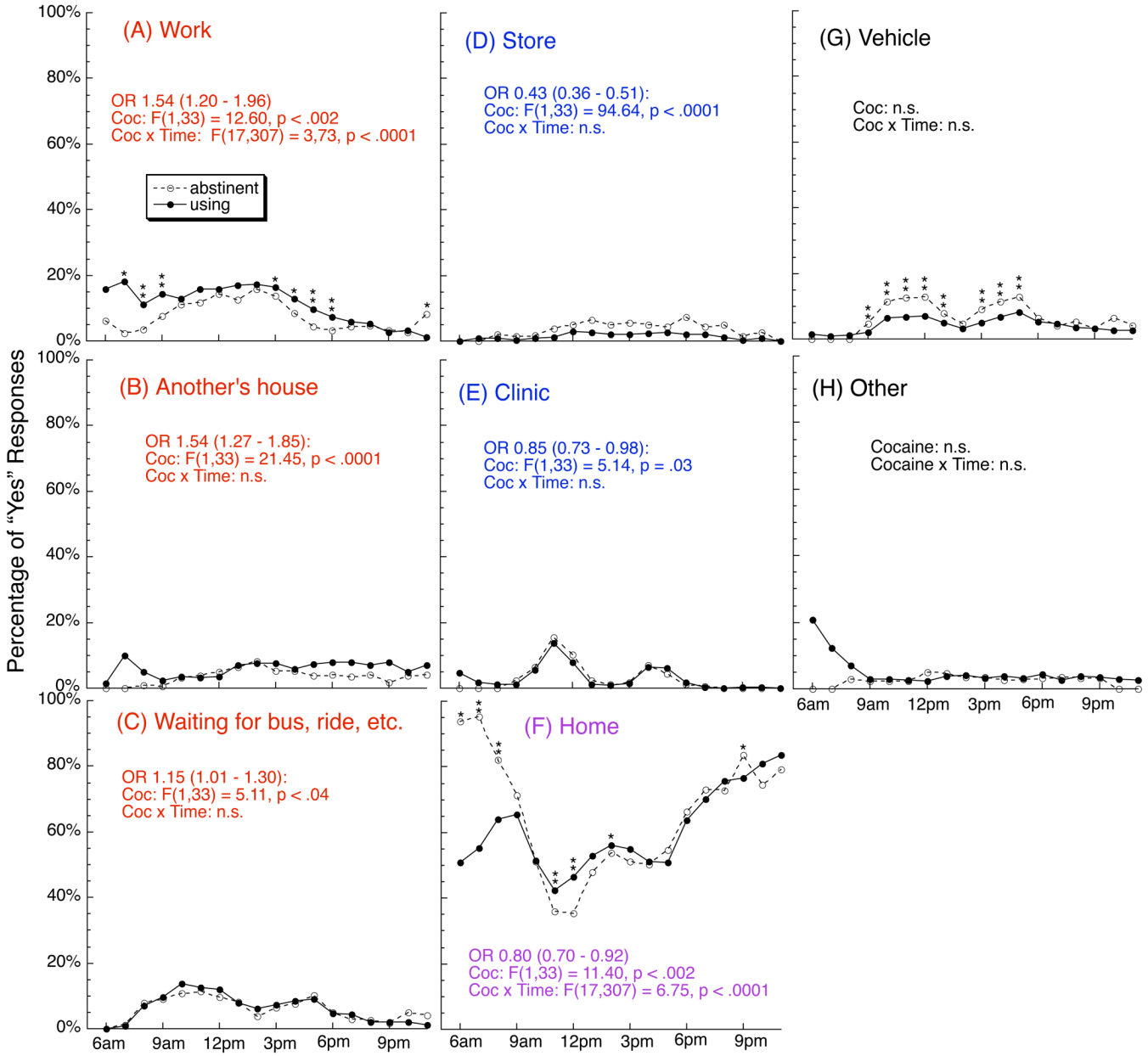

Figure 2.
Time course of responses to the multiple-choice question "Where were you when the beep occurred?" Details are the same as for Figure 1.

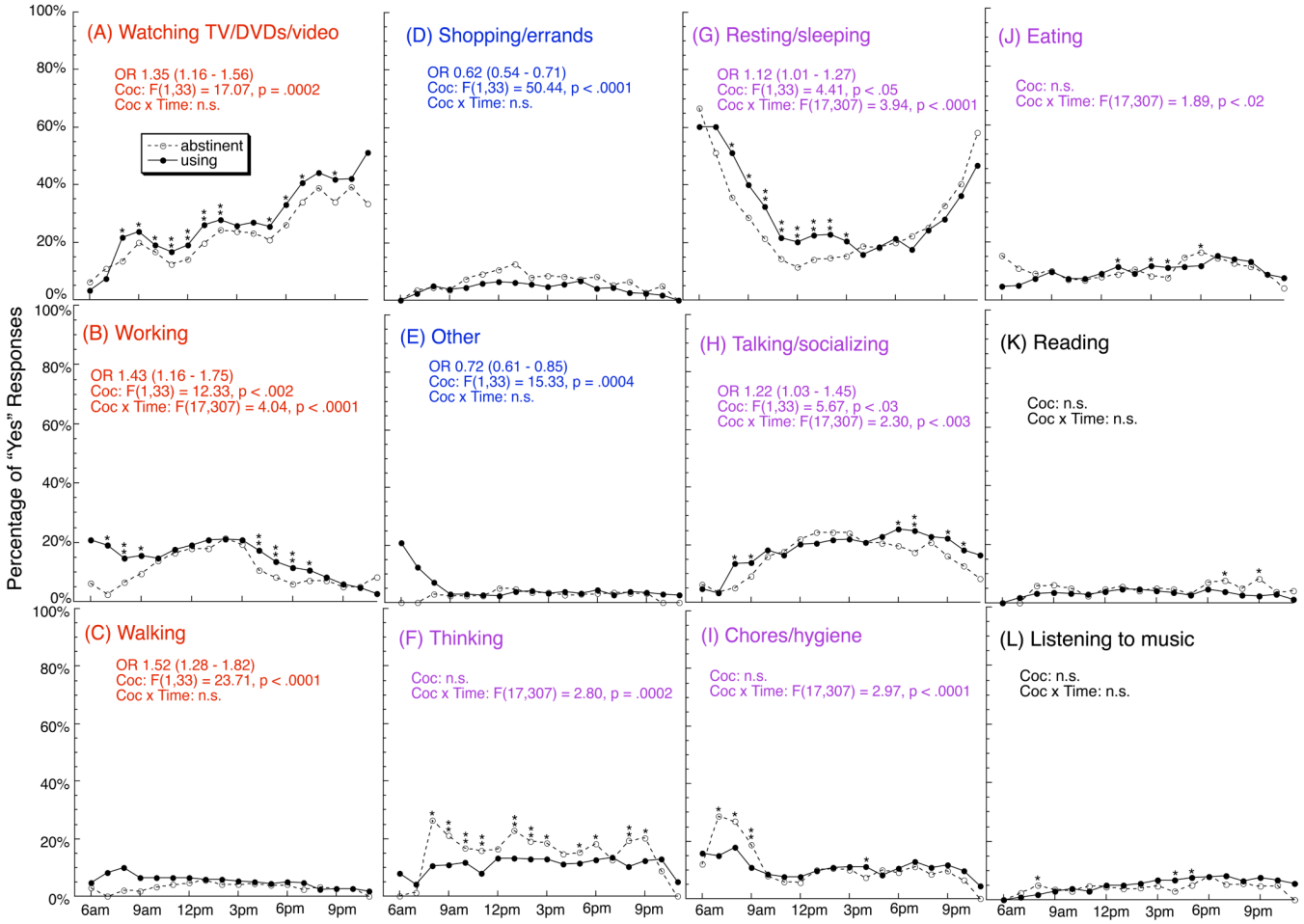

Figure 3.
Time course of responses to the multiple-choice question "What were you doing when the beep occurred?" Details are the same as for Figure 1.

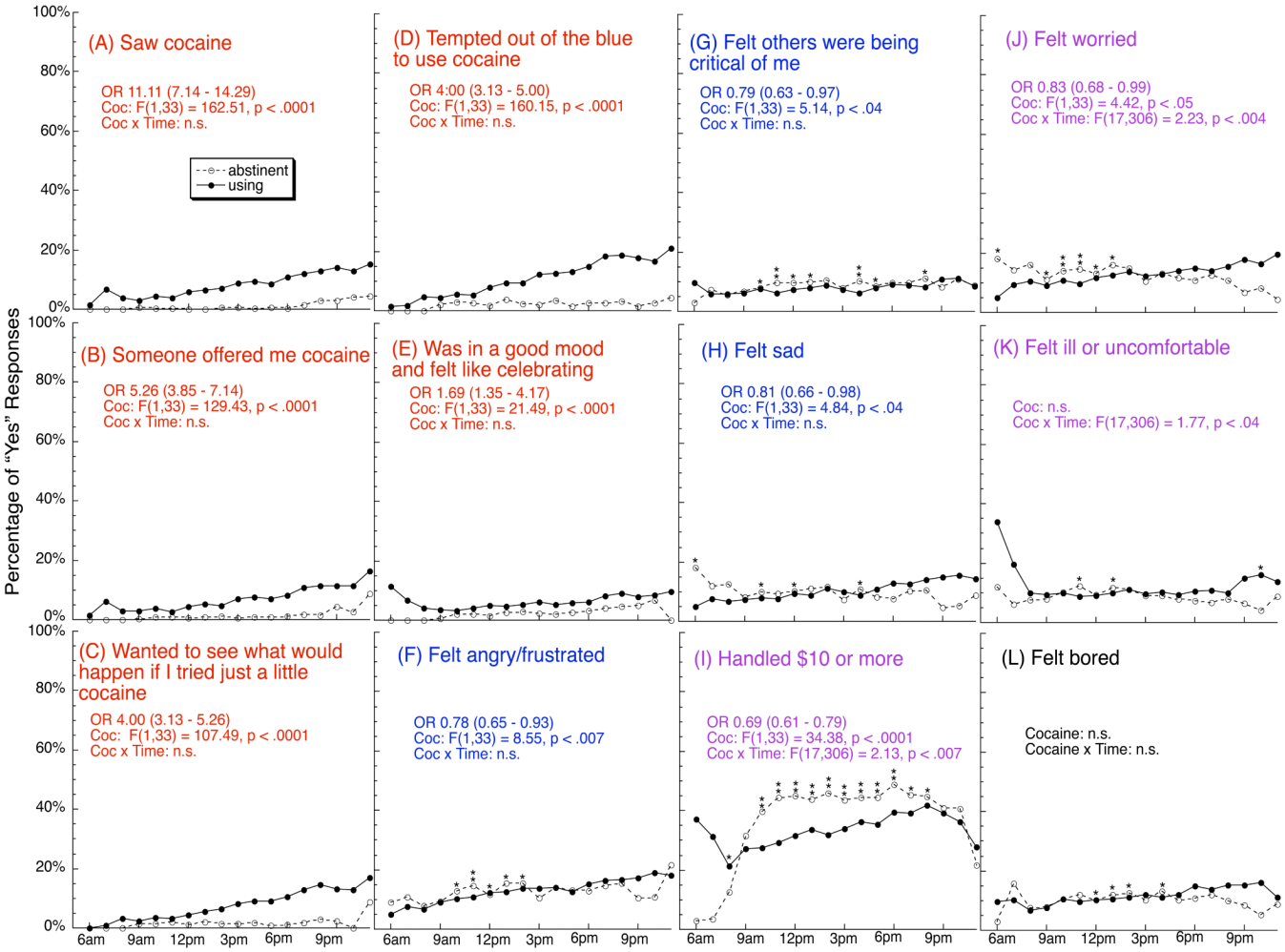

Figure 4.

Time course of responses to yes/no questions beginning "During the past hour..." and assessing putative triggers of drug craving/use. Details are the same as for Figure 1.

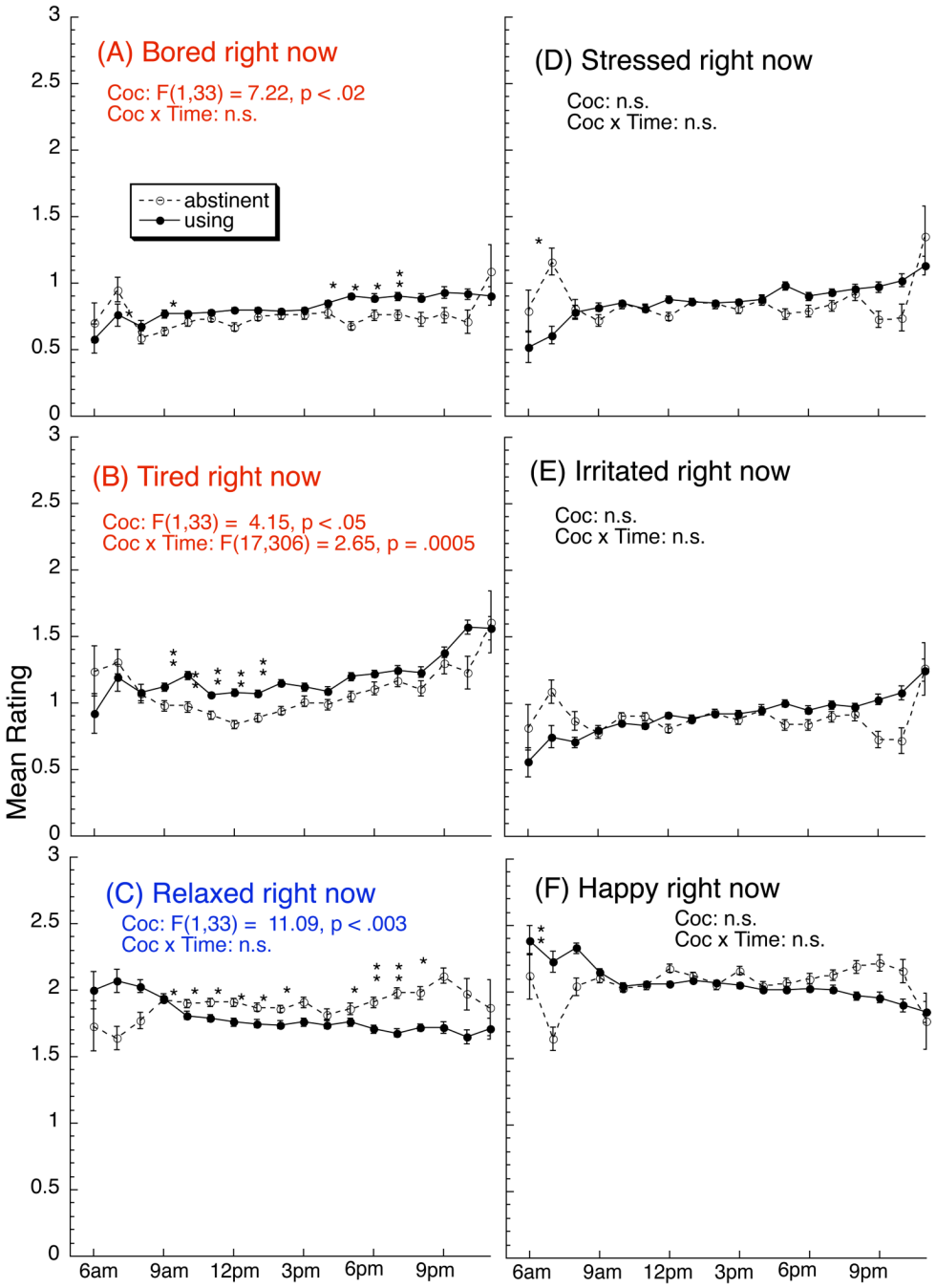

Figure 5.

Time course of responses to Likert-scale questions beginning “Right now, do you feel...?” Data shown are mean ratings on a 0-to-3 scale; error bars indicate SEM. F and p values are from SAS Proc Mixed. Details are otherwise the same as for Figure 1.