

A Comparison of Coping Assessed by Ecological Momentary Assessment and Retrospective Recall

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Recent research suggests that retrospective coping assessments may not correspond well with day-to-day reports. The authors extended this work by examining the correspondence between short-term (within 48 hr) retrospective coping reports and momentary reports recorded via a palm-top computer close in time to when the stressor occurred. There was relatively poor correspondence between the 2 assessments. Some reports of momentary coping were not reported retrospectively, and some coping reported retrospectively was not reported at the time the stressor occurred. Cognitive coping was more likely to be underreported retrospectively; behavioral coping was overreported. Participants were consistent in their discrepancies, but there was no correspondence between discrepancy rates and demographic or personality variables.

Just as stress research progressed quickly only after a self-report life events questionnaire was developed in the 1960s (Holmes & Rahe, 1967), research on coping was limited until the early 1970s by the lack of questionnaire assessments. At that time, researchers such as Lazarus, Moos, and Pearlin began using self-report assessments to investigate the potential moderating effects of coping behaviors and cognitions on affective and health outcomes. By the end of the decade, each of these researchers had published self-report coping questionnaires (Billings & Moos, 1981; Folkman & Lazarus, 1980, 1985; Pearlin & Schooler, 1978) that have subsequently been used in many studies. These instruments typically ask participants to describe a stressful event that occurred within the previous week or month and to identify thoughts and actions that were used to cope with that event. Other coping instruments appeared in

subsequent years, most notably Carver and Scheier's COPE (Carver, Scheier, & Weintraub, 1989).

Early studies using these instruments typically employed cross-sectional designs and revealed that coping was associated with a variety of outcomes. Recently, more sophisticated longitudinal designs have also been used. For example, several studies have examined the impact of coping with breast cancer on outcomes assessed at a 1-year follow-up. These studies showed that avoidant coping was related to higher levels of distress (Carver, Pozo, 1993; Harris, Noriega, Scheier, Robinson, Ketcham, Moffat, & Clark, 1993; Stanton & Snider, 1993) and to poorer disease outcomes (Epping-Jordon, Compas, & Howell, 1994). In a study of the general population, Aldwin and Revenson (1987) reported that, even after controlling for distress before the event, the coping strategies of escapism and support mobilization predicted more psychological symptoms, and instrumental action predicted fewer psychological symptoms.

Despite the success of these longitudinal studies in predicting outcomes, the retrospective nature of the coping reports used gives us pause. A major assumption underlying the use of situation-specific self-report coping inventories is that people are capable of accurate, retrospective reports of coping behaviors. This may not be true. There is emerging evidence that people do not—and perhaps cannot—provide accurate information on the coping behaviors and cognitions they have engaged in over a particular retrospective reporting period. Studies of autobiographical memory (Bradburn, Rips, & Shevell, 1987; Brewer, 1986; Thompson, Skowronski, Larsen, & Betz, 1996) indicate that people's use of heuristic devices biases their reports of the frequency of past events. For example, they reconstruct and

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“recall” on the basis of beliefs about their “typical” behavior. To the extent that participants’ recall relies on global self-perceptions about how they generally cope, retrospective reports of coping may not accurately reflect their actual behavior.

Another concern is based on the concept of retrospective bias or “effort after meaning” (Brown & Harris, 1978); reports of coping with resolved events could be distorted by knowledge of the resolution of the event (i.e., success or failure). For example, Brewer (1994) had newlywed couples describe and evaluate their honeymoon experience. Years later, when asked to recall their honeymoon experience, couples who were distressed and splitting up recalled it more negatively than they had originally reported. In other words, the distressed couples downgraded their honeymoon in retrospect to make their past match their current evaluation of the relationship. Again, the analogy with life events is apt: Reports of event occurrence or event appraisals, or both, may be influenced by participants’ perceptions of the events’ effects (Brown & Harris, 1978). In the coping area, we speculate that resolution of a problem can influence perceptions of the coping used to address the problem.

One recent study explored the possibility that end-of-day daily reports of coping do not correspond well with retrospective coping reports for the same time period. (Ptacek, Smith, Espe, and Raffety (1994) compared brief daily coping reports, completed by college students for 7 days before a scheduled examination, with retrospective reports of coping over the same period. Aggregated scores from the daily assessments were compared with retrospective reports (for the same period) completed 5 days after the exam. As a means of facilitating comparison, the three-item daily coping assessment corresponded to the scales of the Coping Strategy Indicator (Amirkhan, 1990), which was used for retrospective reporting. Correlations between daily coping measures (averaged across days) and the retrospective reports were .58, .49, and .47 for the problem-solving, seeking social support, and avoidance scales, respectively. Thus, an average of 26% of the variance was shared between the two reporting methods. The correspondence was not improved by focusing on more recent daily coping reports or on coping reports from the highest stress days.

Results from the Ptacek et al. (1994) study call into question the validity of coping recall over a 5-day to 12-day period. Recent investigations using ecological momentary assessment (EMA; Stone & Shiffman, 1994) methods have demonstrated that even end-of-day recall may be inaccurate. EMA methods, which involve repeated assessments in participants’ natural environments, aim to obtain assessments in nearly real time to minimize or eliminate recall. EMA has typically been implemented via audible “beeps” to prompt participants, who then complete an assessment using paper and pencil or a hand-held computer. Studies using this method have shown, for example, that end-of-day reports of mood are biased toward more recent experience (Shiffman, 1995) and that retrospective judgments of pain vary considerably from EMA measures of pain over the same period (Stone, Broderick, Kaell, & Porter, 1995).

EMA methods rely on time sampling to assess domains ranging from activity to cognition and mood, and they have been used successfully with individuals, ranging in age from 10 to 85 years in such diverse populations as corporate managers, working mothers, children who have disabilities, recovering al-

coholics, and people with schizophrenia (for reviews, see Csikszentmihalyi & Larson, 1987; DeVries, 1992). Study completion rates of more than 90% are typically achieved, even among schoolchildren (Csikszentmihalyi & Larson, 1987). Compliance has typically been equally impressive; on average, participants respond to 80% of the prompts within 5–10 min (Csikszentmihalyi & Larson, 1987). Using computerized EMA methods, we have found that 95% of participants complete study protocols, responding to more than 88% of prompts within 2 min (Shiffman, Hickcox, Paty, Gnys, Kassel, & Richards, 1997).

The validity of EMA recordings is well established. EMA records of activities have been shown to correlate highly ($r = .93$) with data obtained from observational time budget studies (Robinson, 1985). In our own studies, recorded physical location and position show good correspondence with data obtained from ambulatory heart-rate monitors (Schwartz, Warren, & Pickering, 1994). EMA records of smoking also correspond well to biochemical markers of smoking, as well as to self-reported smoking rates (Shiffman, Paty, & Kassel, 1996). EMA data have been shown to differentiate between populations such as patients with bulimia and nonbulimic women (Johnson & Larson, 1982), satisfied and dissatisfied workers (Giannino, Graef, & Csikszentmihalyi, 1979), and addicted and nonaddicted cigarette smokers (Paty & Shiffman, 1991). More important, EMA records reliably discriminate important situations or events within participants’ lives; for example, EMA data reliably detect mood changes that precede bulimic episodes (Johnson & Larson, 1982) and smoking lapses (Shiffman, Paty, Gnys, Kassel, & Hickcox, 1996), have shown that minor stressful events are associated with increased arthritic pain (Stone, Broderick, Porter, & Kaell, 1997) and cortisol levels (van Eck, Berkhof, Nicolson, & Sulon, 1996), and can distinguish among “alternate personalities” in multiple personality disorder (Loewenstein, Hamilton, Alagna, Reid, & DeVries, 1987). We have also demonstrated their ability to discriminate mood changes associated with minor daily events (Shiffman, Gnys, Paty, & Kassel, 1996).

The present study assessed the correspondence between retrospective coping reports and coping assessed via EMA with hand-held computers using a 33-item assessment drawn from two different coping instruments: the Daily Coping Inventory (DCI; Stone & Neale, 1984) and the Ways of Coping Scale (WOC; Folkman & Lazarus, 1980, 1985). It is important to note that this inquiry was not intended to diminish the importance of data obtained with traditional coping assessments; clearly, that information has been successful in predicting various outcomes, as demonstrated by a large body of research. Instead, our goal was to refine understanding of what those measurements mean and to provide an alternative methodology for assessing coping that is more tightly linked to actual behaviors and cognitions. EMA-assessed coping may yield more accurate data on the coping thoughts and behaviors people engage in, whereas retrospective coping reports may be more influenced by retrieval heuristics, personality factors, and knowledge of the resolution of the stress episode.

Computerized data collection, as implemented in this study, has several advantages over prior forms of signaling and recording EMA data (pagers and programmed wristwatches for signaling and small questionnaires for recording information).

Among the advantages are records of when participants actually answer prompts, scheduling flexibility, the ability to branch to more detailed questions on the basis of on-line responses, on-line data integrity checks, and accurate data transfer (see Shiffman, Paty, & Kassel, 1996, for a more detailed discussion).

To optimize our comparison of the two types of coping assessments, we examined a community sample with significant work or marital stress and evaluated the correspondence between EMA and retrospective reports of coping for specific stress episodes. Our overall hypothesis was that there would be limited correspondence between EMA reports of coping and 1-day to 2-day retrospectively recalled coping. Also, because behavioral coping may be more concrete and more easily recalled than cognitive efforts, we expected that the correspondence between EMA and retrospectively reported coping would be higher for behavioral than for cognitive coping items. Finally, we anticipated that there would be individual differences in the correspondence between EMA and retrospectively reported coping (i.e., some people would be more prone to discrepancies between the two reports), and we planned to examine correlates of these individual differences.

Method

Participants

Participants were recruited primarily through newspaper and radio advertisements seeking men and women with high levels of work or marital stress to take part in a study of stress, coping, and mood. Of the 343 individuals who responded to the advertisements, 196 were screened¹ for the eligibility requirements (described subsequently). Of these, 67 people were ineligible, 9 were eligible but declined to participate, 120 agreed to participate in the study, and 100 completed the study. There were no significant differences in terms of demographic characteristics (age, gender, ethnic background, education, marital status, and employment status) between people who completed the study ($n = 100$) and the others screened ($n = 96$).

Participants qualified for the work stress group if they met four criteria: (a) being employed full time; (b) having a self-reported job stress rating of 5 or higher on a 7-point scale ranging from *never stressful* (1) to *stressful all of the time* (7), with the neutral point being *stressful some days and not others* (4); (c) being able to identify specific sources of work stress (e.g., too much work to do, job insecurity, or interpersonal problems with boss or coworkers); and (d) experiencing those stressors on an almost daily basis. Participants qualified for the marital stress group if they met four similar criteria: (a) being married or living with a partner for at least 6 months, (b) having a self-reported marital stress rating of 5 or greater on the 7-point stress scale just described, (c) being able to identify specific sources of marital stress (e.g., children, finances, or poor communication), and (d) experiencing these marital stressors almost every weekday. The final criterion for the marital stress group was important because participants kept completed EMA assessments on weekdays only, and it was important that our sample of maritally stressed participants experience their stressors during the week. Individuals who qualified for both the work and marital stress groups ($n = 26$) identified which area was more stressful and were placed in that group (8 were placed in the work group).

Although equal numbers of men and women were sought for each group, participants for the marital stress group, especially men, were harder to recruit. The final sample consisted of 60 people with work stress (27 women and 33 men) and 40 people with marital stress (23 women and 17 men) who were primarily White (93%), middle aged (42 ± 8 [$M \pm SD$] years of age), working full time (92%), and married

or living with a partner (85% for an average of 16 ± 10 years) and who had some higher education (36% had 1–3 years of college, and 37% had a college or graduate degree).

Materials

Electronic diary. The ESM reports were collected via an electronic diary (ED), a programmable palm-top computer (Psion Model LZ) with a four-line (20 characters each) LCD screen and an audible alarm. The ED is simple to use and has been used successfully with a variety of populations (for details on the ED computer, see Penner, Shiffman, Paty, & Fritzsche, 1994; Shiffman et al., 1994; Shiffman, Paty, Kassel, Gnys, & Elash, 1995). An advantage of this palm-top device is its high degree of scheduling flexibility, which permits intensive data collection that does not overly disrupt participants' lives. For example, participants could delay answering a prompt for a maximum of 20 min when engaged in an activity that could not be interrupted (e.g., a long-distance phone call or speaking with the boss). They could also temporarily turn off the ED program when they went to sleep or for a limited period when the computer beeping would be troublesome (e.g., at a meeting or in church). Another important feature of the method is that the investigator knows whether participants responded to a signal within a reasonable amount of time. Delayed responses can be eliminated from analyses.

EMA stress and coping assessments. Conceptually, coping should be assessed after a stressor has occurred or during an episode of stress. To determine whether participants had experienced a stressor in the interval before the current report, the computer first asked whether they were thinking about, discussing, or actually doing something about an issue or conflict ("Since the last report, did you think about, discuss, or do something about a [work/marital/other] issue or conflict? [no or yes]). Participants reported on problems occurring since their last report, because more immediate coping assessments (e.g., within the last 5 min) would miss coping behaviors occurring outside of this 5-min time frame. This question was asked about three broad areas: work, marital, and other problems. Participants could report one issue within each area at each prompt. If an issue was reported, it was then categorized according to a list of 10 work (e.g., too much work or conflict with client), 10 marital (e.g., conflict over children or conflict over finances), and 9 other (e.g., being sick or hurt or having problems with close family members) categories selected from common types of such problems used in previous research (Geiss & O'Leary, 1981; Stone et al., 1994; Sutherland & Cooper, 1988). From this list, participants selected the category that best described each issue. These categories were used as a cue during a debriefing interview to help participants describe the issue(s) reported at each prompt. Participants also rated the stressfulness of each event on an 11-point scale.

Although participants could report up to three issues at each prompt, coping information was collected about only one issue to limit participant burden. The ED's default was to collect coping information on an issue in the person's targeted area (i.e., coping with a work issue for participants in the work stress group and coping with a marital issue for participants in the marital stress group). In the absence of an issue within the person's targeted area, coping was collected for an issue within the other targeted area (i.e., coping with a marital issue for the work stress participants and coping with a work issue for the marital

¹ For several reasons, some respondents could not be reached after leaving a message at the research office and were not screened. Some respondents did not leave a phone number for us to return their call. In other cases, we left messages stating that we were attempting to contact the person with information about the study, but the calls were never returned. If a respondent failed to contact us after three messages had been left, that person was dropped from the list of potential participants.

stress participants). Coping information was collected for an issue in the "other" area only in the absence of both work and marital issues.

Coping items were selected from the WOC (Folkman & Lazarus, 1980, 1985) and the DCI (Stone & Neale, 1984). The DCI consists of 8 broad coping items, all of which were presented in the ED (distraction, positive reappraisal, planning-taking action, catharsis, acceptance, social support, relaxation, and religion). The original planning-taking action item was separated into 2 items. As in prior studies, DCI items were scored dichotomously. The WOC is a 50-item scale representing eight dimensions of coping (confrontive coping, distancing, self-controlling, seeking social support, accepting responsibility, escape-avoidance, playful problem solving, and positive reappraisal). Not all of the 50 items could be presented in the ED; therefore, an abbreviated version consisting of the 3 items that loaded most highly on each dimension was used (Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986). In two instances (confrontive coping and escape-avoidance), the 3rd item was redundant with the previous 2 or did not capture all aspects of the dimension, and the 4th item was selected to more accurately represent that dimension. For the analyses of behavioral versus cognitive items, cognitive items were identified as DCI Items 1, 2, 5, 6, 7, 8, and 9 and WOC Items 1-17 and 21-24. Behavioral items were identified as DCI Items 3 and 4 and WOC Items 18-20. The wording of some items was abbreviated to fit the space available on the ED screen (e.g., "Thought of solutions or gathered information about the problem" became "Thought of solutions or gathered info.'). During the training session, both original and abbreviated items were presented to participants to ensure comprehension of the latter. For each item, participants indicated whether they had used that behavior to handle the issue since their last report, and all items were dichotomously scored (0 = no, 1 = yes).

Retrospective Coping Assessment

At the end of the 2-day monitoring period, retrospective coping information about the most stressful event that occurred during the EMA period was collected during a debriefing interview. Although we expected the most stressful event to occur within the person's targeted area (i.e., a work issue for the work stress group or a marital issue for the marital stress group), it was also possible that the most stressful event would occur outside the targeted area, particularly for participants who met both work and marital stress criteria. Because the ED defaulted to collect coping reports in the person's targeted area when more than one issue was reported at a single prompt, we wanted to ensure that all appropriate instances of momentary coping were included in the analyses. Participants' selection of the "main issue" of the EMA period was therefore guided in the following way.

Before having participants select their main issue, the experimenter inspected the ED data to determine whether more than one issue was reported at any prompt. Participants who reported more than one issue at any prompt were instructed to select one issue from their targeted area as their main issue, because the ED would have defaulted to collect coping data in this area. Otherwise, participants were allowed to select the most stressful issue from any area. (Of the participants who were instructed to select an issue in their targeted area, all but 2 confirmed that the issue selected was indeed the most stressful one of the EMA period.) Participants then described this main issue in a short, written paragraph and indicated how they coped with it using retrospective DCI and WOC assessments (described subsequently). The final procedure necessary for comparing retrospective and EMA coping reports was identification of the momentary issues and coping reports that were part of the main issue. The experimenter and participant reviewed the ED data prompt by prompt, and the participant identified which momentary issues were part of his or her main issue. If participants were unsure whether a particular EMA report was part of their main issue, we excluded that report from all analyses to maintain our conservative stance.

For issues identified as part of the main issue, participants also indicated whether they had that particular report in mind when completing the retrospective coping questionnaire.

The retrospective DCI, which consisted of the nine broad items used in the ED diary, asked whether participants used each behavior to handle their main issue (0 = no, 1 = yes). Because an abbreviated version of the WOC was used in the ED, this version was also used as the retrospective measure. As is customary in research using the WOC, participants indicated, on a 4-point scale ranging from *never used* (0) to *a great deal* (3), the extent to which they used each coping behavior to handle their main issue. This 4-point scale was dichotomized (0 vs. 1-3) for some analyses to permit a more direct comparison of EMA and retrospective measures.²

Individual-Differences Measures

Individual-differences measures included age, gender, marital status, level of education, ethnicity, state anxiety, state anger, neuroticism, depression, social desirability, self-consciousness, marital adjustment, and job stress. For the analyses, marital status was coded into three categories (never married, currently married, and previously married), level of education was coded into four categories (high school graduate or less, some college, college graduate, and graduate degree), and ethnicity was coded into five categories (African American, Hispanic American, Native American, European American, and other). The remaining measures were assessed via well-known scales, all of which have been established as reliable and valid. In the interest of brevity, we refer the reader to the scales' original sources for details on their psychometric properties. The Spielberger State-Trait Inventory was used to assess state anxiety and anger (Spielberger, Gorsuch, & Lushene, 1970). Anxiety and anger were represented by two subscales consisting of 10 items each. Neuroticism was measured with the 48-item Neuroticism subscale of the NEO Personality Inventory (Costa & McCrae, 1992). Depression was assessed with the 21-item Beck Depression Inventory (Beck, Ward, Mendelsohn, Mock, & Erbaugh, 1961). The 33-item Marlowe-Crowne Questionnaire (Crowne & Marlowe, 1960) was used to assess level of social desirability. Public and private self-consciousness were assessed with the Self-Consciousness Inventory (Fenigstein, Scheier, & Buss, 1975). The total score from the 32-item Dyadic Adjustment Scale (Spanier, 1976) was used to assess marital adjustment. Finally, job strain was assessed with the 41-item Job Content Questionnaire (Karasek, Pieper, Schwartz, Fry, & Schrier, 1985), which consists of 10 subscales: Skill Discretion (the extent to which the job uses special skills and is nonrepetitive in nature), Decision Authority (the extent to which the worker has decision-making powers), Decision Latitude (the sum of the

² Although the DCI and WOC items are traditionally scored differently, we were concerned that some participants might fail to recognize when the response format changed on the ED. There was no reason, from the perspective of the participant, why some coping items would be presented with dichotomous responses and others with a 4-point scale. We therefore selected a single response format for the EMA coping assessment. The dichotomous response was used because past research has shown that there are individual differences in how people interpret extent ratings. However, presenting different response formats on the retrospective assessment was less of a concern because the DCI and WOC were presented on different pages of the questionnaire packet and were preceded by different instructions for completing each scale. Therefore, the retrospective item responses were presented as they are traditionally assessed (dichotomously for the DCI and continuously for the WOC), because one goal was to examine how EMA reports related to traditional retrospective reports. This required having the traditional retrospective response formats that we could dichotomize when necessary for certain analyses.

prior two scales), Psychological Workload (the extent to which the job requires working very hard and fast), Physical Exertion (amount of physical effort required by the job), Job Insecurity, Supervisor Support, Coworker Support, Total Support, and Job Dissatisfaction.

Procedure

Participation in the study began with a 2.5-hr training session conducted either individually ($n = 77$) or in groups of 2 ($n = 23$). At the outset of the training session, participants provided informed consent and completed a questionnaire packet including information on demographics and the personality scales mentioned in the Materials section. The training procedure consisted of two main tasks: understanding the diary questions and learning how to use the ED computer. Participants were also given a guidelines manual and a phone number to call if questions arose during the 2 days of monitoring.

Participants carried the ED for approximately 48 hr after the training session (48 ± 4.5 hr). The ED randomly prompted them to complete a report an average of every 40 min (range = 20–60 min). After the first several hours (7 ± 3 waking hours), participants were called to check on their compliance with the monitoring procedure. The time before the check-in was a practice period for participants to become familiar with the ED equipment, and only data collected after the check-in were included in the analyses. Two participants did not have a check-in; however, no problems with compliance or EMA data were evident in their debriefing interviews, and their data were included after they were allowed a practice period similar to that of the other participants. One participant admitted to performing “poorly” on Day 2 and was monitored for an additional day. Consequently, Day 2 was considered an extended practice period, and only data from the final day were included in the analyses.

At the end of the 48 hr, participants returned to the lab for a 1.5-hr debriefing interview that included, first, a discussion of the participants’ compliance with the ED procedure (15–20 min) and, second, collection of the retrospective coping assessment (the remainder of the interview time). Participant remuneration included a \$100 payment and the opportunity to attend a 2-hr stress management seminar.

Results

Compliance with the monitoring procedure was very high. Overall, participants spent an average of 90% of their waking hours in the monitoring mode and answered 90% of the prompts (30 ± 6 prompts per person). Ninety-three participants delayed answering reports; these participants had a mean of six delays, each averaging 17 min. Only 51 participants used the “suspend” feature (temporarily turning off the program when the beeping would be inappropriate), and they did so an average of two times for a mean length of 61 min each time. Data from 6 participants were eliminated from all analyses because these individuals did not comply with the study protocol. Participants whose data were used in the analyses were significantly older (49 ± 12 years) than those who completed the study but whose data could not be used (41 ± 8 years), $t(98) = 2.11$, $p < .05$. Otherwise, the two groups did not differ significantly on any demographic characteristics. Eight additional people were eliminated because they could not identify any ED reports that were part of their main issue, and 1 person was eliminated because a researcher placed him in the wrong group. Two participants failed to provide retrospective DCI assessments and were eliminated from these analyses (they were included in analyses for the WOC, however). The problem selected as the most stressful

one from the study period was rated as moderately stressful in the EMA reports (5.9 ± 2.0) and more stressful in the retrospective rating (7.4 ± 2.1).

Overview of Analyses

Our strategy for comparing the EMA and retrospective reports focused on three types of analyses: (a) participants’ reports of whether they used each coping behavior at all, (b) participants’ reports of the extent to which they used each coping behavior, and (c) individual differences in discrepancy rates between the EMA and retrospective reports. Our goal was to compare the coping assessments in such a way as to present the retrospective assessment in the most favorable light possible, in other words, in the direction of not confirming our hypothesis. Because a single retrospective assessment was compared with multiple EMA coping reports, it was necessary to summarize each person’s EMA reports for each analysis. In the sections that follow, we discuss each analytic procedure, the selection and summarizing of EMA data used to answer each research question, and the results of the analyses.

Comparison of EMA and Retrospective Reports

With an EMA report as the point of reference, there are two ways that discrepancies could occur between it and the retrospective assessment. Participants could fail to endorse coping on the retrospective recall that was endorsed in the EMA reports (i.e., underendorsement of coping on the retrospective recall), or they could endorse coping on the retrospective recall that was not endorsed in the EMA reports (i.e., overendorsement of coping on the retrospective recall). The analyses reported here are descriptive in nature and indicate the percentage of participants who showed each type of discrepancy on the retrospective recall. To achieve the goal of deriving conservative estimates of discrepancy rates, it was necessary to use different criteria for including the EMA coping reports in each type of analysis.

For these analyses, the EMA DCI and WOC items were summarized to indicate whether each person did not endorse each item in any of the EMA reports (score = 0) or whether that item was endorsed *at least once* (score = 1). The retrospective DCI items were dichotomously scored in accordance with their typical usage (0 = *no*, 1 = *yes*). Although the retrospective WOC items were measured on a continuous scale, these items were also dichotomously scored (0 = *never used*, 1 = *used somewhat, quite a bit, or a great deal*).

Underendorsement of coping on the retrospective recall. To estimate rates of underendorsement on the retrospective recall, we first identified participants who endorsed each coping item on the ED and then determined whether those participants endorsed the same coping item on the retrospective recall. To ensure that the two reports referred to the same occasions, we included only those EMA reports that participants said they had in mind when they completed the retrospective recall. Four participants were excluded from this analysis because they could not identify any EMA coping reports that they had in mind when filling out the retrospective measure. One participant was excluded from these analyses because he did not endorse any

Table 1
Rates of Disagreement Between Momentary and Retrospective Reports

Coping items	Underendorsement of coping on retrospective recall		Overendorsement of coping on retrospective recall		Overall discrepancy rate (% of participants)
	Endorsed in momentary report ^a (n)	Not endorsed in retrospective report (%)	Not endorsed in momentary report ^b (n)	Endorsed in retrospective report (%)	
DCI items					
1. Distracted self with thought or activity	42	19	32	16	16.4
2. Viewed differently to be more bearable	41	46	36	14	30.0
3. Thought of solution or gathered info	59	12	19	42	18.8
4. Actually did something to solve	54	26	23	39	28.8
5. Expressed feelings to reduce tension	60	25	17	47	28.7
6. Accepted it, nothing could be done	42	38	32	25	30.0
7. Sought/got emotional support from others	33	42	42	14	24.8
8. Did something to relax	35	23	38	16	17.7
9. Sought or found spiritual comfort	10	30	64	6	8.6
<i>M</i>	42	29	34	24	22.6
WOC items					
1. Stood your ground, fought for yourself	50	16	28	39	23.1
2. Tried to get person to change mind	35	26	43	37	30.5
3. Let your feelings out somehow	63	8	16	69	19.6
4. Made light of it	25	40	52	15	21.7
5. Went on as if nothing happened	32	28	44	23	23.3
6. Refused to think about it too much	46	24	30	37	27.0
7. Tried to keep your feelings to self	46	26	30	33	26.6
8. Kept others from knowing about it	36	44	40	38	37.8
9. Tried not to "burn your bridges"	40	18	39	23	19.7
10. Talked to someone to get more info.	51	27	27	37	29.0
11. Asked relative or friend for advice	23	56	55	14	25.1
12. Criticized or lectured yourself	29	24	50	28	25.6
13. Realized you brought it on yourself	20	45	57	19	24.2
14. Determined next time would be different	38	21	40	28	23.4
15. Wished it would go away, or be over	57	9	23	26	13.5
16. Hoped a miracle would happen	32	25	46	17	19.3
17. Ate/drank/smoked/etc to feel better	15	27	63	13	14.9
18. Doubled efforts to make things work	34	15	45	62	40.2
19. Made a plan and followed it	51	12	25	52	23.3
20. Concentrated on the next step	62	5	15	67	16.0
21. I changed or grew in a good way	29	24	49	16	18.0
22. Came out better off than before	27	33	52	19	22.9
23. Found new faith	5	100	72	7	12.2
24. Talked to person able to do something	41	34	37	24	27.8
<i>M</i>	37	28	41	31	23.5

Note. DCI = Daily Coping Inventory; WOC = Ways of Coping Scale. Items are phrased as they appeared in the electronic diary. DCI items are from "New Measure of Daily Coping: Development and Preliminary Results," by A. A. Stone and J. N. Neale, 1984, *Journal of Personality and Social Psychology*, 46, p. 897. Copyright 1984 by the American Psychological Association. Reprinted with permission of the authors. WOC items are from "An Analysis of Coping in a Middle-Aged Community Sample," by S. Folkman and R. S. Lazarus, 1980, *Journal of Health and Social Behavior*, 21, pp. 219-239. Copyright 1980 by the American Sociological Association. Reprinted with permission.

^a This column represents the number of participants who endorsed a particular item in the momentary reports. The next column indicates the percentage of those people who did not endorse the same item on the retrospective measure. These results include only main issue momentary reports that participants had in mind when filling out the retrospective report. ^b This column represents the number of participants who did not endorse a particular item in the momentary reports. The next column indicates the percentage of those people who did endorse the same item on the retrospective measure. These results include all momentary reports related to the main issue.

coping items on the ED. Estimates of the rate of underendorsement on the retrospective recall were therefore based on 285 EMA coping reports ($M = 3.6$ reports per person) collected from 80 participants.

Results of analyses for underendorsement on the retrospective recall are presented in columns 2 and 3 of Table 1. The second column represents the number of people who endorsed each item on the ED; this served as the denominator in calculating the

underendorsement rate. Because the different items had different base rates of endorsement, the underendorsement rate for each item was the percentage of participants who endorsed the item on the ED but failed to endorse that same item on the retrospective recall. Consider the first DCI item, for example. Forty-two participants endorsed "Diverted attention" on the EMA coping report, but 19% of those 42 failed to endorse that same item on the retrospective assessment. The rates of underendorsement on the retrospective assessment for the DCI items ranged from 12% to 46%, depending on the item. Across all DCI items, an average of 29% of the participants who reported using each item did not endorse the same item on the retrospective DCI. The rates of underendorsement for the WOC items ranged from 5% to 100%. Across all WOC items, an average of 28% of the participants who reported using each item did not endorse the same item on the retrospective WOC.

Overendorsement of coping on the retrospective recall. To estimate rates of overendorsement on the retrospective recall, we first identified those participants who did not endorse a particular coping item in the relevant EMA assessment and then determined whether those participants did endorse that item on the retrospective recall. Because we were concerned only with coping pertaining to the main issue, we eliminated 6 participants who were missing EMA coping reports for one or more main issue reports. This occurred when the ED defaulted to ask about coping for another problem. Including these participants could have artifactually inflated the overendorsement rate. Estimates of the rate of overendorsement on the retrospective report were based on 308 EMA coping reports collected from 79 participants ($M = 3.9$ reports per person).

Results of the overendorsement analyses are presented in columns 4 and 5 of Table 1. The fourth column represents the number of people who did not endorse a particular item on any of the EMA reports. As before, the different items had different base rates of endorsement; therefore, the overendorsement rate for each item was the percentage of participants who did not endorse the item on the EMA but did endorse it on the retrospective recall. Again, consider the first DCI item. Thirty-two participants did not endorse "Diverted attention" on the EMA coping reports, but 16% of those 32 did, in fact, endorse that same item on the retrospective recall. The rates of overendorsement for the DCI items ranged from 6% to 47%, depending on the item. Across all items, an average of 24% of the participants overendorsed items on the DCI. The rates of overendorsement for the WOC items ranged from 7% to 69%. Across all items, an average of 31% of the participants overendorsed items on the WOC.

Overall discrepancy rates. An overall discrepancy rate (D) for each item was calculated as the weighted average of the underendorsement and overendorsement rates from Table 1: $D = [(n_{\text{who endorsed on EMA}} \times \%_{\text{not on retrospective}}) + (n_{\text{not on EMA}} \times \%_{\text{who endorsed on retrospective}})] / \text{total } N$. Because there were differential selection criteria for the underendorsement and overendorsement analyses, the total sample size for the DCI items was 80, and the total sample size for the WOC items was 82. Consider DCI Item 1 (distracted self), for example. The overall discrepancy rate for this item was calculated as $[(42 \times 19\%) + (32 \times 16\%)] / 80$, resulting in an overall discrepancy rate of 16.4% (see column 6 of Table 1 for the remaining items). Overall, 8.6% to 30.0% of the participants had discrepancies on the DCI

items and 12.2% to 40.2% had at least one discrepancy on the WOC items. Across items, the overall discrepancy rate for the DCI ($M = 22.6\%$ of participants) was similar to that found for the WOC ($M = 23.5\%$).

Discrepancy rates for cognitive versus behavioral items. Next we examined whether certain items or subsets of items were particularly prone to a lack of correspondence between EMA and retrospective reports. To compare discrepancies for cognitive versus behavioral items, we computed the mean of each type of discrepancy (underendorsement, overendorsement, and overall discrepancy) for the 28 cognitive items and the 5 behavioral items.

Underendorsement was more frequent for cognitive items than for behavioral items, and overendorsement was more frequent for behavioral items than for cognitive items. The mean of the underendorsement rates for the cognitive items (31.4%) was greater than the mean of the underendorsement rates for behavioral items (14.0%), $t(31) = 2.16, p < .05$. Also, the mean of the overendorsement rates for behavioral items (52.4%) was greater than the mean of the overendorsement rates for cognitive items (25.0%), $t(31) = 4.21, p < .001$. There was no difference in the mean overall discrepancy rate for cognitive items (22.9%) and the rate for behavioral items (25.4%), $t(31) = 0.75, n.s.$

Comparison of the Extent to Which Different Coping Strategies Were Used

Because the WOC was designed to measure the extent to which people used certain classes of coping behaviors, the second set of analyses compared EMA and retrospective assessments of the extent to which the coping behaviors assessed by the WOC were used. These analyses provided correlations and percentages of shared variance between EMA and retrospective measures. Both WOC items and subscales were included. The retrospective DCI scale has no continuous scoring procedure and was not included in these analyses.

The multiple EMA reports were aggregated to provide an extent rating for each person. For each WOC item, this score represented the proportion of EMA reports in which each item was endorsed. The EMA WOC subscale scoring represented the proportion of reports in which any of the three items for that subscale were endorsed. The retrospective item scores involved the continuous 0–3 rating, and the retrospective subscales consisted of the sum of these three items. The internal consistencies of the abbreviated scales were moderate to high for both the EMA scales (Cronbach's α s = .53 to .70) and the retrospective scales (α s = .47 to .77). With two exceptions (Self-Control and Social Support), the reliabilities were higher for the retrospective scales than for the corresponding EMA scales.

Results for the individual WOC items are presented in Table 2. The average correlation between EMA and retrospective items was $.51 \pm .16$ (range = $-.06$ to $.83$). The average proportion of shared variance between the two measures was $.29 \pm .13$ (range = $.003$ to $.69$).³

³ Correlational analyses were conducted on both sets of data we described in our analyses of overreporting and underreporting of individual items. The results were similar for the two data sets; therefore, we present only the results from analyses with the larger number of participants ($n = 80$).

Table 2
Correlations Between Momentary and Retrospective
Ways of Coping Scale Items

Item	<i>r</i>	Proportion of shared variance
1. Stood your ground, fought for yourself	.61	.37
2. Tried to get person to change mind	.61	.37
3. Let your feelings out somehow	.46	.20
4. Made light of it	.64	.41
5. Went on as if nothing happened	.53	.28
6. Refused to think about it too much	.48	.23
7. Tried to keep your feelings to self	.55	.30
8. Kept others from knowing about it	.29	.08
9. Tried not to "burn your bridges"	.62	.38
10. Talked to someone to get more info.	.41	.17
11. Asked relative or friend for advice	.50	.25
12. Criticized or lectured yourself	.52	.27
13. Realized you brought it on yourself	.55	.30
14. Determined next time would be different	.59	.35
15. Wished it would go away, or be over	.59	.35
16. Hoped a miracle would happen	.57	.32
17. Ate/drank/smoked/etc to feel better	.83	.69
18. Doubled efforts to make things work	.40	.16
19. Made a plan and followed it	.51	.26
20. Concentrated on the next step	.44	.19
21. I changed or grew in a good way	.60	.36
22. Came out better off than before	.48	.23
23. Found new faith	-.06	.00
24. Talked to person able to do something	.59	.35
<i>M</i>	.51	.29

Note. $n = 80$. For correlations greater than .29, the alpha level is less than .001. Items are phrased as they appeared in the electronic diary. Items are from "An Analysis of Coping in a Middle-Aged Community Sample," by S. Folkman and R. S. Lazarus, 1980, *Journal of Health and Social Behavior*, 21, pp. 219-239. Copyright 1980 by the American Sociological Association. Reprinted with permission.

Results for the WOC subscales are presented in Table 3. The average correlation between the EMA and retrospective subscales was $.60 \pm .07$ (range = .53 to .68). The average proportion of shared variance between the two methods was $.35 \pm .07$ (range = .28 to .46).

Individual Differences in Discrepancy Rates

We also examined the data to determine whether certain individuals had more overendorsements or underendorsements relative to the rest of the sample. Whereas data were collapsed over individuals in the previous analysis, data in this analysis were collapsed over coping items so as to characterize individuals. Before proceeding, though, we examined whether there was consistency in discrepancies across the items. Each item was scored according to whether or not there was a discrepancy, and an alpha coefficient was computed to index internal consistency. The alpha levels were high and significant: .72 ($p < .001$) for underendorsements, .62 ($p < .001$) for overendorsements, and .52 ($p < .001$) for all discrepancies. This indicated that participants could potentially be characterized in terms of proneness to misreport. The correlation between overendorsement and un-

derendorsement rates ($r = -.45$, $p < .001$) indicated that participants having one type of discrepancy were less likely to have the other type as well. We next sought to identify which individual-differences characteristics might be associated with discrepancies. Age, stress level, state anxiety, state anger, neuroticism, Dyadic Adjustment Scale scores, Marlowe-Crowne Questionnaire scores, Beck Depression Inventory scores, scores from 2 Self-Consciousness Inventory subscales, and scores from 10 Job Content Questionnaire subscales were correlated with total discrepancies, underreports, and overreports. General linear models were used to test for differences among sex, education level, ethnicity, and stress group (work vs. marital). In the 72 tests conducted, only the Job Content Questionnaire-skill discretion correlation was significant ($r = .24$, $p = .04$). Given the large number of tests, however, we consider these results to be chance findings, because an alpha correction (e.g., Bonferroni adjustment) to protect against Type I errors for 72 correlations in each set of analyses would have required a considerably higher probability level. Thus, although there were reliable individual differences in discrepancy rates, we could not identify specific characteristics associated with them.

Discussion

To our knowledge, this is the first study to examine coping from an EMA perspective and to compare EMA reports of coping with a retrospective coping assessment. We observed only modest agreement between EMA and short-term retrospective assessments of coping. On average, 30% of the participants failed to retrospectively report using items they had endorsed on EMA assessments. Almost the same percentage of participants retrospectively endorsed coping items that they had not reported on the EMA assessments. Behavioral coping items were more likely to be overendorsed on the retrospective recall and less likely to be underendorsed than cognitive ones. It is noteworthy that both types of discrepancy (underreporting and overreporting on retrospective recall) have also been found in studies of autobiographical memory (Bradburn et al., 1987; Brewer, 1986).

Our findings are consistent with those of Ptacek et al. (1994), who studied coping among college students anticipating an examination. In that study, aggregated brief daily coping measures

Table 3
Correlations Between Momentary and Retrospective
Ways of Coping Subscales

Subscale	<i>r</i>	Proportion of shared variance
Confrontive Coping	.67	.32
Distancing	.68	.46
Self-Controlling	.53	.28
Seeking Social Support	.54	.29
Accepting Responsibility	.60	.36
Escape-Avoidance	.68	.46
Planful Problem Solving	.54	.29
Positive Reappraisal	.57	.32
<i>M</i>	.60	.35

Note. $n = 80$. All correlations are significant at $p < .0001$.

obtained via one format were compared with later retrospective assessments obtained with a different measure. Correlations between the two measures were modest. The present study extends these findings, adding several methodological strengths. The sample was composed of community adults selected on the basis of chronic stress and reporting on a range of specific everyday stressors. EMA assessments of coping covered short intervals of less than 1 hr, and recall for the retrospective assessment covered no more than 48 hr. Our coping assessments used standard scales, and momentary and retrospective assessments used parallel forms. Analyses focused on specific coping items and examined discrepancies in both directions (i.e., false positives and false negatives), which provided a clearer picture of the recall process than computation of correlation coefficients between scales. In comparison with Ptacek et al.'s report, these study features should have increased the correspondence between EMA and retrospective assessments. However, the conclusion is similar: Retrospective reports of coping do not relate well to coping assessed with EMA at a time more proximate to when coping actually occurred.

What accounts for the poor correspondence between retrospective and EMA measures? As we noted earlier, research on autobiographical memory suggests that accurate recall is impeded by many factors, including the use of heuristics and general schemas to reconstruct events as well as the influence of intervening events and respondents' psychological state at the time of recall (Barclay & Wellman, 1986; Bradburn et al., 1987; Brewer, 1986). Some of these factors are more likely to influence retrospective coping than EMA-assessed coping, thus leading to the differences between the two.

It is important to emphasize that we are not claiming that one method is right and the other wrong. They simply yield different information about coping. EMA assessments should accurately capture the details of moment-by-moment coping activities. However, because participants were asked to repeatedly recall their coping efforts over a period of 20–60 min, some coping may have “fallen through the cracks” (e.g., if the participant thought it had already been reported). Conversely, retrospective reports may capture broader coping strategies that might not be reported in repeated momentary assessments. Or, benefiting from the perspective of time, they may capture participants' reconceptualizations of their coping activities. At the same time, retrospective reports may be more subject to distortion based on participants' beliefs about their coping styles or by their after-the-fact appraisals of their coping. Such appraisals may actually make such reports better predictors of future outcomes. We believe that additional research concerning the factors that influence retrospective coping reports would enhance understanding of such associations and predictions and of the respective strengths and weaknesses of each mode of assessment.

It is also possible that some of the discrepancies between EMA-assessed and retrospectively assessed coping were due to changes in the characterization or classification of particular coping responses. For example, going to a movie might have been reported as an instance of relaxation on the EMA assessment and as a distraction on the retrospective assessment. These discrepancies would not truly represent overendorsement or underendorsement as we have defined them; rather, they would

represent test–retest variation that might be present even in momentary assessments. However, such changes in participants' classification of coping, if they occur, present a problem for any self-report assessment.

We had expected that discrepancies between the EMA and the retrospective assessments would be more likely to occur for coping items asking about thoughts than for those assessing behavior. Overall, the percentage of individuals with discrepancies of any type for the average cognitive or behavioral coping item was about 25%. However, a different picture emerged when type of discrepancy was considered. On average, cognitive coping items were much more frequently underreported on retrospective recall than behavioral items. The inverse was the case for overreporting. Cognitive items, then, were “forgotten” at retrospective recall, whereas this was infrequently the case for behavioral items. This was consistent with our expectations. But many more behavioral items were “generated” by participants at retrospective recall than was the case for the cognitive items. Review of the particular behavioral items in question (e.g., “Made a plan and followed it” and “Did something to solve”) indicates that they did not have highly specific behavioral referents but, instead, referred to a cognitive interpretation or appraisal of the intention or impact of particular actions. Thus, it is possible that the observed overendorsement of these items reflects later reinterpretation or appraisal of earlier actions that may have been construed differently at the time. Thus, the cognitive and behavioral items, although equivalent in overall discrepancy rates, may be affected by different recall processes.

Exploratory analyses were also conducted to identify individuals who were particularly discrepancy prone. Unfortunately, none of the individual-differences variables we examined were reliably associated with total discrepancies or with underreporting or overreporting discrepancies. This finding was disappointing, because one of our hopes was that we could identify characteristics of individuals who were particularly “good” reporters of coping. Again, analyses of many of the traits and characteristics that might have predicted discrepancies failed to yield impressive results.

We have a number of additional thoughts about the measurement of coping using the EMA methods. Many of these observations are derived from the postparticipation interview comments made by participants. Participants tended to report concrete events as opposed to problems they were thinking about. Despite our instructions to report all problems, we also observed instances in which participants said that they did not report a problem because they “were still coping with it,” and some participants said they did not report problems that were coped with effectively. If this was a ubiquitous process, then asking about problems, as we did, could have systematically undersampled the most successful coping efforts. This could account for some of the overendorsement observed on retrospective assessment.

We also have some concerns about the procedure in which participants were asked to report about their problems and coping since the previous report. It appeared that some participants were reporting only problems that occurred at approximately the time of the report. Part of the problem may have been the differing instructions that were used for the coping section versus prior sections of the EMA report. At the beginning of the

EMA report, participants were asked to report on their mood for the previous 5 min. It probably is unwise to present participants with two different time frames, because they may simply adopt a single framework for all questions.

A final observation concerns the difficulty that some participants had associating the information from the momentary reports with the retrospective reports. When presented with the time and nature of a momentary problem, some participants had difficulty knowing whether or not the momentary problem was part of the retrospective ("main") problem. At times, they would report that they simply could not remember. Although this is troublesome from the point of view of the analyses we have computed, it also provides additional support for the overall conclusion of this study, namely, that recall of problems and coping is very difficult. It is noteworthy that the interval in question is less than 48 hr, considerably shorter than the interval typically used to assess retrospective coping.

In summary, our findings suggest that retrospective reports of coping do not adequately capture participants' moment-by-moment coping efforts, as reflected in EMA assessments. The findings strongly counsel caution against inferring that retrospective reports of coping are simply complete and accurate reflections of the actual in-the-moment behavioral and cognitive strategies people use to cope with stress.

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