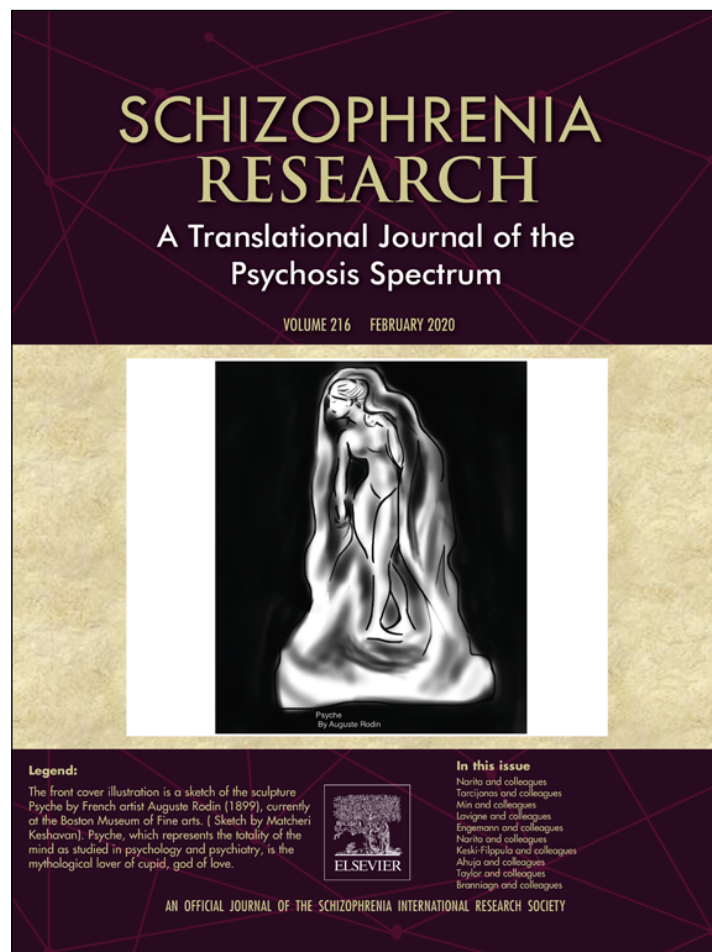


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Ecological momentary assessment of everyday social experiences of people with schizophrenia: A systematic review

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ABSTRACT

Introduction: Our goal in the current review was to summarize the existing literature on the utility of ecological momentary assessment (EMA) in assessing the social experiences of people with schizophrenia (SZ). We were further interested in examining the associations between EMA-reported social outcomes and traditional assessments of social functioning.

Methods: We conducted a systematic review of EMA studies published between January 1, 1990 and October 31, 2018 from PubMed and PsycINFO electronic databases. We included EMA studies that assessed social experiences (proportion of time spent alone/with others, affective experiences when with others, social stress, factors related to social experiences) in people with SZ. We included studies that examined associations between laboratory-based, self-report, or clinical assessments of functioning with EMA-reported social experiences.

Results: We identified 22 EMA studies for inclusion in this review. Though heterogeneous in aspects of social experiences assessed, the current literature suggests that people with SZ report more social stress and a preference to be alone when they are with others (nine out of 10 studies). People with SZ report more positive affect when they are with others compared to being alone, and equivalent amounts of positive affect during social experiences as healthy controls (all four studies assessed). Five studies assessed the coherence between functioning assessments and momentary social experiences, with mixed results.

Conclusion: We discuss limitations of the literature and future directions. EMA shows promise in assessing more granular aspects of social experience (including social stress and social pleasure) in people with SZ compared to other methods.

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1. Introduction

Our ability to navigate our social world is a key facet of daily life. People with schizophrenia (SZ) exhibit difficulties with multiple domains of social functioning, including social skill deficits (Bellack et al., 1990; Mueser et al., 1991), social cognition impairments (Green et al., 2015), loneliness (Lim et al., 2018), reduced social network size (Gayer-Anderson and Morgan, 2013), social motivation impairments (Fulford et al., 2018), and elevated trait social anhedonia (Blanchard et al., 1994, 2001). Studies of social impairment in SZ have relied primarily on retrospective or trait self-report interviews, questionnaires, or laboratory-based measures of functioning (e.g., role plays, facial emotion identification tasks), assessments that have had their reliability and ecological validity called into question (Bowie et al., 2007; Burns and Patrick, 2007; Sabbag et al., 2012; Yager and Ehmann, 2006). Limitations of these methods include lack of coverage of context-specific aspects of social experiences in a naturalistic setting (e.g., how one feels in the presence of a family member versus a stranger) as well as the difficulties in examining interactions among different social experiences over time (e.g., whether positive affect experienced during social activity predicts future social activity). These important qualities of the social worlds of people with SZ are left unmeasured in currently available “gold-standard” functioning assessments.

Ecological momentary assessment (EMA), also known as the experience sampling method, allows researchers to understand participants’ in-the-moment, everyday experiences. Typically, participants are provided with a mobile device (e.g., a Personal Digital Assistant, digital wristwatch, smartphone) that is programmed to signal them multiple times per day over a series of days or weeks to answer brief, specific questions as they go about their daily life. EMA has many strengths over traditional functioning assessment methods. It allows for the relatively unobtrusive, remote assessment of a variety of context-specific experiences, thus providing a more ecologically valid assessment of phenomena (Csikszentmihalyi and Larson, 2014; Devries, 1987; Myin-Germeys et al., 2009; Shiffman et al., 2008). EMA does not require a participant to summarize experiences over a long duration of time, minimizing the biases inherent in other self-report assessments. For example, a person may more easily and accurately reflect on a recent social interaction through EMA (e.g., “How involved were you in your most recent interaction?”) compared to reflecting on several previous social interactions during an interview (e.g., “How involved were in you all of your social interactions over the past month?”). Further, EMA does not rely as heavily on cognitive skills that people with SZ often struggle with and other assessment strategies rely on, such as memory and abstract reasoning. For

example, one might obtain a more accurate assessment of social pleasure by asking a person with SZ to reflect on how they feel immediately following a social interaction using EMA versus asking them to *imagine* how they would feel in a hypothetical social interaction (e.g., on a survey) or how they feel in response to a smiling face on a computer screen (e.g., in a laboratory task).

Because laboratory-based and clinical assessments are used to make inferences about the social functioning of people with SZ, it is important to understand whether they are related to the social experiences that people with SZ have in their daily lives or whether they represent other constructs that are correlated with one’s social world (e.g., beliefs about one’s social competence, social experience memory recall, etc.). For example, recent research has shown that people with SZ show intact hedonic responding in the presence of positive social interactions in laboratory settings (Aghevoli et al., 2003; Martin et al., 2019) despite reporting social anhedonia on trait-based measures (Blanchard et al., 1994, 2001). Thus, different assessment methods may measure different aspects of social pleasure (e.g., in-the-moment hedonic responding versus beliefs regarding social pleasure) rather than reflecting the same dysfunction (“social anhedonia”). If EMA-reported social experiences during real-world social interactions relate to clinical functioning assessments, this would suggest that the two methods reflect the same construct. Alternatively, if social functioning assessments are not related to EMA-reported social outcomes, these methods may reflect separate constructs under the broader umbrella of “social functioning” in SZ.

While EMA has been used as a method to understand the social experiences of people with SZ over the past two decades, no systematic efforts to date have been conducted to summarize our understanding of this literature. As such, in the current study, we systematically reviewed research that utilized EMA to understand the social experiences of people with SZ. Our primary goals were to 1) examine the utility of using EMA to assess everyday social experiences in people with SZ, and 2) explore whether EMA-reported social outcomes were related to traditional social functioning assessments. We were interested in aspects of experiences related to time participants spent both alone (including the quantity of time spent alone, the affective experience of being alone, and whether participants preferred to be with others) and with others (including whom participants spent time with, the extent of involvement in a given social experience, the affective experience of being with others, whether participants preferred to be alone when with others, and factors related to spending time with others). We were also interested in EMA studies that included laboratory-based or clinical assessments of functioning, to better understand whether and in what contexts these measures were related to momentary

social experiences of people with SZ. We included discussion of differences between people with and without SZ for each domain of social experience assessed through EMA when studies included a healthy comparison group. Additionally, when relevant, we included discussion of the relationship between other outcomes that were studied (e.g., psychiatric symptoms) and these domains of momentary social experiences in people with SZ.

2. Method

2.1. Literature search strategy

We conducted a systematic review of EMA studies assessing our pre-determined characterizations of social experiences. We utilized the Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA; Moher et al., 2009) guidelines for this review. The electronic databases of PubMed and PsycINFO were searched for combinations of the following key word terms within the abstract of a given study: “schizo*”, “psychosis”, or “psychotic”; and “ecological momentary”, “experience sampl*”, “momentary assess*”, “mobile interven*”, or “mobile assess*”. Additionally, electronic databases were searched for the key term “social*” within an article’s full text. The search was limited to studies published between January 1, 1990 and October 31, 2018, similar to other reviews on EMA in SZ (Cho et al., 2017). Further articles were identified through reviewing the reference lists of recent reviews on EMA studies in SZ (Bell et al., 2017; Cho et al., 2017) and articles found from the database searches.

After identifying studies through database search or reference list review, we screened articles by reviewing titles and abstracts to exclude reports that clearly did not meet eligibility criteria (e.g., did not include people with SZ). If it was uncertain whether a given article met eligibility criteria from the abstract, full texts were reviewed to assess each study’s eligibility. Articles that reported findings from the same (or portion of the same) study population are noted but are counted as separate studies if different variables of interest were reported in the separate articles.

2.2. Eligibility criteria

For inclusion, studies must have: 1) used the EMA procedure (i.e., remotely collected self-report information at least two times per day, for a minimum of two days) to assess social experiences in an empirical investigation; 2) included an adult population with a schizophrenia-spectrum (SZ) disorder (i.e., schizophrenia, schizoaffective disorder, or schizophreniform disorder); 3) reported group-level statistics on an aspect of social experience as assessed through EMA; 4) been published in a peer-reviewed academic journal; and 5) been written or translated in English. Studies that only assessed general thoughts or feelings regarding social-related outcomes through EMA (e.g., paranoia) but did not assess these variables specific to the participant’s social context during the EMA signaling (e.g., paranoia *specific to the social interaction occurring during the EMA signal*) were excluded. This exclusion criterion was established because we were most interested in studies that reported on in-the-moment, context-specific social experiences to capitalize on the unique advantages of EMA over other assessment strategies.

3. Results

The database search and reference list review returned 139 results, providing 118 unique articles after duplicates were removed (see Fig. 1). After 47 articles were excluded at the title/abstract stage of review, a remaining 49 were excluded after reviewing the full text of the citation. At this stage, articles were excluded due to the

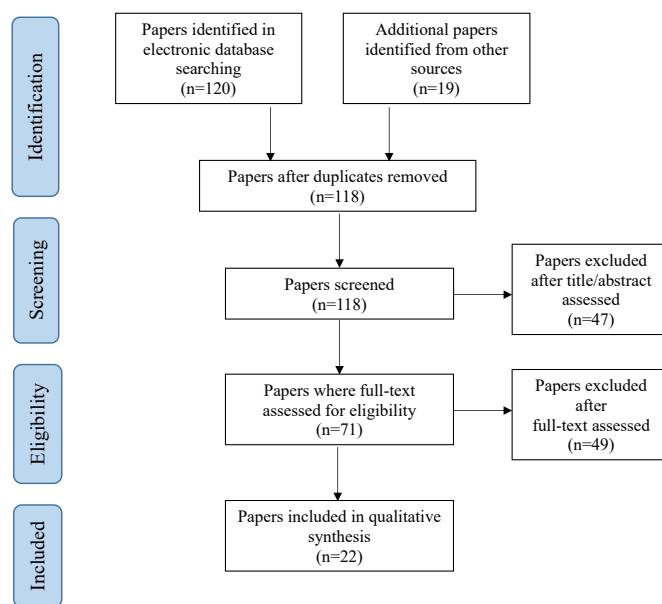


Fig. 1. PRISMA database search and review results.

following reasons: researchers utilized EMA to assess outcomes other than social experiences ($n = 28$); researchers utilized EMA to assess an aspect of social experience, but failed to report results on those experiences by themselves (e.g., a study assessed quantity of social interactions, but created a composite functioning outcome variable) or did not report group-level statistics on the social experience variable(s) ($n = 15$); or researchers utilized mobile technology but did not include an EMA component ($n = 6$). A total of 22 articles met full eligibility criteria and were included in this review.

3.1. Study characteristics

Study characteristics are displayed in Tables 1 and 2. Studies were published between 2001–2018 and research took place in Europe ($n = 16$) or the United States ($n = 6$). The majority of studies ($n = 20$) included adults with schizophrenia-spectrum disorders (SZ), with two articles examining first episode psychosis (Reininghaus et al., 2016a, 2016b). Fourteen studies included a healthy control (HC) comparison group (see Table 3 for a summary of comparisons between SZ and HC groups). Within the six studies that only included a SZ group, multiple studies compared different subgroups of people with SZ: one study compared people with SZ who either did or did not report suicidal ideation at baseline (Depp et al., 2016); one study compared a high negative symptoms subgroup¹ to a low negative symptoms subgroup (Oorschot et al., 2013); one study compared a group of people with SZ who met criterion for symptom remission² to a group who did not meet this criterion (Oorschot et al., 2012); and one study compared a group of people with SZ who reported a higher conviction in the belief that they “deserved” their paranoid delusions (e.g., “Do you feel that you deserve others to plot against you?”) to a group with a lower conviction in this belief (Udachina et al., 2017). People with SZ ranged in ages from 26–47 and the majority of participants were male (52–81%) and white (<21–100%). However, almost half of the studies, all from Europe, failed to report participant racial/ethnic

¹ Defined as having at least two mild Positive and Negative Syndrome Scale (PANSS) negative symptoms item scores (Kay et al., 1987).

² Defined as a score of three or below on a subset of PANSS symptom items.

Table 1
Descriptive statistics, EMA method, and functioning assessments in studies included in systematic review.

| Reference | Location | Group(s) | SZ group description | | | | HC group description | | | Other group description | | | | EMA Method | EMA Duration | EMA Daily Signal Timing |
|---|-------------------------|--|----------------------|-------|------|------------|----------------------|-------|------|-------------------------|-------|------|---------------------------|----------------------------|--|--|
| | | | n | % Men | Age | IN/OUT | n | % Men | Age | n | % Men | Age | IN/OUT | | | |
| Ben-Zeev et al. (2012) | USA | SZ | 24 | 71% | 44.9 | OUT | | | | | | | PDA | 6 signals per day; 7 days | Random between 9:00-22:00 | |
| Delespaul et al. (2002) | Netherlands | SZ; Mood disorders | 57 | N/A | N/A | OUT | | | 37 | N/A | N/A | OUT | Digital watch and booklet | 10 signals per day; 6 days | Random between 7:30-22:30 | |
| Depp et al. (2016) | USA | SZ without suicidal ideation (SZ group); SZ with suicidal ideation (other group) | 75 | 57% | 44.5 | OUT | | | 18 | 67% | 47 | OUT | PDA | 10 signals per day; 7 days | Random (except for 1 st and last survey of each day, time determined by participant) between 9:00-21:00 | |
| Edwards et al. (2018) | England | SZ; HC | 33 | 76% | 42.3 | OUT | 43 | 70% | 39.6 | | | | PsyMate device | 7 signals per day; 6 days | Random between 8:30-22:00 | |
| Gard et al. (2014) | USA | SZ; HC | 47 | 74% | 39.6 | OUT | 41 | 63% | 36.8 | | | | Cell phone call | 4 signals per day; 7 days | Random between 9:00-21:00 | |
| Granhölm et al. (2008) | USA | SZ | 54 | 63% | 44.1 | OUT | | | | | | | PDA | 4 signals per day; 7 days | Fixed (per participant) between 9:00-21:00 | |
| Granhölm et al. (2013) | USA | SZ | 145 | 61% | 46.5 | OUT | | | | | | | PDA | 4 signals per day; 7 days | Fixed (per participant) between 9:00-21:00 | |
| Janssens et al. (2012) | Netherlands/ Belgium | SZ; HC | 50 | 76% | 27.4 | N/A | 67 | 30% | 32.7 | | | | Digital watch and booklet | 10 signals per day; 6 days | Random between 7:30-22:30 | |
| Kasanova et al. (2018) ^a | Netherlands/ Belgium | | 149 | 70% | 38.8 | IN/ OUT | 143 | 39% | 39.7 | | | | Digital watch and booklet | 10 signals per day; 6 days | Random between 7:30-22:30 | |
| Kimhy et al. (2014) | USA | SZ | 33 | 55% | 27.8 | IN | | | | | | | Palm Pilot | 10 signals per day; 2 days | Random between 10:00-22:00 | |
| Leendertse et al. (2018) ^b | Netherlands/ Belgium | SZ; HC | 56 | 70% | 27.8 | IN/ OUT | 71 | 28% | 32.3 | | | | Digital watch and booklet | 10 signals per day; 6 days | Random between 7:30-22:30 | |
| Myin-Germeyns et al. (2001) | Netherlands/ Belgium | SZ; HC; first-degree relatives | 42 | 52% | 31.9 | OUT | 49 | 60% | 35.2 | 47 | 53% | 36.5 | Digital watch and booklet | 10 signals per day; 6 days | Random between 7:30-22:30 | |
| Oorschot et al. (2012) ^a | Netherlands/ Belgium | SZ nonremission (SZ group); HC; SZ in remission (other group) | 107 | 75% | 33.4 | IN/ OUT | 148 | 38% | 36.5 | 70 | 63% | 30.3 | OUT | Digital watch and booklet | 10 signals per day; 6 days | Random between 7:30-22:30 |
| Oorschot et al. (2013) ^a | Netherlands/ Belgium | SZ low negative symptoms (SZ group); HC; SZ high negative symptoms (other group) | 100 | 64% | 33.2 | IN/ OUT | 143 | 39% | 37 | 49 | 81% | 34.3 | OUT | Digital watch and booklet | 10 signals per day; 6 days | Random between 7:30-22:30 |
| Palmier-Claus et al. (2012) | UK | SZ; HC; clinical high risk | 27 | 64% | 33.2 | IN/ OUT | 27 | 52% | 22.6 | 27 | 52% | 22.6 | | Digital watch and booklet | 10 signals per day; 6 days | Fixed (per participant) between 7:30-22:30 |
| Reininghaus et al. (2016a) ^c | UK | SZ; HC; clinical high risk | 50 | 56% | 28.4 | OUT | 52 | 46% | 34.4 | 44 | 46% | 23.8 | | PsyMate device | 10 signals per day; 6 days | Random between 7:30-22:30 |
| Reininghaus et al. (2016b) ^c | UK | SZ; HC; clinical high risk | 51 | 55% | 28.3 | OUT | 53 | 47% | 35 | 46 | 46% | 23.6 | | PsyMate device | 10 signals per day; 6 days | Random between 7:30-22:30 |
| Schneider et al. (2017) ^b | Netherlands/ Belgium | SZ; HC | 126 | 66% | 34.4 | N/A | 109 | 28% | 40.8 | | | | PsyMate device | 10 signals per day; random | Random between 7:30-22:30 | |
| Udachina et al. (2014) | UK | SZ | 41 | 59% | 40.2 | IN/ OUT | | | | | | | Digital watch and booklet | 10 signals per day; 6 days | Random between 7:30-22:30 | |

(continued on next page)

Table 1 (continued)

| Reference | Location | Group(s) | SZ group description | | | | HC group description | | | Other group description | | | | EMA Method | EMA Duration | EMA Daily Signal Timing | | |
|--|-----------------|----------------------------|----------------------|-------|------|--------|----------------------|-------|------|-------------------------|-------|------|--------|---------------------------|----------------------------|-------------------------------|----------------------------|-------------------------------------|
| | | | n | % Men | Age | IN/OUT | n | % Men | Age | n | % Men | Age | IN/OUT | | | | | |
| Udachina et al. (2017) | UK | SZ; HC | 91 | 56% | 39.6 | IN/OUT | 52 | 40% | 36.1 | | | | | Digital watch and booklet | 10 signals per day; 6 days | Random between 7:30-22:30 | | |
| van der Steen et al. (2017) ^b | Belgium/Germany | SZ; HC; clinical high risk | 24 | 63% | 33.9 | IN/OUT | 26 | 62% | 24.5 | 22 | 77% | 25.2 | | Digital watch and booklet | 10 signals per day; 6 days | Random between 7:30-22:30 | | |
| Vasconcelos e Sa et al. (2016) | UK | SZ; relatives | 21 | 71% | 26 | OUT | | | | | | | 21 | 5% | 52 | Palm Pilot with digital watch | 10 signals per day; 6 days | Fixed (per dyad) between 9:00-24:00 |

Notes. EMA = ecological momentary assessment; HC = healthy control; IN = inpatient sample; OUT = outpatient sample; PDA = Personal Digital Assistant; SZ = people with schizophrenia; UK = United Kingdom; USA = United States of America.

^a Studies included overlapping subsample of participants.

^b Studies included overlapping subsample of participants.

^c Studies included the same sample of participants.

background information ($n = 10$). One study took place in an inpatient setting (Kimhy et al., 2014), seven studies recruited participants from both inpatient or outpatient settings (Kasanova et al., 2018; Leendertse et al., 2018; Oorschot et al., 2012, 2013; Palmier-Claus et al., 2012; Udachina et al., 2014, 2017; van der Steen et al., 2017), and two studies did not report inpatient/outpatient status of participants (Janssens et al., 2012; Schneider et al., 2017). All other studies included only outpatient/community samples ($n = 12$).

EMA method varied across studies (see Tables 1 and 2). The majority of researchers provided participants with a digital wristwatch that was programmed to signal (“beep”) when participants were required to respond to predetermined questions in a booklet or journal ($n = 11$), or with a non-phone device (e.g., a Personal Digital Assistant, PsyMate) that was responsible for both signaling participants to respond to EMA prompts and allowed participants to record their responses ($n = 10$). In one study, researchers provided cell phones to participants and called them to respond to EMA prompts (Gard et al., 2014). The most frequently cited EMA signal frequency/duration was 10 signals per day across six days, randomly assigned (often with a minimum amount of time in between signals). The most frequently cited timing of EMA prompts was between the hours of 7:30AM-10:30PM. Generally, participants were included in studies if they responded to a minimum of 20%–30% of EMA prompts, with adherence rates (when reported) ranging from 60%–88% for people with SZ. EMA prompts to assess social experiences and other related variables varied across studies (see Table 2 for summaries of EMA prompts).

3.2. Time spent alone

3.2.1. Proportion of time alone

Eleven studies examined the proportion of time people with SZ reported being alone compared to with others in response to EMA signals (see Table 2). People with SZ ranged in proportion of time spent alone, from 35% (Kimhy et al., 2014) to 60% (Janssens et al., 2012). Six studies compared people with SZ to a healthy control (HC) group in proportion of time spent alone. Of these studies, four did not find a difference between groups, including one study that included an outpatient SZ sample (Edwards et al., 2018), two studies that included both inpatient and outpatient samples (Kasanova et al., 2018; Leendertse et al., 2018), and one study that did not report on patient status of their SZ group (Janssens et al.,

2012). However, two studies found that people with SZ spent significantly more time alone compared to HCs, including one study that included both inpatient and outpatient samples (Oorschot et al., 2012) and another study that did not report patient status (Schneider et al., 2017). Further, these latter studies included significantly larger sample sizes than the individual studies that did not find a difference in proportion of time spent alone between SZ and HC groups.

Six studies examined potential correlates of the proportion of time spent alone in people with SZ. Oorschot et al. (2013) found that a high negative symptoms subgroup spent significantly more time alone compared to both a low negative symptoms subgroup of people with SZ and the HC group. However, proportion of time spent alone did not differ between people with SZ who did or not did not report suicidal ideation (Depp et al., 2016) or who did or did not meet criterion for symptom remission (Oorschot et al., 2012). Proportion of time spent alone was also not related to EMA reports of internalized stigma (Ben-Zeev et al., 2012), hallucinations (Delespaul et al., 2002), or quality of life (Leendertse et al., 2018) in people with SZ.

3.2.2. Affective experience and preferences when alone

Some studies assessed the affective experience of being alone, as well as one's preference to be with others when alone (see Table 2). Four studies examined EMA reports of positive and negative affect when people reported that they were alone. Inpatients with SZ reported more severe depressed mood when they were alone compared to when they were with others (Kimhy et al., 2014). In a separate study, outpatients with SZ who reported suicidal ideation at baseline were more likely to report more sadness and less happiness when they were alone compared to those without suicidal ideation (Depp et al., 2016). Only one study examined positive and negative affect in both people with and without SZ when they reported being alone: both groups reported less positive affect (pleasantness) when alone compared to when they were with others, and people with SZ reported more negative affect (unpleasantness) when they were alone compared to HCs (Oorschot et al., 2012). However, a separate study did not find a difference between people with or without SZ in the extent to which they “liked” being alone when they were alone (Schneider et al., 2017).

Only two studies have examined whether people with SZ preferred to be with others when they reported being alone. In one

Table 2
Summary of types of social experience and other EMA data collected across studies.

| Reference | Social EMA Data | | | | | | | | | Other EMA Data |
|-----------------------------|-------------------------------------|---|----------------------------------|-----------------------------------|---|---------------|------------------------------------|------------------------------------|---|--|
| | Time spent alone and/or with others | Quantity of social activities between signals | Whom participant spent time with | Involvement in social interaction | Preference to be alone (when with others) | Social stress | Positive affect (when with others) | Negative affect (when with others) | Other | |
| Ben-Zeev et al. (2012) | X | | X | | | | | | | Self-stigma |
| Delespaul et al. (2002) | X | | X | X | X | | | | | Hallucinations |
| Depp et al. (2016) | X | X | | | | | X | X | Social beliefs (e.g., social interactions are worth the effort/enjoyable); Anticipating quantity and quality of future social activities | |
| Edwards et al. (2018) | X | | X | | X | | X | | Preference to be with others when alone; Anticipating quantity and quality of future social activities | Negative affect (regardless of social context); Positive affect (regardless of social context) |
| Gard et al. (2014) | | X | | | | | | | | |
| Granholm et al. (2008) | X | X | X | | | | | | | |
| Granholm et al. (2013) | | X | | | | | X | X | Social beliefs (e.g., Degree that social interactions are worth the effort, how well do you think you communicated) | |
| Janssens et al. (2012) | X | | X | X | X | | | | Degree of liking the company person is with | |
| Kasanova et al. (2018) | X | | | | | | X | | Goal-directed ("structured") versus non-goal-directed ("unstructured") social activity | |
| Kimhy et al. (2014) | X | | | | | | | | | Depressed mood |
| Leendertse et al. (2018) | X | | | X | | | | | | Quality of life |
| Myin-Germeyns et al. (2001) | | | | | | | X | | | Negative affect (regardless of social context); Positive affect (regardless of social context) |
| Oorschot et al. (2012) | X | | | X | X | | | | | Negative affect (regardless of social context); Positive affect (regardless of social context) |
| Oorschot et al. (2013) | X | | | | X | | X | X | | |
| Palmier-Claus et al. (2012) | | | | | | | X | | | Hallucinations and delusions; Negative affect (regardless of social context) |
| Reininghaus et al. (2016a) | | | X | | | | X | | | Hallucinations and delusions; Negative affect (regardless of social context) |
| Reininghaus et al. (2016b) | | | X | | | | X | | | Hallucinations and delusions; Negative affect (regardless of social context) |
| Schneider et al. (2017) | X | | X | | X | | | | Preference to be with others when alone; Feelings of ease when with others; Feeling threatened when with others; Enjoyment of being alone | Negative affect (regardless of social context) |
| Udachina et al. (2014) | | | | | | | X | | | Self-esteem |
| Udachina et al. (2017) | | | | | | | X | | | Negative affect (regardless of social context); Positive affect (regardless of social context) |

(continued on next page)

Table 2 (continued)

| Reference | Social EMA Data | | | | | | | | | Other EMA Data |
|---|-------------------------------------|---|----------------------------------|-----------------------------------|---|---------------|------------------------------------|------------------------------------|-------|---|
| | Time spent alone and/or with others | Quantity of social activities between signals | Whom participant spent time with | Involvement in social interaction | Preference to be alone (when with others) | Social stress | Positive affect (when with others) | Negative affect (when with others) | Other | |
| van der Steen et al. (2017) Vasconcelos e Sa et al. (2016) | X | | | | X | | | | | affect (regardless of social context) Hallucinations and delusions; Negative affect (regardless of social context) Negative affect (regardless of social context) Time spent with family member; Behaviorally controlling interactions from family member (e.g., nagging me/ them, helping me/ them, keeping an eye on me/ them) |

Note. EMA = ecological momentary assessment.

Table 3
Comparisons between SZ and HC groups on social experience EMA data.

| Reference | Time spent alone | Involvement in interaction | Positive affect when with others | Preference to be alone (when with others) | Social stress | Other |
|-----------------------------|------------------|----------------------------|----------------------------------|---|---------------|---|
| Edwards et al. (2018) | SZ = HC | | SZ = HC | SZ > HC | | SZ = HC (time spent with unfamiliar and familiar others) |
| Gard et al. (2014) | | | | | | SZ < HC (social goals) |
| Janssens et al. (2012) | SZ = HC | SZ = HC | | SZ > HC | | SZ < HC (time spent with unfamiliar others) |
| Kasanova et al. (2018) | SZ = HC | | SZ = HC | | | SZ < HC (goal-directed social activity); SZ = HC (non-goal-directed social activity) |
| Leendertse et al. (2018) | SZ = HC | SZ < HC | | | | |
| Myin-Germeys et al. (2001) | | | | | SZ > HC | |
| Oorschot et al. (2012) | SZ > HC | SZ = HC | | SZ > HC | | SZ > HC (negative affect when alone) |
| Oorschot et al. (2013) | | | SZ = HC | SZ > HC | | |
| Palmier-Claus et al. (2012) | | | | | SZ > HC | |
| Reininghaus et al. (2016b) | | | | | SZ > HC | |
| Schneider et al. (2017) | SZ > HC | | | SZ > HC | | SZ < HC (time spent with unfamiliar and familiar others) |
| Udachina et al. (2017) | | | | | SZ > HC | |
| van der Steen et al. (2017) | | | | SZ = HC | | |

Notes. EMA = ecological momentary assessment; HC = healthy control; SZ = people with schizophrenia. Reininghaus et al. (2016a) included both a SZ and HC group, but did not directly compare these groups and thus was not included in this table.

study, people with SZ reported wanting to be with others more when they were alone compared to HCs' preferences to be with others when alone (Edwards et al., 2018). However, in a different study, there was no difference between groups in the desire to be with others when participants reported being alone (Schneider et al., 2017).

3.2.3. Summary of studies examining time spent alone

The majority of studies find that people with and without SZ do not differ in proportion of time spent alone based on EMA reports, although there are contradictory findings. Fewer studies have examined the affective experience of being alone, but those that have suggest that people with SZ may experience more negative and less positive affect when they are alone compared to when they are with others. It is unclear whether people with SZ have a preference to be with others when they are alone, and whether this preference differs from HCs.

3.3. Time spent with others

3.3.1. Proportion of time with others

Ten studies examined the proportion of time people with SZ spent with other people during EMA signals, including the proportion of time people with SZ spent with familiar (e.g., friends and family) versus unfamiliar others (see Table 2). Granholm et al. (2008) found that people with SZ spent the most time with family or friends (36%) compared to coworkers or colleagues (5%) and strangers (5%). Similarly, a separate study found that people with SZ spent the most time with family/fellow residents (18–19%) when they were with others, followed by time spent with friends/acquaintances (9–12%) (Depp et al., 2016). Vasconcelos e Sa et al. (2016) found that people with SZ and a caretaking relative, both of whom completed EMAs of social experiences, spent an average of 40 h per week with each other. Alternatively, Kasanova et al. (2018) categorized social experiences as being either goal-

directed/“structured” (i.e., during activities such as work, study, transportation, etc.) or non-goal-directed/“unstructured” (i.e., during activities such as parties, movie/theater, conversation, etc.); they found that people with SZ spent more time in goal-directed (31%) compared to non-goal-directed (22%) social activities. Overall, people with SZ appear to spend most of their time with friends/family members compared to other people in their lives and possibly spend more time in goal-directed compared to non-goal-directed social activities.

Five studies compared people with and without SZ in time spent with others, with the majority of studies only examining differences in time spent with familiar versus unfamiliar others (see Table 3). Two out of three studies found that people with SZ spent significantly less time with unfamiliar others compared to a HC group (Janssens et al., 2012; Schneider et al., 2017), while one study found no difference between groups (Edwards et al., 2018). Results were mixed in examining proportion of time spent with familiar others: one study found that people with SZ spent significantly less time with familiar others compared to HCs (Schneider et al., 2017), while a separate study found no difference between groups (Edwards et al., 2018). Kasanova et al. (2018) found that people with SZ spent significantly less time in goal-directed social activities, but equivalent time in non-goal-directed social activities, compared to HCs.

3.3.2. Involvement in social experiences

Only three studies compared people with and without SZ in how involved a participant was in a given social experience (e.g., degree to which they agreed with the statement, “We are interacting”) (see Tables 2 and 3). Two studies found that people with SZ did not differ from HCs in the degree of involvement during a given social experience (Janssens et al., 2012; Oorschot et al., 2012), while one study found that HCs reported a higher degree of involvement compared to people with SZ (Leendertse et al., 2018). Momentary reports of quality of life were positively associated with involvement in social interactions for both people with and without SZ (Leendertse et al., 2018). In a separate study, involvement in a given social experience was unrelated to EMA reports of hallucinations in people with SZ (Delespaul et al., 2002).

3.3.3. Affective experience when with others

Six studies examined affective experiences (as assessed through EMA) during social activities. Two out of two studies found that people with SZ reported more positive and less negative affect when with others compared to being alone (Depp et al., 2016; Oorschot et al., 2013). Additionally, three out of three studies found that people with and without SZ did not differ in positive affect during social experiences (Edwards et al., 2018; Kasanova et al., 2018; Oorschot et al., 2013). Further, Edwards et al. (2018) found that people with and without SZ did not differ in pleasure in anticipation of a social activity (“How much do you think you will enjoy this activity?”).

What may be related to positive and negative affect in response to social experiences in people with SZ? In one study, people with SZ who reported suicidal ideation also reported that recent social experiences were less enjoyable or “worth the effort” compared to those who did not report suicidal ideation (Depp et al., 2016). Additionally, one study found that more severe avolition (as rated on the PANSS) was related to less positive affect during non-goal-directed social activities in people with SZ (Kasanova et al., 2018). Another study found that when people with SZ appraised social experiences as being more worthwhile and successful, and believed that others perceived them as more likeable, smart, and interesting, they also reported more happiness and less sadness compared to other social experiences (Granholm et al., 2013). Vasconcelos e Sa et al. (2016) was the only study that examined the affective

response of a person with SZ to a specific person (a caretaking relative); the authors found that the extent to which a person with SZ perceived that their family member was “helping them” (conceptualized as behavioral control) predicted increased negative affect (regardless of social context) at subsequent EMA signals.

3.3.4. Social stress when with others

Six studies assessed “social stress,” defined by researchers as a composite of responses to the following (or similar) questions when people with SZ reported being with others: “I like this company,” “Right now, I’d prefer to be alone,” and “I’m enjoying myself” (e.g., Udachina et al., 2017) (see Tables 2 and 3). In the four studies that compared people with and without SZ, all of these studies found that people with SZ reported more social stress compared to people without SZ (Myin-Germeys et al., 2001; Palmier-Claus et al., 2012; Udachina et al., 2017), including people experiencing their first episode of psychosis (Reininghaus et al., 2016b). Seven additional studies examined whether people with SZ had a preference to be alone when with others, a component of social stress. Of the studies that compared people with and without SZ, five out of six found that people with SZ reported a preference to be alone when they were with others compared to people without SZ (Edwards et al., 2018; Janssens et al., 2012; Oorschot et al., 2012, 2013; Schneider et al., 2017; but see van der Steen et al., 2017). Relatedly, one study found that people with SZ felt less at ease and more threatened by others when they were with others compared to a HC group (Schneider et al., 2017). A separate study also found that people with SZ reported liking the people they were interacting with less compared to HCs (Janssens et al., 2012).

Several studies examined factors that may be related to social stress and a preference to be alone when with others in SZ. One study found a relationship between the severity of EMA reports of positive symptoms and social stress (Reininghaus et al., 2016b), while one study did not find this relationship (Palmier-Claus et al., 2012). However, an additional study found that EMA reports of positive symptoms were related to a preference to be alone when with others (van der Steen et al., 2017). Additionally, a preference to be alone when with others did not differ between people with SZ who exhibited high versus low negative symptoms (Oorschot et al., 2013), but this preference was reduced in people with SZ in symptom remission compared to those who were not (Oorschot et al., 2012). No study to date has examined social stress and negative symptoms. In one study, exposure to childhood sexual abuse was related to a stronger relationship between social stress and EMA reports of positive symptoms in people experiencing their first episode of psychosis (Reininghaus et al., 2016a). Studies have also found a relationship between momentary reports of lower self-esteem and social stress in people with SZ (Udachina et al., 2014, 2017), and this relationship was stronger for those who reported that they “deserved” their paranoid delusions (Udachina et al., 2017).

Other studies examined the relationship between affect and social stress. Five studies found associations between higher momentary negative affect (regardless of social context) and social stress in both people with and without SZ (Myin-Germeys et al., 2001; Palmier-Claus et al., 2012; Reininghaus et al., 2016b; Udachina et al., 2017), including in people experiencing their first episode of psychosis (Reininghaus et al., 2016b). Separate studies have also found that the relationship between social stress and negative affect (regardless of social context) may be moderated by the belief in “deserving” one’s paranoid delusions (Udachina et al., 2017) and exposure to childhood sexual abuse (Reininghaus et al., 2016a). Additionally, social stress was related to less momentary reports of positive affect (regardless of social context) in both people with and without SZ (Myin-Germeys et al., 2001; Udachina et al., 2017). Negative affect (regardless of social context) was also

related to a preference to be alone when with others in people with SZ (van der Steen et al., 2017).

3.3.5. Factors related to time spent with others

A handful of studies examined factors related to the proportion of time spent in specific types of social experiences in people with SZ. Granholm et al. (2013) found that the average number of social interactions people with SZ reported in between EMA signals did not vary by age or sex, or differ between those living in assisted versus non-assisted housing. In a separate study, people with SZ who reported suicidal ideation spent more time with strangers (10%) compared to those who did not report suicidal ideation (5%); the groups did not differ in time spent with family/fellow residents, friends/acquaintances, or in total time spent with others per day (Depp et al., 2016). Kasanova et al. (2018) examined negative symptoms, living situation (living with others versus living alone), and participation in vocational activities and their potential relationships with different types of social experiences. In this study, people with SZ who were living with others spent significantly more time in both goal-directed and non-goal-directed social activities compared to people with SZ who lived alone; people with SZ who both lived with others and participated in vocational activities spent significantly more time in goal-directed social activities compared to other people with SZ; and higher avolition (as assessed on the PANSS) was related to spending less time in both goal-directed and non-goal-directed social activities across people with SZ (Kasanova et al., 2018). This study was the only study reviewed that examined relationships between educational/vocational activity and aspects of social experiences. Similar to the findings of when people with SZ reported being alone, proportion of time spent with others was not related to EMA reports of internalized stigma (Ben-Zeev et al., 2012) or hallucinations (Delespaul et al., 2002).

Since EMA is longitudinal by design, we were also interested in studies that analyzed factors that predicted future social experiences in the daily lives of people with SZ. Edwards et al. (2018) found that people with SZ did not differ from HCs in either anticipatory or consummatory (in-the-moment) pleasure for social experiences, and neither type of pleasure predicted future social experiences in either group. Further, the researchers did not find a significant relationship between preference to be alone (when with others) or preference to be with others (when alone) and the probability of a future social experience in either people with or without SZ (Edwards et al., 2018). Granholm et al. (2013), however, found that more happiness at one time point predicted significantly more social experiences at the next EMA signal in people with SZ, controlling for previous social experiences. In a separate study, people with SZ who reported suicidal ideation were more likely to anticipate being alone in the future compared to those without suicidal ideation (Depp et al., 2016). Further, baseline depression severity was related to EMA reports of social experiences, including appraising social experiences as more negative (e.g., not worth the effort) and a lower likelihood that a person would report that they were with others at any given moment (Depp et al., 2016). Overall, few EMA studies have examined potential predictors of future social experiences in people with SZ.

3.3.6. Summary of studies examining time spent with others

People with SZ appear to spend more time with friends and family than with acquaintances, strangers, or others. There is some evidence to suggest that people with SZ spend less time with unfamiliar others (strangers) and less time engaged in goal-directed social activities compared to HCs. It appears that people with SZ do not differ from HCs in positive affect experienced during social activity or the extent of involvement in a given social interaction. However, people with SZ consistently report more social stress and

a preference to be alone when they are with others compared to HCs. Positive symptoms, lower self-esteem, and daily experiences of negative affect (regardless of the social context) may be related to more social stress in people with SZ. There is some evidence that living with others, engagement in vocational activities, suicidal ideation, and negative symptoms may be related to the proportion of time people with SZ spend with others. Very few studies have examined predictors of future social experiences in people with SZ.

3.4. EMA of social experiences and lab-based/clinical/self-report social functioning assessments

We were also interested in examining the potential relationships among lab-based social functioning measures, clinical functioning assessments, self-report measures, and momentary social experiences in people with SZ in this review. Five out of 22 studies included a separate social or global functioning assessment alongside EMA. These five studies examined the coherence between these assessments and EMA reports of social experiences.

3.4.1. Laboratory-based assessments

Facial emotion perception is one component of social cognition, a core feature of social functioning in SZ (Couture et al., 2006; Yager and Ehmann, 2006). Performance on these tasks has been associated with social functioning in SZ in prior studies (e.g., Hooker and Park, 2002). Only one EMA study to date has examined associations between momentary social experiences and a laboratory-based social cognition assessment. Janssens et al. (2012) found that performance on a facial emotion identification task (Performance on the Degraded Facial Affect Recognition Task; van't Wout et al., 2004) was unrelated to daily social experiences—including proportion of time spent alone, preference to be alone when with others, involvement in social interactions, and enjoyment of social interactions—in people with or without SZ.

3.4.2. Clinical interviews

Two different EMA studies examined the relationship between momentary social experiences and a clinical interview functioning assessment. Vasconcelos e Sa et al. (2016) examined the association between expressed emotion, as assessed through the Camberwell Family Interview (Vaughn and Leff, 1976), and EMA reports of social experiences between people with SZ and a caretaking relative. Expressed emotion in relatives has been related to poorer social functioning in people with SZ in prior studies (e.g., Barrowclough and Tarrier, 1990). Expressed emotion was unrelated to the proportion of time that the person with SZ and family member spent together. Further, expressed emotion did not moderate the relationship between the proportion of time the two individuals spent together and either the person with SZ or the relative's affective experiences. Finally, expressed emotion did not moderate the relationship between the proportion of time the two individuals spent together and psychotic symptoms in the person with SZ. In a separate study, lower global functioning, as assessed on an abbreviated version of the clinician-rated Quality of Life Scale (Bilker et al., 2003), was related to a lower proportion of time people with SZ spent with others (Gard et al., 2014).

3.4.3. Self-reports

Two EMA studies examined self-report assessments of functioning and momentary social experiences. Schneider et al. (2017) examined the relationship between the Social Functioning Scale (Birchwood et al., 1990) and social experiences in people with and without SZ. In people with SZ, the social engagement/withdrawal (encompassing social initiation and avoidance) and the interpersonal behaviour (encompassing number of friends, presence of a partner, and social skills) subscales of the Social Functioning Scale

were negatively associated with the proportion of time spent alone and preference to be alone (when with others). Additionally, higher social engagement was positively associated with proportion of time spent with others and the appraisal of feeling at ease with others (when with others) in people with SZ (Schneider et al., 2017). However, other EMA-reported social experiences were unrelated to either subscale. Further, the two subscales were broadly related to similar EMA-reported social experiences, despite putatively assessing different facets of social functioning (Schneider et al., 2017). In a separate study, higher scores (better functioning) on the Independent Living Skills Survey (Wallace et al., 2000), an assessment of global functioning, was negatively associated with proportion of time spent alone in people with SZ (Granholm et al., 2008). Within the same study, higher functioning was also associated with a higher likelihood of visiting friends/family and having social interactions with people other than one's friends/family in people with SZ (Granholm et al., 2008).

3.4.4. Summary of studies examining EMA-reported social experiences and social functioning assessments

Few studies have examined coherence between laboratory-based, clinical, or self-report assessments of social functioning with momentary social experiences. In single studies, researchers have found relationships between global and social functioning assessments (both clinician-rated and self-report) with EMA-reported social outcomes. However, there have yet to be multiple studies that compare the same functioning assessment with EMA-reported social experiences in people with SZ.

4. Discussion

In this review, we summarize studies conducted over the past two decades on the assessment of social experiences in people with SZ using EMA. Despite the heterogeneity of questions asked, EMA has provided granular assessments of a variety of social experiences, including quantity of experiences across discrete periods, affect in the context of social activity, and the relationship between social experiences and other facets of the disorder (symptoms, stigma, suicidality, etc.). While many findings summarized were based on only one or two studies, there were a few consistent findings. People with SZ appear to experience heightened stress (four out of four studies) and a higher preference to be alone (five out of six studies) when they are with others than do people without SZ. Despite this finding, the few studies that directly assessed affect tell a more nuanced story. People with SZ report more positive affect when they are with others compared to when they are alone (two out of two studies), and do not differ from HCs in the experience of positive affect when they are with others (three out of three studies).

People with SZ appear to face a social dilemma: they experience heightened stress and a preference to be alone when they are with others, but more positive affect when they are with others than when alone. EMA is unique in its ability to capture specific affective experiences in the context of real-world social interactions for people with SZ. Importantly, the EMA-reported experience of positive affect during social interactions in people with SZ contradicts evidence of social anhedonia from trait-based reports, but is in line with other evidence supporting intact hedonic responding in the presence of positive social interactions in laboratory settings (Aghevli et al., 2003; Martin et al., 2019). Further, results regarding social stress and positive affect correspond with evidence that people with SZ in general report affective “ambivalence,” or the co-occurrence of positive and negative affect, particularly in the presence of positive stimuli or situations (Cohen and Minor, 2008; Cohen et al., 2010). No EMA study to date has examined momentary experiences of positive and negative affect during social

experiences alongside an assessment of social stress; in other words, it is unclear whether people with SZ experience a preference to be alone when they are with others *in addition to* heightened positive affect *within the same social experience*. In the studies reviewed, “social stress” included both affective (enjoyment of the experience) and non-affective (preference to be alone) constructs, making them difficult to disentangle. While one would assume that a preference to be alone would be highly correlated with diminished enjoyment of a social experience, one cannot make that assertion based on the findings reviewed here. The simultaneous assessment of positive and negative affect alongside other aspects of social stress will improve understanding of the extent to which people with SZ experience affective ambivalence in social situations. Future studies can also compare EMA-reported affective experiences with trait-based reports of social anhedonia to better understand the relationship between in-the-moment experiences of social pleasure, anhedonia, and affective ambivalence in the social domain.

There are limited studies examining relationships between lab-based, self-report, or clinical functioning assessments and EMA-reported social experiences. Theoretically, laboratory tasks and clinical functioning measures assess a person's ability to successfully navigate their social worlds—we (researchers and clinicians) assume that this provides a window into how people with SZ live their daily lives. Examining the coherence between these assessments and EMA-reported social experiences can provide integral evidence that this assumption is true. Of the limited evidence reviewed, it may be that certain lab-based tasks (e.g., facial emotion identification tasks) are unrelated to momentary social experiences, or that certain functioning assessments are less sensitive in distinguishing different aspects of daily social experiences than previously thought (e.g., Social Functioning Scale). These relationships from single studies await replication.

Thus far, EMA has not been utilized extensively as a proxy assessment of social functioning in SZ; rather, many EMA studies included in this review have focused their attention on a separate construct (e.g., self-esteem, quality of life) and assessed social experience as a correlate of these foci. While administering EMA may be more burdensome than a questionnaire or interview administered at one point in time, EMA has numerous unique advantages over these methods. For example, with EMA we can assess social functioning through an in-depth evaluation of momentary experiences of social engagement, motivation, and pleasure in a naturalistic context. By comparing conventional functioning assessments with EMA-reported social experiences, we can better understand when and how the two methods are related to one another, and when one method might be preferred over another to assess an aspect of social functioning in people with SZ. It may be that clinical functioning assessments are more useful to understand broad perceptions of one's social world (e.g., how satisfied one is with their relationships) or one's beliefs regarding their level of social functioning (e.g., how much time they spend alone in general). EMA, on the other hand, is more suitable for understanding in-the-moment feelings or thoughts about specific contexts, situations, and relationships. While both assessments are useful, only EMA can provide both summative as well as context-specific information regarding social experiences as they occur in daily life. Within a clinical context, EMA may be helpful for providing supplementary information that a more traditional assessment may be unable to provide. For example, a person with SZ may report on a clinical interview that she generally avoids social experiences because she feels uncomfortable around others. However, EMA reports may show that the same person feels more positive affect when she is with others than when she is alone. Thus, a clinician can use this information to help this person reduce her avoidance of social experiences through engaging in more positive social

interactions and/or reminding her that she feels more positive when she is with others, even when she feels uncomfortable.

Few studies examined qualitative aspects of social experiences outside of whom one spent time with and affective experiences during interactions. For example, while four out of six studies found that people with SZ spent the same proportion of time alone compared to HCs, it remains unknown what “time spent with others” entailed in the context of these studies. A person might state that they are “with others” when they are on a bus, purchasing something at the grocery store, or alone in one room while others are in a different part of their house. These more superficial “social” experiences are experientially distinct from engaging in a conversation with a loved one or enduring a performance review from an employer. Further, studies examining whom people with SZ spend time with use categories such as “family,” “friend,” “stranger,” etc., without examining whether people with and without SZ differ in their perceptions of these categories. Perhaps people with SZ characterize some people as “friends” that people without SZ would not, such as mental health care workers. This is an open research question that EMA could help to answer. Understanding the proportion of time spent alone versus with others may be less informative for our understanding of social functioning than assessments of the extent to which one’s social needs are being met, such as more granular assessments of the content of conversations with others, specificity in types of relationships one engages in, and appraisals of the interactions themselves (e.g., whether it was successful, whether one felt lonely during the interaction). For example, [Kasanova et al. \(2018\)](#) categorized social activities as goal-directed versus non-goal directed, whereas [Granholtm et al. \(2013\)](#) examined appraisals of social experiences (e.g., belief that one was successful or perceived as likable in an interaction). Through continuing to explore more in-depth qualitative aspects of social experiences, we can gain a richer, more nuanced understanding of daily social functioning in people with SZ.

Another major limitation of the existing literature is that many demographic factors were often not included in analyses regarding social experiences. Gender, marriage status, and educational/vocational activity engagement most likely contribute to different opportunities for social experiences and warrant further investigation. Further, the majority of participants in the reviewed studies were white/Caucasian, with 10 out of 22 studies (all from Europe) failing to report on any ethnic background information, making it difficult to generalize findings to populations outside of white European samples. Finally, multiple studies recruited both inpatients and outpatients, with only one study reporting the proportion of inpatient participants in their mixed sample ([Kasanova et al., 2018](#)) and two studies failing to indicate patient status of their participants with SZ. Inpatient status not only reflects a difference in symptom severity, but also in the opportunity for a variety of social interactions, compared to outpatient status. Further, it is difficult to make group comparisons if a proportion of those with SZ are inpatients during a portion of the study. Future studies that assess aspects of social experiences through EMA should clarify the patient status of their SZ sample and, if inpatients are included, compare those of different patient statuses to better understand how treatment context may influence social experiences.

Future EMA studies would also benefit from capitalizing more on the advantages that EMA has over other methods in assessing social experiences. EMA is longitudinal in nature and designed to be utilized in various contexts as participants go about their daily lives. Despite this, few studies have examined what predicts future social experiences over time or attempted to examine social contexts outside of whom with a participant is interacting. This limits the richness of data that could be quickly and efficiently obtained through using EMA over other self-report methods. Further, of the studies reviewed, approximately half did not use a mobile device to

collect data. This was most likely because the technology was not available at the time of study design/data collection. Using a wristwatch and paper booklet to respond to EMA prompts may have limited the variety of settings within which participants could feasibly respond during a signal (e.g., in transit, at another person’s house, etc.). Thus, social experiences assessed through EMA may have differed between these studies and those that used a mobile device (e.g., PDA); however, it is difficult to speculate on these differences as no study compared the two methodologies. As mobile technology becomes more ubiquitous and less cost-prohibitive, researchers will most likely take advantage of using mobile devices to assess social experiences through EMA. It remains an open question as to whether the findings summarized here will differ substantially from future research that relies solely on mobile technology to administer/collect EMA data.

Relatedly, no study included in this review utilized smartphone technology to incorporate passive sensing metrics (e.g., GPS, microphone) that may help predict or add context to momentary reports of social experiences ([Harari et al., 2017](#)). This is most likely due to the novel nature of this technology and will hopefully be a more prominent feature in future research. Utilizing social sensing metrics along with EMA within the same device can help provide both subjective (e.g., affect) and objective (e.g., number of phone calls per day, total time spent at home, accelerometer-based physical activity data) predictors of future social experiences in people with SZ. Additionally, the combination of subjective and objective assessments of social experiences could help provide information to develop personalized, just-in-time interventions to target context-specific social difficulties as they arise. Interventions such as these could address both external (e.g., isolation) and internal (e.g., defeatist performance beliefs) social barriers to promote better social functioning ([Mote et al., 2018](#)). For example, a text notification could be sent to encourage a person with SZ to seek out a social experience if they have not left their home for a certain proportion of time or report feeling lonely.

The scope of this review could not incorporate all types of social experiences assessed through EMA. Studies that reported on constructs related to social experiences, but not social experiences themselves (e.g., negative symptoms: [Moran et al., 2017](#)), were not included in this discussion. Further, we did not include EMA studies of social media use or other types of electronic social experiences (e.g., [Berry et al., 2018](#)); however, as this research continues to grow, it will be important to understand how these types of social experiences differ from in-person experiences. Finally, we did not discuss the growing literature on mobile interventions intended to improve the social lives of people with SZ (e.g., [Achtyes et al., 2019](#); [Granholtm et al., 2012](#); [Schlosser et al., 2018](#)).

In summary, EMA studies of social experiences to date show that people with SZ report heightened social stress and a preference to be alone when they are with others, despite the experience of positive affect when they are with others. While it appears that people with SZ do not differ from HCs in proportion of time spent alone, there are many unanswered questions as to how people with SZ are spending their time with others and the extent to which their social needs are being met. Few studies have compared functioning assessments with EMA reports of social experiences, making it difficult to examine whether the different methods capture unique aspects of social functioning. Despite the heterogeneity of questions asked related to the everyday social experiences of people with SZ, it is clear that EMA is a valuable method for providing context-specific information regarding the social lives of people with SZ that differ from what traditional assessment methods may capture. Researchers should continue to capitalize on the benefits of EMA and mobile technology to improve understanding of both subjective and objective predictors of future social experiences over time in people with SZ. Further, understanding

and exploring other currently-unmeasured qualities of social experiences, the potential co-occurrence of positive and negative affect, and the influence of demographic factors on momentary social experiences are all fruitful avenues for future research on utilizing EMA to better understand the daily social experiences of people with SZ.

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