

**Psychological and Mnemonic Benefits of Nostalgia for People with Dementia**

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Running title: Benefit of nostalgia for people with dementia

Trial Identifiers: ISRCTN54996662 (experiment 1 & 2) and ISRCTN78958013 (experiment 3)

Word count: 5,803

**ABSTRACT**

*Background:* Studies with non-clinical populations show that nostalgia increases psychological resources, such as self-esteem and social connectedness.

*Objectives:* Our objectives were to find out if the benefits of nostalgia in non-clinical populations generalize to people with dementia and if nostalgia facilitates recall of dementia-related information.

*Methods:* All three experiments recruited participants with mild or moderate levels of dementia. Experiment 1 tested whether nostalgia (compared to control) enhances psychological resources among 27 participants. Experiment 2 used music to induce nostalgia (compared to control) in 29 participants. Experiment 3 compared recall for self-referent dementia statements among 50 participants randomized to either a nostalgia or control condition. Findings across experiments were synthesized with integrative data analysis.

*Results:* Nostalgia (compared to control) significantly increased self-reported social connectedness, meaning in life, self-continuity, optimism, self-esteem, and positive (but not negative) affect (Experiments 1-3). Compared to controls, nostalgic participants also recalled significantly more self-referent dementia-related information (Experiment 3).

*Conclusion:* This series of experiments extends social psychological research with non-clinical populations into dementia care, providing evidence that nostalgia significantly enhances psychological resources. The finding that nostalgia increased recall of self-referent statements about dementia suggests that this emotion lends participants the fortitude to face the threat posed by their illness. The finding has potentially important clinical implications both for the development of reminiscence therapy and for facilitating adjustment to a diagnosis of dementia.

*Keywords:* dementia; Alzheimer's disease; autobiographical memory; immediate recall; psychological adaptation

## INTRODUCTION

Nostalgia is a neglected topic in the dementia literature. Reminiscence Therapy involves “*the discussion of past activities, events and experiences*” [1, p3], but typically does not qualify what types of memories should be recalled. However, within social psychology the differences between nostalgic and non-nostalgic reminiscence have constituted an important focus of inquiry. Nostalgia refers to the evocation of bittersweet memories [2] and affords psychosocial benefits that other forms of autobiographical recall lack [3]. Moreover, while there is some evidence to suggest that reminiscence “*is effective in improving mood,*” its “*effects on mood, cognition and well-being ... are less well understood*” [1, p3]. A major, multi-national trial of Reminiscence Therapy for people living with dementia, for instance, found no evidence that reminiscence had a therapeutic benefit, and even suggested that it had a negative impact on caregivers [4]. By contrast, there is consistent evidence that for at least non-clinical populations nostalgia “*serves a self-oriented function (by raising self-positivity and facilitating perceptions of a positive future), an existential function (by increasing perceptions of life as meaningful), and a sociality function (by increasing social connectedness, reinforcing socially oriented action tendencies, and promoting prosocial behavior)*” [3, p2].

Of particular importance is the way in which nostalgia has been identified as enhancing key psychological resources that act as buffers against distress arising from threats to the self. In other words, nostalgia provides a form of self-protection against events or circumstances that undermine or pose a risk to a person’s sense of who they are. This is potentially significant for dementia care, given the psychological threat that a diagnosis of dementia represents. Thus, the threat to identity that dementia represents has been construed as: a malignant social psychological world that reduces the well-being of the person living with dementia [5, 6]; storylines that limit social understanding and facilitate stereotypes so that the person living with dementia risks being defined entirely in terms of their diagnosis [7, 8]; and as

precipitating feelings of loss, insecurity and separation that initiate attachment-seeking behaviours [9].

Reminiscence that is specifically nostalgic in focus may therefore have the potential to be used as an intervention within those clinical populations where an individual's identity is at risk of being undermined [10, 11]. Given that dementia represents a profound psychological threat, then it is important to understand whether the findings from the wider psychological literature about the beneficial functions of nostalgia also hold true for people with dementia. The three experiments reported in this article aim to do that. In Experiment 1 ( $N = 27$ ), we tested whether nostalgic reminiscence boosted psychological resources among people with dementia. In Experiment 2 ( $N = 29$ ) we conceptually replicated Experiment 1, but induced nostalgia by randomizing participants to listen either to nostalgic or non-nostalgic music. Finally, in Experiment 3 ( $N = 50$ ) we tested whether nostalgic reminiscence improved the recall of self-referent, dementia-related statements. To address the issue of modest sample sizes, we used integrative data analysis (IDA) [12] to combine results across experiments in a research synthesis ( $N = 106$ ). The increased sample size achieved through IDA also enabled us to correct for multiple comparisons while retaining adequate statistical power, thus balancing concerns relating to Type I and Type II errors [13].

### **EXPERIMENT 1**

We investigated the potential of nostalgia to improve psychological well-being among people with dementia. We tested the hypothesis that recall of nostalgic events relative to ordinary autobiographical events would increase self-reported social connectedness, self-esteem, self-continuity, meaning in life, optimism, and positive (but not negative) affect.

## **MATERIALS AND METHODS**

The protocol was registered in advance<sup>1</sup>. Ethical approval was provided by the East of England National Research Ethics Service (NRES) Committee<sup>2</sup>, with site approval being provided by the appropriate National Health Service (NHS) organisation.

### ***Participants and design***

Experiment 1 was a parallel randomized controlled trial with two arms and an allocation ratio of 1:1, comparing the effect of recalling nostalgic memories against ordinary autobiographical memories on key psychological resources. A sealed envelope procedure was used to ensure that the researcher was blind to allocation. Participants were recruited from the Research Institute for the Care of Older People (RICE), memory services under the Avon and Wiltshire Mental Health Partnership NHS Trust (AWP), and the Join Dementia Research (JDR) Register. All participants included in the study had:

- a diagnosis made within the previous 18 months by a consultant psychiatrist or geriatrician of either probable Alzheimer’s disease [14], probable vascular dementia [15], or dementia with Lewy bodies [16], or a mixed form of these;
- mild or moderate levels of cognitive impairment as demonstrated, for example, by a score over 12 on the Montreal Cognitive Assessment (MoCA) [17] screening tool;
- the capacity to consent to be part of the research; and
- sufficient communication skills to be able to take part in the research.

Participants were excluded if:

- they had a significant history of pre-morbid psychiatric problems; or
- they had a diagnosis of frontotemporal dementia [18]; or
- if deficits in short-term memory were not the primary cause of disability.

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<sup>1</sup> ISRCTN54996662

<sup>2</sup> REC reference: 14/EE/1135; IRAS reference: 161394; permission given on 25/01/2015; minor amendments approved on 11/05/2015 and 19/08/2015.

### ***Participant flow***

After screening, 29 participants entered the experiment (Figure 1). Sixteen participants were randomized to the nostalgia arm and 13 to the ordinary-memory arm. One participant in each arm was excluded, because they scored below the cut-off for cognitive functioning (a MoCA score of less than 12), leaving 15 participants in the nostalgia arm and 12 in the ordinary-memory arm.

### ***Nostalgia induction***

Following procedures used extensively in prior research with non-clinical populations [19, 20, 21, 22 and 23], participants were asked to recall either a nostalgic event or an ordinary (i.e., regular) event. In the nostalgia arm, participants received the following instructions:

“According to the New Oxford English Dictionary, nostalgia is defined as a ‘sentimental longing for the past.’ Please bring to mind a nostalgic event in your life. Specifically, try to think of a past event that makes you feel most nostalgic. Bring this nostalgic experience to mind. Immerse yourself in the nostalgic experience. How does it make you feel? Please spend a couple of minutes thinking about how it makes you feel. Please describe this nostalgic event (i.e., describe the experience).”

In the control condition, participants received the following instructions:

“According to the New Oxford English Dictionary, an ordinary event is ‘an event with no special or distinctive features’. Please bring to mind an ordinary event in your life. Specifically, try to think of a past event that is ordinary. Bring this ordinary experience to mind. Immerse yourself in the ordinary experience. How does it make you feel? Please spend a couple of minutes thinking about how it makes you feel. Please describe this ordinary event (i.e., describe the experience).”

***Outcome measures***

After the experimental manipulation of nostalgia, participants completed a manipulation check and a measure of psychological resources. They were repeatedly prompted to keep the corresponding memory (nostalgic or non-nostalgic) in mind. The manipulation check [24] assessed in-the-moment nostalgia with three items (“*Right now, I am feeling quite nostalgic*”; “*Right now, I am having nostalgic feelings*”; “*I feel nostalgic at the moment*”). Items were rated on a 6-point scale (1 = *strongly disagree*, 6 = *strongly agree*). We assessed psychological resources with the State Functions of Nostalgia Scale (SFNS). This is a 24-item scale, which assesses six psychological resources (four items each): self-esteem (e.g., “*I feel good about myself*”); self-continuity (e.g., “*I feel connected with my past*”); social connectedness (e.g., “*I feel connected to loved ones*”); meaning in life (e.g., “*I feel life is meaningful*”); optimism (e.g., “*I feel optimistic about my future*”), and positive and negative affect (e.g., “*I feel happy*” and “*I feel sad*”). Items were rated on a 6-point scale (1 = *strongly disagree*, 6 = *strongly agree*), with each item being prefixed by the phrase “*Now that I have this event in mind ...*”. The SFNS has been used in previous studies of nostalgia [20] and has been validated [24].

***Statistical analysis***

Data were recorded and analyzed using SPSS version 22. A series of one-way analyses of variance (ANOVAs) was used to examine the effect of nostalgia (vs. control) on psychological resources. Supplemental analyses of covariance (ANCOVAs) were used to adjust for the influence of sex and age on these comparisons.

**RESULTS AND DISCUSSION*****Demographic and clinical characteristics***

Demographic and clinical characteristics are shown in Table 1. Apart from one participant, who was from another White background, all participants were White British.



There were significantly more females in the nostalgia arm than the ordinary-memory arm,  $\chi^2(1) = 4.636, p = 0.031$ . The two arms did not differ significantly on any of the other demographic or clinical characteristics.

### ***Manipulation check***

We present descriptive and inferential statistics in Table 2. The manipulation check confirmed that the nostalgia induction had been successful. Participants in the nostalgia arm reported feeling significantly more nostalgic than those in the ordinary-memory arm.

### ***Psychological resources***

Participants in the nostalgia arm reported significantly higher levels of social connectedness, meaning in life, self-continuity, optimism, and positive affect than did those in the ordinary-memory arm. Although participants in the nostalgia arm also reported higher levels of self-esteem, this difference was not statistically significant. Finally, the effect of nostalgia on negative affect was not statistically significant (Table 2). Controlling for age and sex in ANCOVAs did not change the pattern of significant/non-significant results, with one exception: the previously significant nostalgia effect on positive affect was rendered marginal,  $F(1, 23) = 3.47, p = 0.075$ , partial  $\eta^2 = 0.131$ . Experiment 1 thus offers preliminary evidence that the psychological benefits of nostalgia (vs. control) generalize to people with dementia.

## **EXPERIMENT 2**

In Experiment 2, we used an alternative nostalgia induction to corroborate our initial findings and thereby establish convergent validity [25]. Music is a powerful trigger of nostalgia and has been used to induce this emotion in studies with non-clinical populations [25, 26]. Music may be particularly suitable for inducing nostalgia among individuals with Alzheimer's disease, because it triggers self-defining memories [27] that are more specific, are accompanied by more emotional content, and are retrieved faster [28]. Furthermore, musical memories tend

to be well preserved in Alzheimer's disease [29]. Accordingly, we extended a validated procedure to induce music-evoked nostalgia in people living with dementia.

## **MATERIALS AND METHODS**

Experiment 2 replicated Experiment 1, with the exception of the randomization method and nostalgia induction.

### ***Participants and design***

Experiment 2 was a parallel randomized controlled trial with two arms and an allocation ratio of 1:1, testing the effect of music-evoked nostalgia (compared to control) on psychological resources. Recruitment method and inclusion/exclusion criteria were identical to Experiment 1. Participants were randomly allocated to one of two arms: nostalgia or control. The process of randomization and yoking used was identical to previous studies of music-evoked nostalgia [21, 30]. Participants were recruited into the experiment in pairs, with one person in each pair being randomly assigned to the nostalgia arm and the other to the control arm. At the time of recruitment, participants were asked to provide three of their favorite nostalgic songs. The participant who was randomly allocated to the nostalgia arm subsequently listened to one of his or her favorite, nostalgic songs. The identical song was also played to the yoked participant in the control arm. Thus, whereas both participants listened to the same piece of music, it had only been identified as a nostalgic trigger for one of them. Allocation to the nostalgia or control condition was carried out by RC, ensuring that the researcher (SI) was blind to allocation. Blinding was further maintained through a sealed envelope procedure. Participants listened to music through headphones. Participants in both the nostalgia and control arms received the following instructions:

“Please listen to this song through the audio device provided. Please immerse yourself in this song. Please spend 2 minutes thinking about how it makes you feel. Please

describe any past event or experience associated with this music you have just listened to (i.e., describe the experience)”.

### ***Participant flow***

Thirty-two eligible individuals agreed to take part in the experiment, with 17 being randomly allocated to the nostalgia arm and 15 to the control arm (Figure 2). One participant in each arm was excluded, because they scored below the cut-off point for cognitive functioning. In the nostalgia arm, one participant fell ill prior to the research appointment and was unable to take part. A total of 15 participants in the nostalgia arm and 14 in the control arm completed the experiment.

## **RESULTS AND DISCUSSION**

### ***Demographic and clinical characteristics***

There were no significant differences in the demographic or clinical characteristics between participants in the nostalgia and control arms (Table 3). All participants self-identified as being White-British or from other White backgrounds.

### ***Manipulation check***

The music-evoked nostalgia induction was successful. Participants in the nostalgia arm reported feeling significantly more nostalgic than did those in the control arm (Table 4).

### ***Psychological resources***

Participants in the nostalgia (compared to control) arm reported significantly higher levels of social connectedness, self-esteem, meaning in life, self-continuity, and optimism. Although there was a trend toward higher positive affect among participants in the nostalgia (than control) arm, this difference was not statistically significant. Finally, as in Experiment 1, the effect of nostalgia on negative affect was not significant (Table 4). Controlling for age and sex in ANCOVAs did not change the pattern of significant/non-significant results.

Experiment 1 revealed that the beneficial effects of nostalgia generalize to people with

dementia. Experiment 2 replicated these findings with a different induction that harnessed music's capacity to evoke nostalgia, thereby providing vital convergent validation.

### **EXPERIMENT 3**

To advance this line of research and investigate further its clinical relevance to the care of people with dementia, Experiment 3 examined whether the boost in psychological resources provided by nostalgia lends individuals with dementia the resilience to assimilate self-referent information about their illness. It is often assumed that a key reason why people affected by a diagnosis of dementia are sometimes unaware of their illness is that the disease has affected their cognitive abilities. However, motivational, self-protective factors may also be at play [30, 31]. A 2016 opinion poll in the UK<sup>3</sup>, for instance, showed that people were more frightened of getting dementia as they grew older than they were of dying. One possibility is that, because the prospect of developing dementia is so frightening, people diagnosed with dementia avoid thinking about the illness and do not attend to dementia-related information. It is possible, therefore, that nostalgia, by fortifying psychological resources, can promote the processing of self-referent dementia-related information and help people to remember more information about their illness. Such a process could improve delivery of illness-related information by providing a framework through which group support/therapy is facilitated [32] or people are helped to assimilate the diagnosis [33].

Experiment 3 tested three primary hypotheses. First, we sought to replicate the findings of Experiments 1-2 and, accordingly, predicted that nostalgia would boost psychological resources by increasing social connectedness, self-esteem, self-continuity, meaning in life, optimism, and positive (but not negative) affect. Second, we hypothesized that nostalgia would facilitate the recall and recognition of dementia-related information. Third, we formulated the

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<sup>3</sup> <https://www.saga.co.uk/newsroom/press-releases/2016/may/older-people-fear-dementia-more-than-cancer-new-saga-survey-reveals.aspx>

mediational hypothesis that nostalgia would improve recall and recognition of dementia-related information by virtue of its capacity to boost psychological resources. That is, increased psychological resources would mediate the beneficial nostalgia effect on recall and recognition of dementia-related information.

Experiment 3 also had two supplementary objectives. The first pertained to the valence of dementia-related information. In a previous study [34], a list of 24 dementia-related statements was created, half of which were rated as relatively negative (e.g. “*The illness means that you may forget the names of family and friends*”) with the other half being rated as relatively positive (e.g. “*Even with the illness you can be reassured*”). In Experiment 3, we used these statements to examine if nostalgia differentially influenced the recall and recognition of, respectively, negative and positive dementia-related information. One possibility is that the nostalgia effect would be more pronounced for recall and recognition of negative than positive dementia-related information because the former demands more psychological fortitude (which nostalgia provides). Our second supplementary objective concerned psychological distress. We propose that nostalgia lends the fortitude to assimilate dementia-related information without producing a concomitant increase in psychological distress. To ascertain this, we tested if recall and recognition of dementia-related statements were associated with increased negative affect and/or decreased positive affect.

## **MATERIALS AND METHODS**

The study protocol was registered<sup>4</sup> and received both site<sup>5</sup> and ethical approval<sup>6</sup>.

### ***Participants and design***

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<sup>4</sup> ISRCTN 78958013

<sup>5</sup> From BANES CCG R&D department

<sup>6</sup> NHS ethical approval was received from East of Scotland Research Ethics Service (EoSRES) on the 30<sup>th</sup> August 2016 (REC ref: 16/ES/0097) and University of the West of England (UWE) ethics approval on 9<sup>th</sup> September 2016 (ref: HAS.16.07.181).

The experiment was a parallel randomized controlled trial with an allocation ratio of 1:1. Participants were recruited through the RICE memory clinic and were interviewed either at the clinic or in their own homes. The nostalgia induction was identical to Experiment 1. As in previous experiments, a sealed envelope procedure was used to conceal allocation prior to entry into the experiment.

### ***Participant flow***

After screening, 50 participants entered the experiment (Figure 3), with half being randomized to the nostalgia arm and half to the ordinary-memory (control) condition.

### ***Outcomes***

At the start of the procedure and before the nostalgia induction, participants completed the Geriatric Anxiety Inventory or GAI [35] to assess anxiety, the 15-item version of the Geriatric Depression Scale or GDS [36] to measure depression, and Addenbrooke's Cognitive Evaluation or ACE III [37] to index cognitive functioning. Following the nostalgia induction, participants first completed a manipulation check and then the SNFS to assess self-reported psychological resources. Finally, in order to assess whether mood changed as a result of completing the recall of dementia-related statements, participants completed a measure of positive and negative affect (the Positive and Negative Affect Schedule or PANAS) [38] twice: prior to the nostalgia/ordinary memory manipulation (T1) and then again after the memory test (T2). The PANAS includes 10 items assessing positive affect (PA; e.g., "interested," "enthusiastic") and 10 items assessing negative affect (NA; e.g., "distressed," "scared"). Participants rated how much they were experiencing each emotion "right now" (1 = *not all*, 5 = *very much*).

### ***Recall and recognition of dementia-related statements***

In a previous study [34], a list of 24 dementia-related statements were created, with half being rated as relatively negative and the other half as relatively positive. These 24 self-referent

statements about dementia were read out to participants in four groups of six statements with each group of statements containing the same number of relatively negative and relatively positive statements. Specifically, before the statements were read out, participants imagined that the statements were about a real illness, and that this illness affected them. After each of the four groups of statements was read out, participants recalled as many of the six statements that they had just heard as they could. After the 24 statements were presented, there was a 2-minute distracter task before participants completed a recognition test, which consisted of 48 statements: the 24 statements participants had previously heard and an additional 24 control statements. The control statements included items such as: “*The chances of you developing the illness increases with age*” and “*The illness may mean that you forget where you have put something*”.

### ***Data analysis***

We proposed that nostalgia, by boosting psychological resources, strengthens the assimilation of self-referent dementia-related information and, by so doing, helps people to remember more information about their illness. If this is the case, psychological resources should account for (i.e., mediate) the effect of nostalgia on increased recall and recognition [39]. To test this hypothesis, we carried out a series of mediational analyses. The well-documented limitations of mediation analyses include the reverse-causality and third-variable problem [40]. The reverse-causality problem entails that, because both mediator (psychological resources) and outcome (recall and recognition) are measured variables, one cannot rule out the possibility that the outcome causes the mediator (rather than the reverse). The third-variable problem means that the relation between mediator and outcome could be due to one or more unmeasured variable(s). Nevertheless, we regard the mediation analyses as informative, because they placed our hypotheses at risk [41]. For example, failure to detect a positive indirect effect of nostalgia on recall/recognition via psychological resources would count

against our hypothesis. Following advances in mediation analyses [42], we focused on the indirect effects of nostalgia on recall and recognition via psychological resources (rather than on the distinction between partial vs. complete mediation). By using the term *indirect effect*, we adopted the terminology of intervening variable models and do not claim support for causal effects. To test the indirect effects, we carried out bootstrapping analyses (10,000 resamples) with Hayes' PROCESS macro [39, 43].

## RESULTS

### *Demographic and clinical characteristics*

All participants identified themselves as White British, except for one participant in the nostalgia condition, who identified themselves as Chinese. We found no significant differences between the two conditions on demographic or clinical characteristics (Table 5). Furthermore, controlling for age and sex in ANCOVAs did not change the pattern of significant/non-significant results reported below.

### *Manipulation check*

We present descriptive and inferential statistics in Table 6. The nostalgia manipulation was effective. As intended, the manipulation check indicated that participants in the nostalgia condition felt significantly more nostalgic than those in the control condition.

### *Psychological resources*

Compared to participants in the control condition, participants in the nostalgia condition reported significantly higher levels of social connectedness, meaning in life, self-continuity, self-esteem, optimism, and positive affect. Participants in the nostalgia condition (compared to control) also scored significantly lower on negative affect (Table 6).

### *Recall of dementia-related information*

Results revealed that participants in the nostalgia (compared to control) condition recalled significantly more dementia-related statements (Table 6). In a previous study [34], 12



of the 24 dementia-related statements presented in the current experiment were rated as relatively negative (e.g. “*The illness means that you may forget the names of family and friends*”) and 12 statements were rated as relatively positive (e.g. “*Even with the illness you can be reassured*”). As a supplementary objective, we examined whether nostalgia differentially influenced recall of negative and positive dementia-related information, respectively. We calculated average recall scores for negative and positive dementia-related statements and entered these two recall scores in a 2 (condition: nostalgia vs. control)  $\times$  2 (statement valence: negative vs. positive) mixed ANOVA, treating statement valence as a within-subject variable. This analysis revealed that the beneficial effect of nostalgia (vs. control) on recall of dementia-related statements was not qualified by statement valence: the Condition  $\times$  Statement Valence interaction was not significant,  $F(1, 48) = 1.93, p = 0.171$ . (The significant main effect of nostalgia in this analysis is identical to the nostalgia effect reported in Table 6.)

We also coded recall errors. A valence reversal error occurs when the recalled statement reverses or negates the meaning of the original statement that has just been read out (e.g., when the statement “*your illness is a progressive disease*” is recalled as “*the illness does not mean that I will get progressively worse*”). A repetition error occurs when participants recall a statement from a previous set, thinking it had just been read out. The majority of participants ( $n = 34, 68\%$ ) made zero errors, and a small number ( $n = 9, 14\%$ ) made 69% of all errors (20/29). We analysed the total error count in a Poisson regression with adjustment for overdispersion. Participants in the nostalgic condition ( $M = 0.36, SD = 0.76$ ) made fewer errors than those in the control condition ( $M = 0.80, SD = 1.29$ ), but the difference was not significant,  $\chi^2(1) = 2.15, p = .142$ . In a fine-grained analysis, we distinguished between self-protective (valence reversal of negative statement, repetition of positive statement) and self-threatening (valence reversal of positive statement, repetition of negative statement) errors. Nostalgia did not affect the frequency of either self-protective ( $\chi^2[1] = 1.68, p = .195$ ) or self-

threatening ( $\chi^2[1] = 0.64, p = .424$ ) errors. These null results should be interpreted with caution due to the low number of errors, almost all of which were committed by just a few participants.

### ***Recognition of dementia-related information***

Following previous research [34, 44], we used Signal Detection Theory to analyze the recognition data. We calculated a discrimination index ( $d'$ ) by subtracting the ratio of false positives (or False Alarms) from the ratio of correct positive responses (or Hits). This index corrects for potential response bias (e.g., a participant identified all 48 items as having been in the original list of words). Participants in the nostalgia condition (compared to control) evinced better recognition, as indicated by a significantly higher  $d'$  index (Table 6). To examine whether nostalgia improved recognition more for negative than positive dementia-related statements, we calculated separate discrimination indexes for negative and positive statements, respectively. A 2 (condition: nostalgia vs. control)  $\times$  2 (statement valence: negative vs. positive) mixed ANOVA revealed that the beneficial effect of nostalgia (vs. control) on recognition of dementia-related statements was not qualified by statement valence: the Condition  $\times$  Statement Valence interaction was not significant,  $F(1, 48) = 0.00, p = 1.000$ . (The significant main effect of nostalgia in this analysis is identical to the nostalgia effect reported in Table 6.)

### ***Mediation analyses***

Nostalgia improved both recall and recognition of self-referent dementia-related statements, regardless of whether these statements were relatively negative or positive. As our next step, we used Hayes's PROCESS macro (model 4; 10,000 resamples) to test the indirect effect of nostalgia (compared to control) on recall and recognition via the psychological resources assessed by the SFNS (social connectedness, meaning in life, self-continuity, self-esteem, optimism, positive affect, negative affect). We did not test indirect effects via T1 PANAS measures (because they preceded the nostalgia manipulation) or T2 PANAS measures

(because they followed the recall and recognition tasks). We present the results of the mediational analyses in Table 7. We found a significant indirect effect of nostalgia (compared to control) on recall via increased positive affect (SFNS). Nostalgia increased positive affect, which, in turn, was associated with better recall of dementia-related words. We repeated these mediational analyses for recognition ( $d^1$ ) and found a significant indirect effect of nostalgia (compared to control) on recognition via meaning in life. Nostalgia increased meaning in life, which then predicted better recognition of dementia-related words (indexed by  $d^1$ ).

### ***Model fit and alternative models***

We first assessed fit of the mediational model for recall. We trimmed the direct path from nostalgia (compared to control) to recall and calculated fit indices for the resultant non-saturated path model (nostalgia  $\Rightarrow$  positive affect  $\Rightarrow$  recall). This model provided excellent fit,  $\chi^2(1) = 0.01, p = .903, RMSEA = .00, CFI = 1.00$ . We also tested an alternative model, in which recall preceded positive affect (nostalgia  $\Rightarrow$  recall  $\Rightarrow$  positive affect). This model had poor fit,  $\chi^2(1) = 34.07, p < .001, RMSEA = .82, CFI = .38$ . Within a set of models for the same data, the Akaike Information Criterion (AIC) can be used to compare competing models that need not be nested (smaller is better). AIC was smaller for our proposed model (10.01) than for the alternative (44.07). Next, we repeated these steps to test the proposed mediational model for recognition (nostalgia  $\Rightarrow$  meaning  $\Rightarrow$  recognition) and its alternative (nostalgia  $\Rightarrow$  recognition  $\Rightarrow$  meaning). The proposed model had excellent fit ( $\chi^2[1] = 0.36, p = .550, RMSEA = .00, CFI = 1.00$ ) but the alternative model did not ( $\chi^2[1] = 42.56, p < .001, RMSEA = .92, CFI = .36$ ). AIC was smaller for the proposed (10.36) than the alternative (52.56) model. These findings further support the hypothesis that nostalgia increases recall and recognition of dementia-related information by boosting psychological resources.

### ***Change in positive and negative affect***

As nostalgia increased recall and recognition of self-referent dementia-related statements, we addressed the possibility that this produced psychological distress, in particular an increase in negative affect. We administered the PANAS at two time points: prior to the nostalgia manipulation (T1) and after the recall and recognition tasks (T2). The PANAS includes PA and NA subscales, which we analyzed separately. First, we entered PA scores as dependent variables in a 2 (condition: nostalgia vs. control)  $\times$  2 (time: T1 vs. T2) mixed ANOVA, treating time as a within-subjects variable. Results revealed a significant Condition  $\times$  Time interaction,  $F(1, 48) = 6.93, p = 0.011$ . In general, PA was significantly higher after than before the recall and recognition tasks, but this increase in PA was larger in the nostalgia arm,  $F(1, 24) = 17.98, p < 0.001$ , than in the control arm,  $F(1, 24) = 3.07, p = 0.093$  (Table 6). Next, we entered NA scores in a 2 (condition: nostalgia vs. control)  $\times$  2 (time: T1 vs. T2) mixed ANOVA. This analysis yielded no significant effects,  $F_s(1, 48) < 2.76, p_s > 0.103$ . NA levels were very low both prior to the nostalgia manipulation and after the recall and recognition tasks (Table 6).

In all, we showed that PA (but not NA) was higher at the end than at the start of the experiment, particularly in the nostalgia arm. This suggests that the increased recall and recognition of dementia-related statements in the nostalgia arm did not heighten psychological distress. To corroborate this conclusion, we calculated change scores by subtracting T1 from T2 affect ratings. Recall of dementia-related statements was positively associated with change over time in PA ( $r[50] = .29, p = .044$ ) and negatively associated (marginally) with change over time in NA ( $r[50] = -.26, p = .069$ ). Recognition scores ( $d^1$ ) were also positively associated with change in PA ( $r[50] = .33, p = .021$ ) but were unrelated to change in NA ( $r[50] = -.03, p = .846$ ). These results ascertain that neither recall nor recognition of dementia-related statements heightened psychological distress. On the contrary, recall and recognition were

associated with *increases* in PA. Recall, but not recognition, was also associated with *decreases* in NA.

## DISCUSSION

Experiment 3 provided further evidence that a brief nostalgia induction boosts self-reported psychological resources in people with dementia. Benefitting from a larger sample than in the first two experiments, the nostalgia effect was statistically significant for each of the psychological resources we assessed (except negative affect). In addition, prior reflection on a nostalgic (compared to ordinary) autobiographical event significantly improved both the recall and the recognition of the self-referent dementia-related statements. Importantly, the beneficial effect of nostalgia on recall and recognition of potentially unsettling information about one's illness did not come at the expense of increased distress.

Experiment 3 also examined, as a supplemental objective, whether nostalgia differentially influenced the recall and recognition of, respectively, negative and positive dementia-related information. We speculated that the nostalgia effect could be more pronounced for recall and recognition of negative than positive dementia-related information because the former demands more psychological fortitude. Although this prediction was not supported, we think it would be premature to entirely abandon it. Perhaps negative statements were particularly memorable because they were consistent with the pervasive negative schema of dementia [45, 46]. Indeed, overall recall was *better* for negative ( $M = 3.44$ ) than positive ( $M = 1.66$ ) statements, and schema-based memory for negative information may have attenuated the nostalgia effect.

We proposed that, by virtue of its capacity to boost psychological resources, nostalgia gives individuals the fortitude to assimilate self-referent dementia-related information, resulting in higher recall and recognition. The mediation analyses provided preliminary support for this hypothesis. Specifically, results revealed a double dissociation [47]. Whereas positive

affect mediated the effect of nostalgia on recall but not its effect on recognition, meaning in life mediated the effect of nostalgia on recognition but not its effect on recall. The relative independence of recall and recognition was further demonstrated by their modest correlation,  $r(50) = 0.22, p = 0.134$ . These findings are consistent with the notion that recognition memory rests on two independent processes (recollective and familiarity detection), only one of which (recollective) depends on episodic memory [48, 49]. Although in need of replication, initial evidence for the role of positive affect and meaning in life in mediating nostalgia's beneficial effect on, respectively, recall and recognition can serve as roadmap for future research.

### RESEARCH SYNTHESIS

An important limitation of Experiments 1-3 is their relatively small sample size and the resultant low statistical power. To address this, we synthesized the results of these experiments with IDA [12]. In IDA, one combines the raw data from a set of relevant studies and estimates effects in the aggregated sample [50, 51, 52]. This approach is also known as individual patient data analysis [53] or mega-analysis [54]. IDA has several advantages over traditional meta-analysis of summary statistics drawn from multiple studies, including increased statistical power [55]. The statistical power afforded by IDA enabled us to correct for multiple comparisons. The necessity of correcting for multiple comparisons to control Type I error has been challenged on the grounds that it reduces statistical power and, hence, inflates Type II error [13]. This concern is particularly pertinent in studies that already have low statistical power, which is why we did not implement a correction in Experiments 1-3. However, IDA effectively solved this problem, allowing us to balance Type I and Type II error control. A recent review of several multiple-comparison methods demonstrated that the classical Bonferroni procedure adequately controls both family-wise and per-family Type I error rates [56]. Accordingly, we selected this procedure to control for multiple comparisons ( $\alpha = .05 / 7 = .007$ ).

We used fixed-effects IDA (rather than random-effects IDA), because (1) the number of experiments was insufficient to allow for the reliable estimation of random effects, with 20 to 30 independent samples often being viewed as a minimum [57], and (2) our experiments could not be meaningfully viewed as random draws from a homogenous population of studies given the implementation of a distinctly different nostalgia induction in Experiment 2. In fixed-effects IDA, study membership is simply included as a fixed characteristic of each observation in the aggregated sample ( $N = 106$ ). Accordingly, we ran a series of 2 (condition: nostalgia vs. control)  $\times$  3 (experiment) ANOVAs with the seven psychological outcomes assessed by the SFNS as dependent variables. Table 8 presents the results of these analyses.

We found significant ( $p < .007$ ) and large effects of condition on all positive psychological resources: nostalgia (compared to control) increased social connectedness, meaning in life, self-continuity, self-esteem, optimism, and positive affect. Consistent with prior research in non-clinical samples, nostalgia did not significantly influence negative affect [3]. Results further indicated significant differences between experiments. Inspection of Tables 2, 4, and 6 shows that mean ratings tended to be higher in Experiments 1 and 3 (which involved narrative recall) than in Experiment 2 (which involved musical stimuli). A planned contrast indeed revealed that participants who recalled an autobiographical event (Experiments 1 and 3 pooled) scored significantly ( $p < 0.007$ ) higher than those who listened to music (Experiment 2) on social connectedness and meaning in life. Crucially, none of the Condition  $\times$  Experiment interactions were significant and associated effect sizes were small, indicating that there was little variation across experiments in the magnitude of nostalgia's beneficial effect on psychological resources.

## GENERAL DISCUSSION

### *Summary of findings*

Our results demonstrate that nostalgia enhances psychological resources and improves the recall and recognition of self-referent dementia-related information. In particular, two key findings emerged from these experiments. First, nostalgia builds the psychological resources of people with dementia. On some occasions, however, we failed to find statistically significant differences between the nostalgia and control arms on self-esteem (Experiment 1) and positive affect (Experiment 2). The most plausible explanation for this is that it reflects the relatively smaller sample sizes involved. Indeed, when we used IDA to synthesize our findings and increase statistical power, results revealed a highly robust effect of nostalgia on each of the assessed psychological resources (except negative affect, which was uniformly low across experiments). These beneficial effects of nostalgia are consistent with previous investigations among non-clinical populations [3, 10, 58, 59].

Our second key finding is that nostalgia improved recall and recognition of self-referent dementia-related information. Among non-clinical populations, research has documented motivated forgetting of negative self-referent material [60]. The aim of Experiment 3 was to test whether a nostalgia induction would act to improve recall of self-referent dementia-related material without producing distress by doing so. Compared to the control condition, nostalgia significantly improved both the recall and the recognition of the dementia-related statements. At the same time, this improved recall and recognition dementia-related material did not reduce PA or increase NA (as assessed by PANAS). In fact, PA was higher at the end than at the start of Experiment 3, and this increase over time in PA was strongest for nostalgic participants. NA did not change over time but, at the end of the experiment, NA was marginally lower in the nostalgia (compared to control) arm. Clearly, the increased recall and recognition of dementia-related statements in the nostalgia arm did not trigger distress.

Preliminary evidence suggests that nostalgia facilitated recall of self-referent dementia-related statements via positive affect, and improved recognition of those statements by



elevating meaning in life. Yet, our data do not speak to the precise mechanisms by which positive affect facilitates recall, improves recognition, or elevates meaning in life. Furthermore, any causal inferences are constrained by the inherent limitations of measurement-of-mediation designs (i.e., reverse causality, third variables). Nonetheless, our finding of different mediational mechanisms for recall and recognition is consistent with a large body of research that suggests the presence of two separate, but interlinked, structures and processes [49].

Whereas recall relies on episodic memory, recognition memory also draws on the detection of familiarity [48]. Moreover, patterns of recognition and recall deficits in people with dementia vary according to diagnosis, indicating that neurological damage impacts differently on these two separate processes [61, 62, 63]. The present findings provide an informative starting point for future research aimed at identifying the exact processes by which nostalgia improves recall and recognition.

We recognize that our study has a number of limitations. For instance, in Experiments 1 and 2, we recruited from a number of different sites, each of which used different methods of assessing cognitive functioning. Consequently, we only report general levels of impairment for these two studies. We did, however, remedy this design flaw in Experiment 3, in which cognitive functioning was assessed using a single measure and which showed that there was no difference in cognitive functioning the two conditions.

Nevertheless, the three experiments reported here are amongst the first to use a research paradigm that although established within social psychology, is novel within both clinical psychology and the dementia literature. In addition to the conceptual advances that we have sketched above, these techniques have several methodological advantages. In particular, we were able to utilize established research procedures with high levels of internal validity, thus minimizing the risks of systematic bias, as a result of selection, detection, and attrition [64]. As such, we argue that these procedures can be adopted widely for addressing the impact of

manipulated variables on participants' behaviour: we manipulated nostalgia, assessed psychological resources, and examined the extent to which enhanced resources account for recall and recognition of dementia-related statements.

### ***Broader implications***

The deficit in autobiographical memory associated with Alzheimer's disease is well-established [65, 66]. This is thought both to induce a diminished sense of self and identity [67] and to compromise auto-noetic consciousness (i.e., the ability to mentally transport oneself back in subjective time to relive past events). However, while people with Alzheimer's disease have reduced levels of auto-noetic functioning, nevertheless they highly value their remaining capacity to relive autobiographical experiences [68]. At the same time, people with mild levels of Alzheimer's can reliably experience other phenomenological features (i.e., emotion and importance) of autobiographical recall [69].

Given that a fundamental aspect of nostalgia is the bittersweet emotional quality associated with bringing to mind and reliving a past event, the series of experiments reported here may pertain to the discrepancy between a deficit in auto-noetic functioning and the high value placed upon it by people with Alzheimer's disease [68]. Thus, it may be especially important for people who live with dementia to draw on nostalgic experiences to boost their psychological resources. In doing so, they enlist their remaining auto-noetic capacity to relive aspects of the past that enhance their self-esteem, provide life with a greater sense of meaning, facilitate a connection with the emotionally significant people in their life, and afford a stronger sense of self-continuity and optimism.

This series of experiments also has implications for clinical practice. Whereas many dementia care services routinely use reminiscence as a clinical intervention, the research evidence for this is somewhat inconsistent [4]. One reason for the inconsistency may be that reminiscence habitually fails to distinguish between nostalgic and non-nostalgic memory. We

posit that such a distinction is important, because, as our experiments revealed, nostalgia boosts psychological resources and well-being in a way that recall of other, non-nostalgic memories does not. Moreover, as Experiment 2 demonstrated, nostalgia's ability to strengthen psychological resources can be triggered through music as well as through autobiographical recall. Indeed, although the IDA indicated slightly stronger overall effects for autobiographical recall than music, there may well be clinical advantages in using music. Music enhances the production of self-defining memories (27) that are more specific, are accompanied by more emotional content, and are retrieved faster (26) among participants with Alzheimer's disease. Furthermore, imaging studies have identified an overlap of brain regions involved in musical memory with areas that are relatively well preserved in Alzheimer's disease, which may explain the remarkable retention of musical memories in this disease [29].

### *Coda*

In three experiments, we adapted validated nostalgia interventions for the potential benefit of people with dementia. We obtained compelling evidence that the beneficial effects of nostalgia identified in non-clinical populations generalize to people with dementia. Nostalgia boosted self-reported psychological resources. Going beyond mere self-report, these psychological resources (specifically positive affect and meaning in life) in turn predicted clinically relevant outcomes: improved recall and recognition of self-referent dementia-related statements. Our findings, then, begin to shed light on the psychological mechanisms linking nostalgia to the assimilation of illness-related information. This is an important initial step toward finding new ways to improve the delivery of such information and, ultimately, help affected individuals to cope better with their illness.

### **ACKNOWLEDGEMENTS**

We would like to thank all those participants who gave their time and energy to take part in the three reported experiments. Experiments 1 and 2 were supported by a University of the West of England bursary, and Experiment 3 was funded by a small grant from Alzheimer's Research UK (ref: HAS-HSS-15-033). We would also like to thank the staff at the RICE memory clinic, and the R&D unit of Avon and Wiltshire Mental Health Partnership NHS Trust who supported this project - particularly Lauren Buckley, Charlotte Godwin, Abbie Jones, and Michelle Phillips.

### **Conflict of Interest Statement**

The authors have no conflict of interest to report.

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**Table 1**  
**Demographic and Clinical Characteristics in Experiment 1**

	Control	Nostalgia	Difference	<i>p</i>
	<i>n</i> or <i>M</i> ( <i>SD</i> )	<i>n</i> or <i>M</i> ( <i>SD</i> )		
Age	77.42 (9.15)	78.60 (9.98)	$F(1, 25) = 0.10$	0.754
Sex				
Women	3	10	$\chi^2(1) = 4.64$	0.031
Men	9	5		
Living circumstances				
Alone	1	5	$\chi^2(3) = 4.44$	0.218
With partner	10	9		
With family	0	1		
Residential care	1	0		
Diagnosis				
Alzheimer's disease	6	9	$\chi^2(2) = 1.62$	0.445
Vascular dementia	2	4		
DLB	0	0		
Mixed	4	2		
Cognitive impairment				
Mild	6	6	$\chi^2(1) = 0.27$	0.603
Moderate	6	9		

*Note.* DLB = Dementia with Lewy Bodies.

**Table 2****Means and Standard Deviations for Outcome Variables as a Function of Nostalgia****Manipulation in Experiment 1**

	Control	Nostalgia			
	<i>M (SD)</i>	<i>M (SD)</i>	<i>F(1, 25)</i>	<i>p</i>	$\eta^2$
Manipulation check	2.53 (1.63)	5.62 (0.62)	46.24	< 0.001	0.649
Social connectedness	3.23 (1.19)	4.98 (1.10)	15.72	< 0.001	0.386
Meaning in life	3.63 (1.34)	5.50 (1.02)	17.01	< 0.001	0.405
Self-continuity	3.90 (1.32)	5.35 (0.82)	12.41	0.002	0.332
Self-esteem	4.10 (1.13)	4.98 (1.14)	4.03	0.056	0.139
Optimism	3.02 (1.38)	4.77 (1.30)	11.42	0.002	0.314
Positive affect	4.42 (1.44)	5.50 (1.05)	5.09	0.033	0.169
Negative affect	1.83 (1.27)	1.60 (0.95)	0.30	0.589	0.012

*Note.*  $\eta^2$  denotes proportion of variance accounted for by nostalgia manipulation.

**Table 3**  
**Demographic and Clinical Characteristics in Experiment 2**

	Control	Nostalgia	Difference	<i>p</i>
	<i>n</i> or <i>M</i> ( <i>SD</i> )	<i>n</i> or <i>M</i> ( <i>SD</i> )		
Age	75.14 (10.96)	77.67 (8.69)	$F(1, 27) = 0.48$	0.496
Sex				
Women	7	5	$\chi^2(1) = 0.83$	0.362
Men	7	10		
Living circumstances				
Alone	2	3	$\chi^2(2) = 0.17$	0.920
With partner	11	11		
With family	1	1		
Residential care	0	0		
Diagnosis				
Alzheimer's disease	9	8	$\chi^2(3) = 2.83$	0.419
Vascular dementia	1	4		
DLB	1	0		
Mixed	3	3		
Cognitive impairment				
Mild	8	6	$\chi^2(1) = 0.85$	0.356
Moderate	6	9		

*Note.* DLB = dementia with Lewy bodies.

**Table 4**

**Means and Standard Deviations for Outcome Variables as a Function of  
Nostalgia Manipulation in Experiment 2**

	Control	Nostalgia			
	<i>M (SD)</i>	<i>M (SD)</i>	<i>F(1, 27)</i>	<i>p</i>	$\eta^2$
Manipulation check	2.67 (1.45)	5.42 (1.11)	33.33	< 0.001	0.552
Social connectedness	2.29 (1.56)	4.61 (1.31)	18.93	< 0.001	0.412
Meaning in life	2.88 (1.91)	4.80 (1.46)	9.35	0.005	0.257
Self-continuity	2.84 (1.98)	4.85 (1.19)	11.13	0.002	0.292
Self-esteem	2.80 (1.88)	4.42 (1.43)	6.85	0.014	0.202
Optimism	2.48 (1.74)	3.83 (1.43)	5.25	0.030	0.163
Positive affect	4.00 (2.02)	5.20 (1.19)	3.86	0.060	0.125
Negative affect	1.54 (0.87)	1.83 (1.13)	0.63	0.435	0.023

*Note.*  $\eta^2$  denotes proportion of variance accounted for by nostalgia manipulation.



Table 5

## Demographic and Clinical Characteristics in Experiment 3

	Control	Nostalgia	Difference	<i>p</i>
	<i>n</i> or <i>M</i> ( <i>SD</i> )	<i>n</i> or <i>M</i> ( <i>SD</i> )		
Age	82.08 (5.67)	80.52 (8.78)	$F(1, 48) = 0.56$	0.459
Sex				
Women	10	15	$\chi^2(1) = 2.00$	0.157
Men	15	10		
Living circumstances				
Alone	6	8	$\chi^2(2) = 1.54$	0.462
With partner	19	16		
With family	0	1		
Cognition (ACE III)	74.08 (5.50)	74.96 (7.21)	$F(1, 48) = 0.24$	0.630
Depression (GDS)	1.40 (1.15)	2.28 (2.56)	$F(1, 48) = 2.46$	0.124
Anxiety (GAI)	0.84 (1.55)	1.64 (2.81)	$F(1, 48) = 1.55$	0.219
Diagnosis				
Alzheimer's disease	20	13	$\chi^2(3) = 4.75$	0.191
Vascular dementia	2	4		
DLB	0	1		
Mixed	3	7		

*Note.* DLB = dementia with Lewy bodies

**Table 6**  
**Means and Standard Deviations for Outcome Variables as a Function of**  
**Nostalgia Manipulation in Experiment 3**

	Control	Nostalgia			
	<i>M (SD)</i>	<i>M (SD)</i>	<i>F(1, 48)</i>	<i>p</i>	$\eta^2$
Manipulation check	2.58 (1.07)	5.61 (0.54)	160.24	< 0.001	0.769
Social connectedness	3.32 (1.00)	5.30 (0.67)	68.05	< 0.001	0.586
Meaning in life	4.01 (0.82)	5.78 (0.38)	94.70	< 0.001	0.664
Self-continuity	3.06 (0.76)	5.22 (0.63)	119.38	< 0.001	0.713
Self-esteem	3.05 (0.80)	5.10 (0.75)	86.95	< 0.001	0.644
Optimism	2.70 (0.82)	4.53 (1.07)	46.15	< 0.001	0.490
Positive affect	4.36 (0.78)	5.84 (0.47)	65.32	< 0.001	0.576
Negative affect	1.48 (0.60)	1.16 (0.37)	5.08	0.029	0.096
Recall	4.48 (1.19)	5.80 (1.91)	8.55	0.005	0.151
Recognition ( $d^1$ )	0.17 (0.14)	0.31 (0.13)	12.31	0.001	0.204
T1 PANAS PA	3.47 (0.64)	3.15 (0.70)	2.93	0.094	0.057
T2 PANAS PA	3.59 (0.66)	3.59 (0.65)	0.00	1.000	0.000
T1 PANAS NA	1.18 (0.28)	1.10 (0.17)	1.56	0.217	0.032
T2 PANAS NA	1.18 (0.29)	1.06 (0.10)	4.02	0.051	0.077

*Note.*  $\eta^2$  denotes proportion of variance accounted for by nostalgia manipulation. T1 = administered prior to nostalgia manipulation. T2 = administered after recall and recognition tasks. PANAS = Positive and Negative Affect Schedule. PA = positive affect. NA = negative affect.

Table 7

## Mediational Analysis of Recall and Recognition Outcomes in Experiment 3

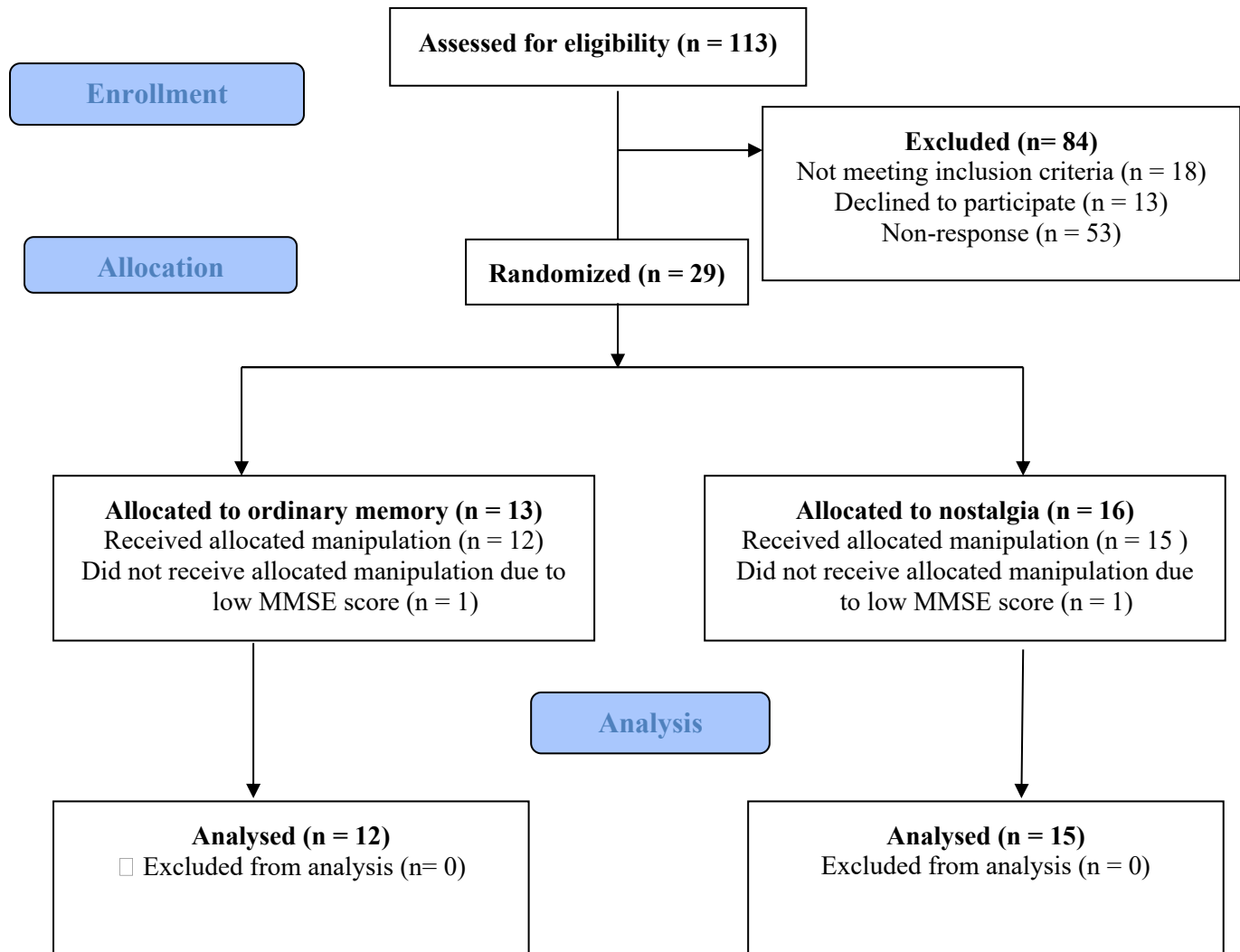
Mediator	Recall			Recognition ( $d^1$ )		
	<i>ab</i>	<i>SE</i>	95% CI	<i>ab</i>	<i>SE</i>	95% CI
Social connectedness	-0.01	0.24	[-0.50, 0.44]	-0.02	0.02	[-0.07 0.02]
Meaning in life	-0.20	0.32	[-0.83, 0.45]	0.05	0.03	[0.0002 0.11]
Self-continuity	0.47	0.28	[-0.05, 1.10]	0.00	0.02	[-0.04 0.05]
Self-esteem	0.45	0.23	[-0.02, 0.91]	0.01	0.03	[-0.05 0.06]
Optimism	0.04	0.20	[-0.33, 0.46]	0.02	0.02	[-0.01 0.06]
Positive affect	0.62	0.29	[0.06, 1.20]	0.02	0.03	[-0.04 0.07]

**Table 8****Fixed-Effects Integrative Data Analysis Results for the Aggregated Sample (Experiments 1-3): Analysis of Variance**

	Condition			Experiment			Condition × Experiment		
	$F(1, 100)$	$p$	$\eta^2_p$	$F(2, 100)$	$p$	$\eta^2_p$	$F(2, 100)$	$p$	$\eta^2_p$
Social connectedness	81.11	< 0.001	0.448	5.69	0.005	0.102	0.47	0.629	0.009
Meaning in life	63.96	< 0.001	0.390	7.81	< 0.001	0.135	0.05	0.955	0.001
Self-continuity	69.93	< 0.001	0.411	3.49	0.034	0.065	0.90	0.409	0.018
Self-esteem	41.45	< 0.001	0.293	4.48	0.014	0.082	2.21	0.116	0.042
Optimism	42.26	< 0.001	0.297	2.50	0.087	0.048	0.35	0.705	0.007
Positive affect	29.27	< 0.001	0.226	1.76	0.178	0.034	0.30	0.741	0.006
Negative affect	0.25	0.615	0.003	2.73	0.070	0.052	1.32	0.272	0.026

*Note.*  $\eta^2_p$  denotes partial proportion of variance accounted for by each effect, controlling for other effects in the model. Bonferroni-corrected  $\alpha = .050 / 7 = .007$ .

Figure 1: CONSORT flow chart illustrating recruitment to Experiment 1



**Figure 2: CONSORT flow chart illustrating recruitment to Experiment 2**

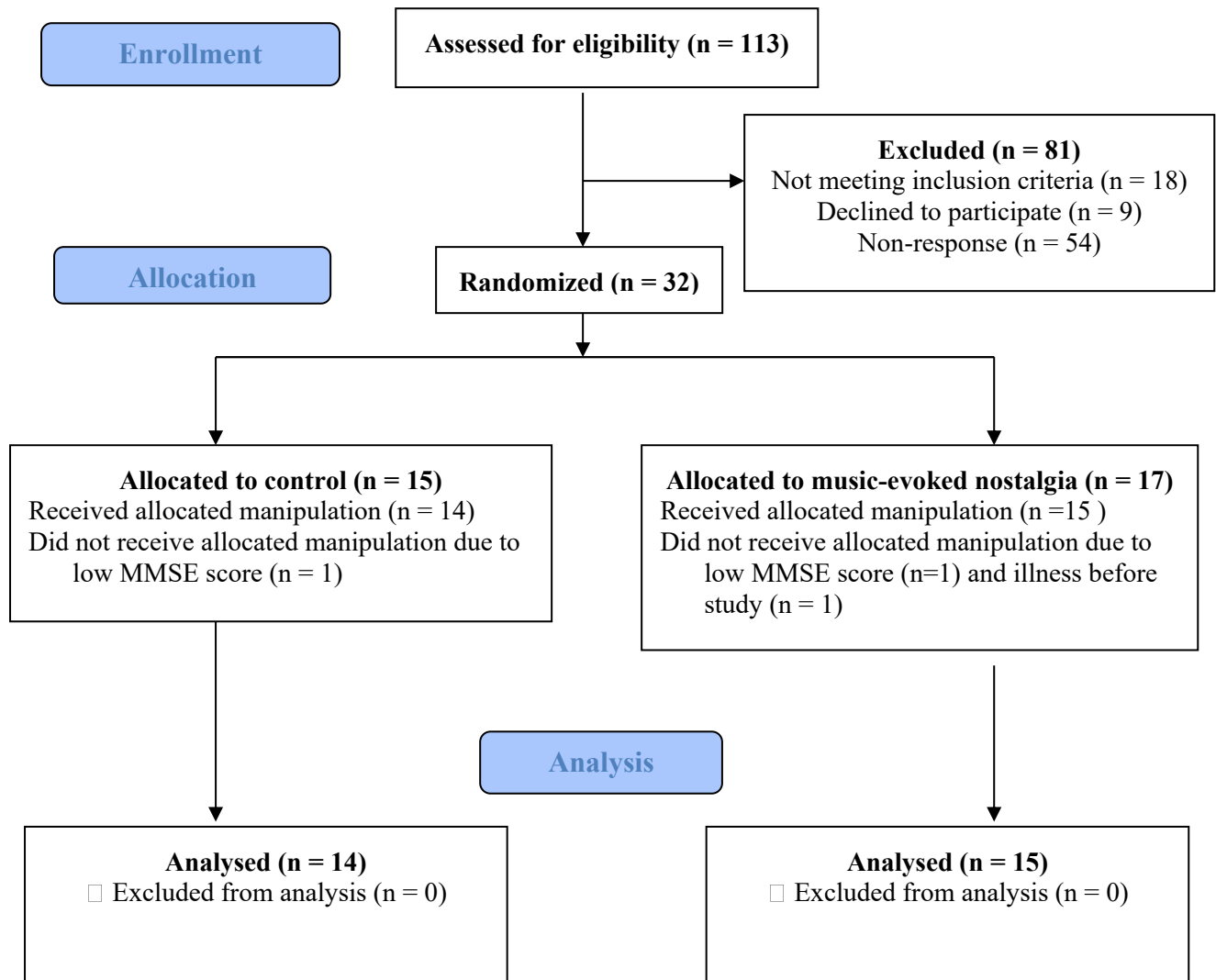


Figure 3: CONSORT flow chart illustrating recruitment to Experiment 3

