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Measuring implicit associations with behaviours to improve resident mood: development of implicit association tasks for nursing home care providers

Inge Knippenberg [a,b,*], Ruslan Leontjevas [a,b], Ine Declercq [a,b,c], Jacques van Lankveld [b], Debby Gerritsen [a]

[a] Department of Primary and Community Care, Radboud University Medical Center, Research Institute for Medical Innovation, Radboudumc Alzheimer Center, Geert Grooteplein 21, 6525 EZ Nijmegen, the Netherlands
[b] Faculty of Psychology, Open University of the Netherlands, Valkenburgerweg 177, 6419 AT, Heerlen, the Netherlands
[c] Department of Gerontology and Frailty in Ageing (FRIA) Research Group, Mental Health and Wellbeing (MENT) Research Group, Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussels, Belgium

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ABSTRACT

Objective: To develop and evaluate instruments for measuring implicit associations of nursing home care providers with behaviours aimed at improving resident mood.
Method: Study 1 ($N = 41$) followed an iterative approach to develop two implicit association tasks measuring implicit attitude (positive versus negative valence) and motivation (wanting versus not wanting) regarding mood-improving behaviours, followed by an evaluation of the content validity for target stimuli representing these behaviours. In Study 2 ($N = 230$), the tasks were assessed for stimulus classification ease (accuracy and speed) and internal consistency. A subsample ($n = 111$) completed additional questionnaires to evaluate convergent validity (with self-reported attitudes towards depression, altruism, and mood-improving behaviours), and discriminant validity (against social desirability), and repeated the tasks after 2 weeks to assess test-retest reliability.
Results: Content validity indexes for target stimuli were satisfactory. Error rates were acceptable for attribute stimuli, but exceeded the 10 % limit for target stimuli. Response times for all stimuli exceeded the 800-millisecond threshold. Both tasks demonstrated good internal consistency but poor test-retest reliability. Regarding convergent validity, both tasks significantly correlated with altruism, the implicit attitude task associated with self-reported mood-improving behaviours, and the implicit motivation task correlated with the behavioural scale of attitudes towards depression. Discriminant validity was supported as neither task was significantly associated with social desirability.
Conclusions: The implicit association tasks show potential for measuring implicit associations with mood-improving behaviours of care providers, offering an innovative pathway for exploring processes influencing caregiving behaviours. However, limitations in psychometric properties were identified, aligning with challenges observed in similar measures.

* Corresponding author at: Radboudumc, Geert Grooteplein 21, 6525 EZ Nijmegen, the Netherlands.
E-mail address: inge.knippenberg@radboudumc.nl (I. Knippenberg).

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What is already known

- Nursing home care providers play an important role in providing care and support to residents.
- Exploring automatic cognitive processes in caregiving behaviour may offer new insights into improving resident mood.
- Implicit association tasks can be used to explore automatic processes by measuring the relative strength of implicit associations between concepts.

What this paper adds

- We developed and evaluated two implicit association tasks to measure nursing home staff implicit associations with mood-improving behaviours for residents.
- These tasks provide an innovative approach for exploring automatic cognitive processes influencing caregiving behaviours.

1. Introduction

A nursing home offers a residential environment that provides functional support and care for individuals who need assistance with daily activities and who often have complex healthcare needs (Sanford et al., 2015). Within this environment, the role of professional nursing home care providers is paramount. Through their regular interaction with residents, care providers become an integral part of resident daily lives, potentially influencing resident mood and psychological well-being (Haugan et al., 2013; Lee et al., 2017). Addressing resident mood is important because a depressed mood affects a substantial portion of nursing home residents and is associated with reduced quality of life and increased mortality (Gilman et al., 2017; Sivertsen et al., 2015; Van Asch et al., 2013). While formal treatments such as antidepressant medication and psychotherapeutic interventions are important (Declercq et al., 2024; Burley et al., 2022), informal approaches may also contribute to supporting resident emotional well-being (Knippenberg et al., 2022). Although not categorized as formal therapeutic interventions, specific care provider behaviours can influence resident mood. For example, behaviours such as paying personal attention and fostering meaningful connections have been shown to positively affect the mood of residents (Haunch et al., 2023; Meeks and Looney, 2011). However, little is known about the automatic cognitive processes guiding these behaviours. Automatic cognitive processes refer to mental operations that occur rapidly and effortlessly, often beyond conscious awareness (Schneider and Chein, 2003). Shaped by past experiences and social influences, these processes impact routine actions and habits and contribute to the formation of preferences, thereby influencing behaviour (Aarts and Dijksterhuis, 2000; Ajzen and Fishbein, 2000). Exploring the automatic cognitive processes involved in care provider behaviours could provide novel insights into improving resident mood (Ferguson and Bargh, 2004).

Psychological theories, such as the integrated behavioural model emphasize the role of behavioural intentions in predicting and understanding behaviours (Montano and Kasprzyk, 2015). Attitudes towards specific behaviours are important determinants of these intentions, with contrasting evaluations (e.g., positive or negative, liking or disliking, good or bad) fostering either approach or avoidance behaviours (Elliot, 2013). At the level of automatic cognitive processing, these evaluations can be measured as implicit associations with the target of interest, reflecting the strength of the underlying connection (i.e., the implicit evaluation of the target) (Greenwald et al., 2002). While explicit evaluations can be measured via direct instruments (e.g., questionnaires or interviews), implicit evaluations require alternative approaches. Indirect instruments, such as the implicit association task and the implicit relational assessment procedure, offer promising methods for measuring these implicit evaluations (Bar-Anan and Nosek, 2014; Brownstein et al., 2019; Goodall, 2011). These instruments assess the strength of automatic associations by analysing behavioural response patterns. Faster responses to one pair of stimuli (e.g., positive attributes paired with an object) compared to another pair (e.g., negative attributes paired with the same object) indicate a stronger implicit association in memory between the object and a positive evaluation (Brownstein et al., 2019; De Houwer et al., 2009).

Previous researchers within the caregiving context have investigated implicit evaluations concerning various topics, such as depression (Kashihara and Sakamoto, 2018; Monteith and Pettit, 2011), dementia (Kane et al., 2020), and older adults (Liao et al., 2023; Maximiano-Barreto et al., 2019). However, these researchers have not specifically targeted the measurement of implicit evaluations of care provider behaviours associated with these topics. This is relevant because evaluations of behaviour (e.g., liking or disliking mood-improving behaviours) tend to be more predictive of behaviour occurrence than evaluations of the topic or object to which the behaviour is directed (e.g., a positive or negative evaluation of individuals with depression) (Ajzen et al., 2018).

In addition to implicit evaluations, exploring implicit motivations for behaviour (e.g., wanting or not wanting to pursue mood-improving behaviours) is important, as implicit motivation may have an even more profound influence on actual behaviour than implicit evaluations do (Tibboel et al., 2015; Meissner et al., 2019). Investigating nursing home care provider implicit attitude and motivation regarding behaviours to improve resident mood could, therefore, offer valuable insights into underlying processes guiding caregiving actions. This understanding could inform daily practice and aid in the development of more effective interventions to enhance resident mood. To achieve this, appropriate measurement instruments are needed.

Therefore, with this study, we aimed to develop implicit association tasks for measuring nursing home care provider implicit attitude (positive versus negative valence) toward mood-improving behaviours for residents, as well as their implicit motivation

(wanting versus not wanting) for these behaviours. Additionally, we evaluated the psychometric properties of these tasks. With these instruments, we could enable future researchers to evaluate how care provider automatic cognitive processes may influence their behaviours, providing insight for improving resident mood in nursing homes.

2. General methods

2.1. Overview of the studies

Study 1 involved developing two computer-based implicit association tasks to measure implicit associations of nursing home care providers with behaviours to improve resident mood. The first, the 'Valence towards Behaviors to improve resident Mood Implicit Association Task', aimed to measure implicit attitude (positive versus negative valence) towards mood-improving behaviours. The second, the 'Motivation for Behaviors to improve resident Mood Implicit Association Task', focused on measuring implicit motivation (wanting versus not wanting) associated with these behaviours. For these tasks, pictorial target stimuli were created, representing behaviours performed by nursing home care providers aimed at improving resident mood. Additionally, three vignettes reflecting various resident mood states were developed as priming stimuli prior to the tasks. The purpose of using these priming vignettes was based on another study (Knippenberg et al., 2024a), which aimed to explore whether resident mood influenced care provider implicit attitude and motivation regarding behaviours to improve resident mood. Study 1 concluded with an evaluation of the content validity of the proposed target stimuli.

Study 2 focused on assessing the psychometric properties of the developed implicit association tasks. This included evaluating the ease of stimulus classification, internal consistency, test-retest reliability, and convergent and discriminant validity.

2.2. Ethics statement

This project followed the guidelines established by the Radboudumc Ethics Committee, which deemed it to be outside the scope of the Medical Research Involving Human Subjects Act (reference number: 2021-11047). The research was conducted in accordance with Dutch legislation and the principles outlined in the Declaration of Helsinki (World Medical Association, 2013). Prior to their involvement, participants were fully informed about the study's objectives and procedures, and their informed consent was obtained. The participants in Study 2 were rewarded with a 15 euro gift card.

3. Study 1: development process and content validity

3.1. Methods

3.1.1. Design, procedure, and materials

Study 1 comprised two sequential phases. Phase 1 involved the development of the 'Valence towards Behaviors to improve resident

Table 1
Sequence of trial blocks in the implicit association tasks.

Block	Function	No. of trials	Stimuli assigned to left-key response (*n*)	Stimuli assigned to right-key response (*n*)
1	Attribute practice	16	Positive images[†] (8)	Negative images[‡] (8)
–	Vignette presentation[§]			
2	Attribute/target practice	32	Positive images (8) & Images representing mood-improving behaviours of care providers for nursing home residents (8)	Negative images (16)
3	Attribute/target test	64	Positive images (16) & Images representing mood-improving behaviours of care providers for nursing home residents (16)	Negative images (32)
–	Vignette presentation			
4	Attribute/target practice	32	Positive images (16)	Negative images (8) & Images representing mood-improving behaviours of care providers for nursing home residents (8)
5	Attribute/target test	64	Positive images (32)	Negative images (16) & Images representing mood-improving behaviours of care providers for nursing home residents (16)

Note. For half the subjects, the positions of Blocks 2 and 3 are switched with those of Blocks 4 and 5, respectively.

[†] Positive images represented positive attitude (valence) and motivation (wanting).

[‡] Negative images reflected negative attitude (valence) and demotivation (not wanting).

[§] During the implicit association task, participants were primed with one of three vignettes, randomly assigned to each participant. Each vignette was presented twice during the task. The type of vignette maintained consistent across all assessments.

n = number of stimuli assigned to the key response.

Mood Implicit Association Task' (implicit attitude task) and the 'Motivation for Behaviors to improve resident Mood Implicit Association Task' (implicit motivation task), including the creation of target stimuli reflecting mood-improving behaviours. Care providers evaluated the initial target stimuli through an online questionnaire. Their feedback was deliberated upon by the research team, leading to refinements and the final selection of target stimuli. Subsequently, in Phase 2, care providers evaluated the content validity of the selected target stimuli through an online questionnaire.

Phase 1: Development of the implicit association tasks. An iterative approach was followed for creating the implicit association tasks, adhering to the guidelines outlined by Greenwald et al. (2022) and incorporating feedback from stakeholders. Given the absence of a counterpart for the target category (mood-improving behaviours), a single-category variant was chosen (Karpinski and Steinman, 2006). Consequently, each task was structured into five blocks (Table 1). To familiarize participants with the procedure, the task started with a practice block (Block 1), exclusively involving stimuli and labels from the attribute categories. Subsequent blocks contained both target and attribute stimuli and labels. Blocks 2 (practice) and 3 (test) combined target stimuli with the same response key as stimuli from one attribute category (e.g., 'positive'), while Blocks 4 and 5 mapped target stimuli to the other attribute category (i.e., 'negative').

In both tasks, the target category was labelled "do something" (in Dutch: "*Iets doen*"). For attribute categories, the implicit attitude task used the labels "positive" ("*positief*") versus "negative" ("*negatief*"), while the implicit motivation task employed the labels "I want" ("*wil ik graag*") versus "I do not want" ("*wil ik niet graag*"). Target and attribute labels were prominently displayed in the upper-left and upper-right corners of the screen, corresponding to the block.

The stimuli were presented in the centre of the screen, with a 150-millisecond interval following each correct response. Participants were instructed to categorize the stimuli on the basis of the displayed labels by using the left ('E') or right ('I') computer keys. For example, when presented with a target stimulus, participants were instructed to press the key associated with the label "do something." To minimize response bias, an equal number of left and right keyboard strikes were required, with stimuli from the attribute category that were not associated with the target category appearing twice as frequently (Greenwald et al., 2022). Upon an incorrect response, a red X appeared in the centre of the screen until the correct key was pressed. Within the test blocks (Blocks 3 and 5), each stimulus was presented at least twice to ensure a sufficient number of responses (Greenwald et al., 2022).

Stimulus selection. In selecting stimuli for the implicit tasks, images were preferred over textual prompts, given their demonstrated validity (Hogenboom et al., 2023). We aimed to select between four and eight stimuli per category to strike a balance between maintaining a concise task administration and ensuring comprehensive coverage of the target construct.

The attribute stimuli were selected from the International Affective Picture System (Lang et al., 2008). Half of these stimuli were required to possess normative valence scores exceeding 6 on a 9-point scale, representing positive attitude (valence) and motivation (wanting). Conversely, the remaining half of the stimuli were selected to have low valence scores, falling below 4 on the scale, reflecting negative attitude (valence) and demotivation (not wanting). In addition, arousal levels, thematic content, and colour usage of the stimuli were carefully balanced to ensure similarity between positively valenced (motivation) and negatively valenced (demotivation) stimuli. Further criteria for the attribute stimuli included the absence of human actions to prevent overlap with target stimuli, and the exclusion of gruesome or shocking themes (e.g., images of dead animals) as judged by the research team.

Target stimuli illustrating nursing home care provider behaviours aimed at improving resident mood were specifically developed for these implicit tasks. Based on input from the research team, a graphic designer created 12 images representing various mood-improving behaviours. These images were informed by a Group Concept Mapping Study (Knippenberg et al., 2022), in which nursing home residents, relatives, and care providers brainstormed and clustered strategies for improving resident mood. Follow-up research (Knippenberg et al., 2024b) identified 18 main themes (e.g., contact with others, music, and physical activity), which were reflected in the designed images. Care providers then evaluated these images for their initial impressions, relevance in improving resident mood, and recognizability in daily practice through an online questionnaire administered via LimeSurvey (LimeSurvey Project Team and Schmitz, 2015). The questionnaire included both open-ended questions (e.g., "What are your first thoughts when you look at this image?") and closed-ended questions (e.g., "To what extent does this image illustrate a recognizable situation in practice?" with a 5-point scale ranging from "not at all" to "completely"). Additionally, each care provider selected six images that they believed most accurately depicted mood-improving behaviours by care providers in nursing homes. Subsequently, the research team deliberated upon care provider feedback on the images, leading to refinements and a final selection of target stimuli representing mood-improving behaviours in nursing homes (https://osf.io/ywdjq/).

Phase 2: Evaluation of the content validity of the target stimuli. The content validity of the selected target stimuli was assessed through an online questionnaire (LimeSurvey Project Team and Schmitz, 2015). Care providers rated the relevance of each image in improving resident mood via the options "not relevant," "somewhat relevant," "quite relevant," and "highly relevant." Additionally, by selecting "yes," "no" or "don't know," care providers indicated whether the predefined themes relevant to mood-improving behaviours (e.g., contact with others, music, and physical activity) were represented by the images.

3.1.2. Participants and setting

The study included care providers actively engaged in caregiving tasks within Dutch nursing homes under a financial employment relationship (i.e., registered nurses [RNs], certified nurse assistants, and nurse assistants). A convenience sample was drawn from care providers who had previously participated in a related study (Knippenberg et al., 2024b). These care providers contributed to selecting and refining target stimuli in Phase 1 and to assessing the content validity of the final target stimuli in Phase 2.

3.1.3. Analysis

To analyse the qualitative data concerning the selection and refinement of the target stimuli, thematic analysis (Braun and Clarke,

2006) was conducted using ATLAS.ti 9 (ATLAS.ti, 2023). Descriptive statistics and calculation of the content validity index for the selected target stimuli were performed using IBM SPSS 27 (IBM CORP, 2020). The content validity index ranges from 0.00 to 1.00, with a threshold of at least 0.78 generally considered satisfactory (Polit et al., 2007). To evaluate how well the predefined themes regarding mood-improving behaviours were reflected by the selected target stimuli, the research team set the criterion that at least one stimulus for each theme should be rated as representative by at least 80 % of participants.

3.2. Results

3.2.1. Participants

A total of 41 nursing home care providers (five nurse assistants, 20 certified nurse assistants, and 16 RNs) participated in the selection and refinement of the target stimuli. The mean age of the participants was 45.0 years (Standard Deviation [SD] = 13.2), with the majority being female (Number of cases in the subsample [*n*] = 37, 90.2 %). In the evaluation phase regarding the content validity of the selected target stimuli, 35 care providers (85.4 % of the total, 32 females), took part. These care providers had an average age of 43.3 years (SD = 12.6).

3.2.2. Stimuli selection and content validity

The selection process resulted in eight positive (wanting) and eight negative (not wanting) attribute stimuli, along with eight target stimuli (Supplementary Material A and https://osf.io/ywdjq/). For the attribute stimuli, the mean valence score was 7.4 (SD = 1.5) for positive stimuli and 3.4 (SD = 1.6) for negative stimuli. The average arousal scores were 4.8 (SD = 2.4) and 4.9 (SD = 2.1), respectively. The content validity index of the selected target stimuli ranged from 0.85 to 0.97 (Supplementary Material A). Except for the theme "Faith and meaning," all themes were represented by at least one target stimulus (Supplementary Material B). Most of the themes were represented by either one or two target stimuli. Notably, three themes were reflected in (almost) all target stimuli: "Stimulating the senses," "Contact with others," and "Positive attitude."

4. Study 2: psychometric evaluation

4.1. Methods

4.1.1. Design and procedure

Study 2 was designed to examine the psychometric properties of the implicit attitude and the implicit motivation task (https://osf.io/ywdjq/). Participants completed online questionnaires to evaluate their self-reported attitudes towards depression, altruistic tendencies, social desirability proneness, and mood-improving behaviours, with the aim of evaluating the convergent and discriminant validity of the implicit tasks. In addition, they performed several computer-based reaction tasks: alongside completing the implicit attitude and the implicit motivation task, participants performed a Simon task (Simon, 1990).

The psychometric evaluation of the implicit attitude and the implicit motivation task focused on ease of stimulus classification (accuracy and speed), internal consistency, test-retest reliability (measured after a 2-week follow-up period), convergent validity (with self-reported attitudes towards depression, altruism, and mood-improving behaviours), and discriminant validity (against social desirability). Test-retest reliability, convergent validity, and discriminant validity were evaluated in a random subsample of participants, comprising half of the total sample.

All participants provided demographic information and completed both implicit tasks. To account for potential order effects, participants were randomly assigned to start with the implicit attitude or the implicit motivation task. The sequence of blocks within each task was also counterbalanced, with half of the participants starting with the hypothesis-consistent sequence (where the target stimuli shared the response key with "positive" and "I want" stimuli) and the remaining half with the hypothesis-inconsistent sequence (where the target stimuli shared the response key with "negative" and "I do not want" stimuli). The assigned sequence of blocks within the task remained consistent across both tasks. A Simon task was administered between task administrations to minimize potential carry-over effects from previous questions and tasks (Kiesel et al., 2010).

Additionally, after providing demographic information, half of the participants completed a baseline questionnaire to assess their self-reported attitudes towards depression, altruism, and social desirability proneness, followed by a Simon task. After completing both implicit tasks with a Simon task in-between, participants in the subsample repeated the Simon task and completed a questionnaire about mood-improving behaviours at the end of the baseline measure. Using a repeated-measures design with a 14-day interval between assessments, as recommended by Terwee et al. (2007), this subsample of participants completed the questionnaire about their attitudes towards depression again, as well as both the implicit attitude and the implicit motivation task during a follow-up measure. A Simon task preceded each implicit task administration. The repeated administration of the questionnaire measuring attitudes towards depression was necessitated by the unavailability of test-retest reliability data for the instrument. The sequence within the task (starting with hypothesis-consistent or hypothesis-inconsistent blocks) and the order of the tasks (implicit attitude or implicit motivation task first) remained consistent across all measurements.

4.1.2. Participants and setting

Care providers with a financial employment relationship and who actively engaged in caregiving tasks within a Dutch nursing home were eligible to participate. While recruitment specifically targeted RNs and certified nurse assistants, other caregiving staff, such as nurse assistants, were also included. Recruitment involved contacting a random 5 % sample of nursing homes in the

Netherlands listed on "Zorgkaartnederland (2023). These facilities were contacted via telephone and asked to distribute research invitations by email to their care staff who met the eligibility criteria. Participation took place online, requiring participants to use a laptop or computer with a keyboard. Participants were allowed to choose their preferred location for study participation, provided that the chosen setting was minimally distracting. Notably, while the subsample completed a 2-week follow-up measure, the remaining participants were invited to take part in another study (Knippenberg et al., 2024a).

4.1.3. Materials

Measuring equipment and software. We used the O4U platform (Slot, 2023), which facilitates the integration of computer-based tasks and online questionnaire administration. Lab.js (Henninger et al., 2022), an online open-source experiment builder, was used for constructing the reaction tasks (i.e., the implicit tasks and the Simon task), while LimeSurvey (LimeSurvey Project Team and Schmitz, 2015) was employed for questionnaire administration.

Reaction tasks. The 'Valence towards Behaviors to improve resident Mood Implicit Association Task' and the 'Motivation for Behaviors to improve resident Mood Implicit Association Task' were used to assess nursing home care providers' implicit attitude and motivation, respectively, related to mood-improving behaviours for residents. Detailed descriptions of these tasks can be found in the methods and results sections of Study 1. Following Greenwald et al.'s (2022) guidelines, D-values for both tasks were computed using the algorithm with a built-in error penalty procedure. The D-value represents the standardized difference in response latencies between contrasted conditions, calculated as the mean difference in response times dived by the pooled standard deviation of latencies across conditions (Greenwald et al., 2022). Data from Blocks 2 through 5 were used for this computation. Trials that exceeded 10,000 milliseconds, constituting a mere 0.09 % of all trials, were removed. Data from participants with >10 % of the remaining trials displaying latencies <300 milliseconds were likewise excluded ($n = 1$ participant) (Greenwald et al., 2022). D-values from implicit association tasks range from −2 (indicating a negative implicit attitude or motivation toward mood-improving behaviours) to +2 (reflecting a positive implicit attitude or motivation).

In this study, the Simon task (Simon, 1990) served as a wash-out task between the implicit task assessments and following the additional baseline questionnaire in the subsample. In this task, participants were presented with sequences of blue and green circles that randomly appeared on either the left or right side of the screen. Participants were instructed to respond to the colour of the stimulus ('E' key for blue, 'I' for green) while disregarding its position. The task was completed in approximately 3 min.

Questionnaire. All participants provided demographic information (i.e., sex, age, professional function, years of working experience, type of ward, and regularity of their involvement in the care of residents with depression). Additionally, the participants in the subsample completed questionnaires to evaluate their self-reported attitudes towards depression, altruistic tendencies, social desirability proneness, and mood-improving behaviours.

To evaluate care provider attitudes towards nursing home residents with depression, the Nijmegen Depression Attitude Scale (Raap et al., 2010) was used. This scale consists of three subscales: knowledge (eight items), behaviour (four items), and affect (three items). Sample items include "Medication is the best way to treat depression in nursing home residents" (a reverse item from the knowledge subscale) and "With residents with depression, I often feel like I cannot accomplish anything" (a reverse item from the affect subscale). The responses are recorded on a 5-point scale ranging from "totally disagree" to "totally agree." In the current sample ($n = 111$), the Cronbach's alpha coefficients (α) for these three subscales were deemed acceptable (α = 0.73, 0.66, and 0.76, respectively). Furthermore, the intraclass correlation coefficient (ICC) (2-way random effects, absolute agreement, single measure) indicated satisfactory test-retest consistency ($n = 94$, ICC = 0.75 [95 % Confidence Interval = 0.64; 0.82], 0.68 [0.55; 0.77], and 0.78 [0.69; 0.85], $p < .001$).

Altruistic tendencies were assessed using a validated Dutch translation of the NEO Five-Factor Inventory-3 Altruism scale (Hoekstra et al., 2007; McCrae and Costa Jr, 2007). This scale is a concise version of the NEO Personality Inventory (Costa and McCrae, 1992), designed to measure personality traits. The altruism scale comprises 12 items, rated on a scale ranging from 1 (totally disagree) to 5 (totally agree). An example item is "In general, I try to be thoughtful and caring." The Cronbach's alpha coefficient for the altruism scale in this study was 0.85.

Social desirability was evaluated using a Dutch adaptation of the Social Desirability scale from the Eysenck Personality Questionnaire Revised Short Scale (Eysenck and Eysenck, 1991; Sanderman et al., 1991). This validated scale includes 12 items, such as "Are all your habits good and desirable?", with response options of "yes" or "no." In the current sample, the Cronbach's alpha coefficient of the scale was 0.75.

Mood-improving behaviours were assessed using the Actions to Improve Mood by Caregivers inventory (Knippenberg et al., 2024b). This inventory is specifically designed to measure actions initiated by nursing home care providers to improve the mood of residents. The inventory covers 18 themes (e.g., physical activity, contact with others, music), each accompanied by a brief description and examples of potential actions. Following this, each theme includes two items. The first item pertains to the frequency of the action—for example, "As for encouraging physical activity, how often do you or your colleagues do this in an average week?" Responses are recorded on a 5-point scale ranging from "never" to "very often." The second item focuses on the anticipated effect of the action on the resident's mood—for example, "If you do (or would do) this, does this make the resident feel happy?" Responses to this item are categorized into "no," "yes, a bit happy," and "yes, very happy."

Items across all scales were recoded when necessary. For each scale, except the Actions to Improve Mood by Caregivers inventory, average scores were calculated following the scale's guidelines, where higher scores indicate a higher degree of the respective trait or characteristic. For the Actions to Improve Mood by Caregivers inventory, an interaction score was computed for each theme by multiplying the frequency and anticipated effect ratings. These scores for individual themes were then averaged, offering an overarching measure of the frequency of mood-improving behaviours while taking their anticipated effect into account.

4.1.4. Analysis

Point-biserial correlation and Pearson correlation analyses were conducted to explore the associations between demographic variables with the implicit attitude and the implicit motivation task at baseline. This exploration aided in determining the potential inclusion of covariates in subsequent analyses. Additionally, the correlation between the two implicit tasks was examined using Pearson correlation analysis.

Order effects were assessed by performing a factorial Analysis of Variance (ANOVA) for each implicit task. This analysis investigated the influence of the block order within each task (whether hypothesis-consistent or hypothesis-inconsistent blocks were presented first), between tasks (implicit attitude or implicit motivation task presented first), and the interaction effect of order within and between tasks on implicit attitude and motivation. In the case of a significant order effect, sensitivity analyses are performed to correct for this, using the respective order effect as a factor.

The ease of stimulus classification, for both the attribute and target stimuli, was evaluated by computing the percentage of false responses (error rates) and the mean latency (speed) during the initial presentation of each stimulus. This analysis included data from Block 1 for the attribute stimuli and Block 2 (or Block 4 in case of an alternate order) for the target stimuli in the first presented implicit task. Findings were compared against the accuracy (< 10 % errors) and speed (response latencies < 800 millisecond) cut-off criteria proposed by Greenwald et al. (2022).

The internal consistency of the implicit tasks at baseline was assessed using the split-half reliability method with the odd-even technique and corrected for attenuation using the Spearman-Brown formula (Cohen et al., 2014). Reliability coefficients were calculated separately for practice trials, test trials, and a combination of both. Test-retest reliabilities between the implicit tasks' D-value at baseline and the 2-week follow-up were evaluated using ICC (2-way random effects, consistency, single measure). To interpret the results, these findings were compared to previously reported meta-analytic coefficients for internal consistency ($\alpha = 0.76$, $N = 33$ studies) and test-retest reliability ($r = 0.25$, $N = 7$ studies) of single-category implicit association tasks, as documented by Greenwald and Lai (2020).

Mixed model analyses were conducted to examine the convergent validity of the implicit tasks. Models were built for the tasks' D-values with fixed effects of self-reported attitudes toward depression, altruism, and mood-improving behaviours. Discriminant validity of the tasks was assessed using mixed models with fixed effects of self-reported social desirability. Separate models were constructed for both the implicit attitude and the implicit motivation task. Prior to analyses, all variables were standardized. To interpret these results, we drew upon the findings from a meta-analysis comprising 81 studies exploring the associations between implicit association tasks and explicit self-report measures, revealing an overall effect size of 0.24 (Hofmann et al., 2005).

Sample size calculations were conducted for the primary analyses of this study: test-retest reliability and convergent validity. A power level of 0.80 and a significance level of 0.05 were used. The R package "ICC.Sample.Size" (Rathbone et al., 2015) was employed to determine the required sample size for calculating the ICC. With an anticipated correlation of 0.25, as reported in the meta-analysis conducted by Greenwald and Lai (2020), the sample size calculation indicated that 122 participants would be necessary. Additionally, G*Power 3 (Faul et al., 2007) was used to estimate the optimal sample size for evaluating convergent validity. Based on an effect size of 0.20, the analysis indicated a sample size of 42 participants.

Table 2
Demographic characteristics of care providers for study 2.

	Initial sample	**Subsample**	
	Baseline	**Baseline**	**2-week follow up**
N	230	111	91
Sex, female, N (%) / male, *n*	208 (91.2) / 20	102 (91.9) / 9	83 (91.2) / 8
Age, mean, (SD) [range]	41.6 (12.7) [18–66]	41.8 (12.4) [19–66]	41.0 (12.5) [19–66]
Type of care provider, *n* (%)			
Registered nurse	94 (41.0)	42 (37.8)	41 (45.1)
Certified nurse assistant	115 (50.2)	58 (52.3)	44 (48.4)
Nurse assistant / nurse aide	16 (7.0)	9 (8.1)	4 (4.4)
Other	4 (1.7)	2 (1.8)	2 (2.2)
Years of working experience, mean (SD) [range]	11.4 (11.0) [0–43]	10.8 (10.3) [0–38]	9.9 (9.5) [0–37]
Type of ward employment[†], yes *n* (%) / no, *n*			
Medical-somatic care	117 (51.1) / 112	60 (54.1) / 51	51 (56.0) / 40
Psychogeriatric care	153 (66.8) / 76	78 (70.3) / 33	61 (67.0) / 30
Mental-physical multimorbidity care	20 (8.7) / 209	10 (9.0) / 101	7 (7.7) / 84
Other	15 (6.6) / 214	6 (5.4) / 105	6 (6.6) / 85
Regularity of involvement in the care of residents with depression, *n* (%)			
Never	0 (0.0)	0 (0.0)	0 (0.0)
Occasionally	78 (34.1)	42 (37.8)	38 (41.8)
Regularly	113 (49.3)	51 (45.9)	36 (39.6)
Often	29 (12.7)	13 (11.7)	13 (14.3)
Very often	9 (3.9)	5 (4.5)	4 (4.4)

Note. Valid percentages are shown.
[†] The percentages for type of ward employment do not sum to 100 % because individuals may work in multiple wards. N = Total sample size; n = Subsample size; SD = Standard Deviation.

4.2. Results

4.2.1. Participants

Table 2 provides an overview of the demographics of the study participants. Data from participants who completed at least the first implicit task were used in the analysis to evaluate stimulus classification ease and internal consistency. Concerning the order of implicit task administration, 122 participants (53.0 %) started with the implicit attitude task, while the remainder began with the implicit motivation task. With respect to the sequence within each task, 122 participants (53.0 %) started with the hypothesis-consistent blocks.

4.2.2. Associations between demographic characteristics and the implicit association tasks

Correlation analysis revealed no significant correlations between demographic characteristics and either the implicit attitude or implicit motivation task (coefficients ranging from −0.02 to 0.09, $p > .05$). Consequently, demographic characteristics were not included as covariates in subsequent analyses. A significant weak positive correlation was observed between the implicit attitude task and the implicit motivation task ($r = 0.24$ [95 % Confidence Interval: 0.11 to 0.36], $p < .001$).

4.2.3. Order effects

Concerning the D-values for implicit attitude as measured with the implicit attitude task, a significant interaction effect (between tasks x within task sequence) related to order was found (F (1, 223) = 4.56, $p = .034$, $\eta^2 = 0.02$). For the 'implicit attitude task first' condition, D-values for implicit attitude were lower when participants were initially presented with hypothesis-consistent blocks (Mean [M] = 0.20, SD = 0.25) than when they were first presented with hypothesis-inconsistent blocks (M = 0.29, SD = 0.24), while the reverse pattern was noted for the 'implicit motivation task first' condition (M = 0.22, SD = 0.19; M = 0.18, SD = 0.24, respectively).

In terms of implicit motivation (as measured with the implicit motivation task), a significant main order effect between task administrations was detected (F (1, 220) = 18.73, $p < .001$, $\eta^2 = 0.08$). Participants displayed higher D-values for implicit motivation when the implicit motivation task was presented first (M = 0.28, SD = 0.26) than when the implicit attitude task was presented first (M = 0.14, SD = 0.22). No other significant order effects were observed for either implicit attitude or implicit motivation ($p > .05$).

4.2.4. Stimulus classification ease

The analyses for accuracy of stimulus classification indicated a mean error rate of 4.0 % for attribute stimuli and 12.4 % for target stimuli (Supplementary Material A). All stimuli displayed prolonged response times exceeding the desirable 800-millisecond threshold, with mean latencies of 1118.2 milliseconds (SD = 749.9) for attribute stimuli and 1299.7 milliseconds (SD = 1075.7) for target stimuli. Notably, the attribute stimulus 'Galaxy' stood out because of its high error rate (24.9 %) compared with the other stimuli.

4.2.5. Internal consistency and test-retest reliability

Both implicit tasks demonstrated acceptable split-half reliability coefficients for the practice trials (implicit attitude task: $r_{sb} = 0.66$; and implicit motivation task: $r_{sb} = 0.81$), test trials (r_{sb}= 0.84; 0.77), and for the combined practice and test trials ($r_{sb} = 0.81$; 0.85). Additionally, ICCs revealed a significant yet poor level of test-retest reliability for the implicit attitude (ICC = 0.29 [95 % Confidence Interval: 0.10 to 0.47], $p = .002$) and the implicit motivation task (0.25 [0.04 to 0.43], $p = .009$).

4.2.6. Convergent and discriminant validity

Mixed model analyses (Table 3) showed significant associations between self-reported altruism and both the implicit attitude and the implicit motivation task. Furthermore, the behavioural subscale of the Nijmegen Depression Attitude Scale was significantly

Table 3
Fixed effect estimates of self-reported attitudes towards depression, altruism, mood-improving behaviours, and social desirability with the implicit attitude and implicit motivation task.

Parameter	VBM-IAT, $n = 110$			MBM-IAT, $n = 109$		
	Estimate (SE)	95 % CI	p-value	Estimate (SE)	95 % CI	p-value
NDAS – Knowledge	.04 (0.09)	[−0.14, 0.22]	.673	.18 (0.09)	[−0.00,.36]	.052
NDAS – Behaviour	−0.02 (0.09)	[−0.20, 0.16]	.823	**.21 (0.09)**	**[.03, 0.39]**	**.022***
NDAS – Affect	.10 (0.09)	[−0.08, 0.28]	.263	.15 (0.09)	[−0.03, 0.33]	.095
NEO-FFI-3 – Altruism	**.28 (0.09)**	**[.11, 0.45]**	**.001*****	**.24 (0.09)**	**[.07, 0.42]**	**.008****
AIM-C	**.20 (0.09)**	**[.03, 0.36]**	**.023***	.12 (0.09)	[−0.06, 0.31]	.183
EPQ-RRS – Social desirability	.05 (0.09)	[−0.13, 0.23]	.556	.03 (0.09)	[−0.15, 0.21]	.735

Note. Individual models were built for each predictor and for each outcome. All variables are standardized. $p < .05$ are in boldface.
*$p < .05$; **$p \leq 0.01$; ***$p \leq 0.001$.
VBM-IAT = Valence towards Behaviors to improve resident Mood Implicit Association Task (implicit attitude task); MBM-IAT = Motivation for Behaviors to improve resident Mood Implicit Association Task (implicit motivation task); SE = Standard Error; CI = Confidence Interval; NDAS = Nijmegen Depression Attitude Scale; NEO-FFI-3 = NEO Five-Factor Inventory-3; AIM-C = Actions to Improve Mood by Caregivers inventory; EPQ-RRS = Eysenck Personality Questionnaire – Revised.

related to the implicit motivation task, but not to the implicit attitude task. Conversely, the Actions to Improve Mood by Caregivers inventory showed a significant association with the implicit attitude task, but not with the implicit motivation task. Neither the knowledge subscale nor the affect subscale of the Nijmegen Depression Attitude Scale was significantly related to either the implicit attitude or the implicit motivation task.

Regarding discriminant validity, the analysis revealed that social desirability was not related to either the implicit attitude or the implicit motivation task. Subsequent sensitivity analyses, with correction for order effects, yielded comparable results.

5. General discussion

To facilitate future research on how nursing home care provider automatic cognitive processes may influence their behaviours, we introduced two implicit association tasks designed to measure care provider implicit associations with mood-improving behaviours for residents. Specifically, we developed and evaluated the 'Valence towards Behaviors to improve resident Mood Implicit Association Task' (implicit attitude task) and the 'Motivation for Behaviors to improve resident Mood Implicit Association Task' (implicit motivation task). The implicit attitude task assesses implicit attitude (positive versus negative valence) towards mood-improving behaviours, while the implicit motivation task measures implicit motivation (wanting versus not wanting) for these behaviours. The target stimuli were designed specifically for these tasks, representing nursing home care provider behaviours aimed at improving resident mood.

The content validity analysis confirmed that the selected target stimuli are appropriate for depicting care provider behaviours aimed at improving resident mood. However, it is important to consider that the representation of mood-improving behaviours may vary across different themes. The themes "stimulating the senses," "contact with others," and "positive attitude" seem to be prominently featured in the stimuli, whereas "faith and meaning" appears to be less prevalent. This variation is not necessarily problematic, as it plausibly reflects actual care provider behaviours, with the prominent themes potentially being more frequently applied in caregiving practices (Knippenberg et al., 2022). Nevertheless, it is important to take this variation in represented themes into account when these tasks are used, as they offer valuable insights into the topic being measured.

Regarding the ease of stimulus classification, acceptable error rates were observed for attribute stimuli (representing positive or negative valence, and motivation or demotivation), but slightly higher rates than those deemed acceptable were noted for the target stimuli. This variation could be ascribed to differing presentation contexts: attribute stimuli were presented in a block that consists solely of attribute stimuli (Block 1), while target stimuli were displayed alongside attribute stimuli within the same block, potentially complicating their categorization. Moreover, the complexity of the target stimuli, which encompassed multiple themes within a single image, may have contributed to a less straightforward interpretation compared to the potentially simpler attribute stimuli, such as a solitary depiction of a fawn (Greenwald et al., 2022).

The prolonged reaction times for all stimuli indicate that participants found them difficult to classify, potentially leading to less accurate measurements of implicit associations (Greenwald et al., 2022). Additionally, the observed high error rate for the 'Galaxy' attribute stimulus, sourced from the widely used International Affective Picture System (Lang et al., 2008), emphasizes the need for further exploration of the adequacy of using this stimulus in implicit association tasks. While challenges in stimulus validity are apparent in this study, they align with those identified in previous research (Hogenboom et al., 2023). Nevertheless, these findings indicate the importance of further investigating stimulus validation in implicit association task studies, an aspect that appears to have received limited attention within this field of research.

Both implicit tasks demonstrated good internal consistency, aligning with findings from similar single-category implicit association task studies (Greenwald and Lai, 2020). However, their seemingly poor test-retest reliability, although statistically significant and consistent with previous studies (Greenwald and Lai, 2020), suggests an area for improvement. In the future, researchers may explore and refine strategies aimed at improving the temporal consistency of these tasks. One potential approach for improvement could involve controlling environmental factors, for example, by considering exclusive task administration in a controlled environment.

The negligible and insignificant correlation between the implicit tasks and self-reported social desirability supports the tasks' discriminant validity. We also found partial support for the tasks' convergent validity, with weak yet positive associations of both tasks with altruism. However, findings regarding convergent validity with other scales are less clear. For example, the behavioural subscale of the Nijmegen Depression Attitude Scale showed a weak positive correlation with the implicit motivation task but not with the implicit attitude task. This finding supports the idea of a closer depiction of a goal-directed motivational state (wanting) measured by the implicit motivation task rather than reflecting a positive valence towards the behaviour itself as assessed by the implicit attitude task. This is also in line with prior research indicating that the desire to pursue behaviours may be more closely related to actual behaviour than to implicit evaluations of the behaviour (Meissner et al., 2019; Tibboel et al., 2015). However, the findings might also be influenced by the attribute labels for valence possibly being more abstract than those used for motivation, as we used general (nonpropositional) "positive" and "negative" labels and not propositional "I like" and "I do not like" as labels for valence. Future researchers may explore propositional (personalized) implicit attitude tasks (using attribute labels "I like" and "I do not like"), as proposed by Olson and Fazio (2004).

Conversely, the implicit attitude task, but not the implicit motivation task, displayed a poor yet positive correlation with the Actions to Improve Mood by Caregivers inventory. Post hoc analysis (not reported) suggested that this discrepancy could be partially ascribed to the anticipated effect of the behaviour on resident mood, rather than solely the frequency of the behaviour. Unlike the implicit attitude task, the implicit motivation task appears to be unaffected by the expected effect of mood-improving behaviours. This suggests that additional factors, such as prior knowledge regarding the efficacy of the behaviour for a specific resident or engaging in behaviours for purposes unrelated to mood improvement (e.g., enhancing physical well-being), may influence implicit motivation.

Overall, the small effect sizes observed in these analyses, although consistent with previous implicit association task research (Hofmann et al., 2005), underscore the need for cautious interpretation of these results.

Interestingly, neither the implicit attitude nor the implicit motivation task was significantly related to the knowledge or the affect subscale of the Nijmegen Depression Attitude Scale. Given the homogeneous research sample (i.e., nursing home care providers), it is plausible that the measures used in this study may not have sufficiently differentiated between participants, potentially limiting the variability needed to detect significant relationships (Tabachnick and Fidell, 2007). Future researchers may benefit from including the general population or other specific target groups to further evaluate the psychometric properties and potential differentiation capabilities of the implicit tasks.

5.1. Strengths and limitations

A notable strength of this research lies in the development of implicit association tasks within the field of nursing home care, an area where the use of indirect measurement instruments has been limited. Using such tools holds promise for yielding additional insights into improving resident mood. Particularly noteworthy is the emphasis on behaviours aimed at improving resident mood, rather than merely focusing on resident mood as a topic. This approach aligns with research indicating that evaluating behaviour is more predictive of its occurrence than assessing the topic or object to which the behaviour is directed (Ajzen et al., 2018). Furthermore, the creation of implicit tasks for both attitude and motivation regarding behaviours facilitates comparative analysis, allowing ongoing research to gain further understanding of the potentially distinct effects associated with each aspect. Moreover, the comprehensive evaluation of the tasks' psychometric properties, including an assessment of content validity for the target stimuli and post hoc validation of all stimuli, represents a noteworthy but uncommon practice in implicit association task research. Nevertheless, while using the implicit tasks can provide additional insights into the underlying mechanisms relative to directly measured behaviours (Roefs et al., 2011), future longitudinal research is needed to explore the predictive value of these tasks for actual behaviours and their combined value with direct measurement instruments.

This study also has limitations that call for consideration. For convergent validity, ideally, instruments measuring 'attitudes towards mood-improving behaviours' and 'willingness for mood-improving behaviours' are used. However, such instruments are not available. Therefore, we selected related instruments that are expected to positively correlate with the constructs of interest. The lack of instruments specifically designed to measure attitude towards and motivation for mood-improving behaviours limits the strength of our convergent validity assessment. Additionally, both the Actions to Improve Mood by Caregivers inventory and Nijmegen Depression Attitude Scale require further validation (Knippenberg et al., 2024b; Raap et al., 2010), underscoring the need for additional research to further validate the implicit association tasks.

Furthermore, the implicit tasks were not evaluated for correlation with an established standard of comparison (i.e., criterion validity) using external criteria such as actual mood-improving behaviours performed by care providers or resident mood. The Actions to Improve Mood by Caregivers inventory, used in this study as a measure for convergent validity, is not suitable as a gold standard for criterion validity because it covers the behaviours of various care providers, while the implicit tasks specifically target particular care provider actions. Additionally, measuring the mood of nursing home residents was not feasible within the design of the current study. Future researchers could examine the criterion validity of the tasks by correlating the tasks' scores with other measures of care provider behaviours to improve resident mood (e.g., direct observations) or with established measures of resident mood.

Moreover, the use of fictional pictorial illustrations of mood-improving behaviours (target stimuli) in the tasks poses limitations in terms of ecological validity. The selected target stimuli may not fully capture the complexity of real-world scenarios of care provider behaviours in nursing homes. For example, care provider and resident characteristics, factors related to their interaction, and environmental factors may also influence care provider behaviours. Subsequent researchers could address this issue by directly observing care provider interactions in authentic nursing home settings.

In addition, we focused on the behaviours of care providers working in nursing homes, rather than those with a personal relationship with the residents. Exploring implicit associations among caregivers with personal ties to residents could be valuable, as these relationships may influence their attitudes and motivations regarding mood-improving behaviours differently. Adapting the target stimuli and assessing the psychometric properties of implicit association tasks in this context could provide additional insights.

5.2. Conclusions

The developed implicit association tasks show promise in measuring nursing home care provider implicit attitude (positive versus negative valence) and motivation (wanting versus not wanting) regarding behaviours to improve resident mood. While limitations in stimulus validity, temporal consistency, and convergent validity of the new instruments were identified – challenges common to similar instruments – these instruments may represent an innovative pathway for future research. By providing insight into how care provider automatic cognitive processes may influence their behaviours, these instruments can contribute to advancing strategies to improve resident mood and caregiving practices in nursing homes.

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Ethics

This project followed the guidelines established by the Radboudumc Ethics Committee, which deemed it to be outside the scope of the Medical Research Involving Human Subjects Act (reference number: 2021-11047).

Data availability statement

Data, materials, and analysis code are available at https://osf.io/ywdjq/.

CRediT authorship contribution statement

Inge Knippenberg: Writing – original draft, Software, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Ruslan Leontjevas:** Writing – review & editing, Validation, Supervision, Project administration, Methodology, Funding acquisition, Formal analysis, Conceptualization. **Ine Declercq:** Writing – review & editing, Software, Investigation, Conceptualization. **Jacques van Lankveld:** Writing – review & editing, Supervision, Software, Project administration, Methodology, Funding acquisition, Conceptualization. **Debby Gerritsen:** Writing – review & editing, Supervision, Project administration, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary materials

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