



HAL
open science

Long-Term Efficacy of a Home-Care Hypnosis Program in Elderly Persons Suffering From Chronic Pain: A 12-Month Follow-Up

Marion Dumain, Pauline Jaglin, Chantal Wood, Pierre Rainville, Benjamin Pageaux, Anaick Perrochon, Martin Lavallière, Tanguy Vendevre, Romain David, Pascaline Langlois, et al.

► To cite this version:

Marion Dumain, Pauline Jaglin, Chantal Wood, Pierre Rainville, Benjamin Pageaux, et al.. Long-Term Efficacy of a Home-Care Hypnosis Program in Elderly Persons Suffering From Chronic Pain: A 12-Month Follow-Up. *Pain Management Nursing*, 2022, 23 (3), pp.330-337. 10.1016/j.pmn.2021.06.005 . hal-03723759

HAL Id: hal-03723759

<https://hal.science/hal-03723759>

Submitted on 22 Jul 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License

Long-term efficacy of a home care hypnosis program in elderly persons suffering from chronic pain: a twelve-month follow-up

Running head: Long-term hypnosis pain relief in elderly

Dumain Marion¹, Jaglin Pauline², Wood Chantal¹, Rainville Pierre^{3,4}, Pageaux Benjamin^{4,5},
Perrochon Anaick⁶, Lavallière Martin⁷, Vendevre Tanguy^{1,8,9,10,11}, David Romain^{1,12},
Langlois Pascaline¹, Cardinaud Noelle^{13,14}, Tchalla Achille¹³, Rigoard Philippe^{1,9,10}, Billot
Maxime¹

¹ PRISMATICS Lab (Predictive Research In Spine/neurostimulation Management And Thoracic Innovation in Cardiac Surgery), Poitiers University Hospital, Poitiers, France.

² Centre De Rééducation André Lalande - Fondation Partage et Vie, Noth, France.

³ Department of Stomatology, University of Montreal, Montreal, Quebec, Canada.

⁴ Centre de recherche de l'institut universitaire de gériatrie de Montréal, Montréal, Québec, Canada.

⁵ École de kinésiologie et des sciences de l'activité physique (EKSAP), Faculté de médecine, Université de Montréal, Montréal, Québec, Canada.

⁶ HAVAE EA 6310 Laboratory, University of Limoges, Limoges, France.

⁷ Laboratoire de Recherche Biomécanique & Neurophysiologique en Réadaptation Neuro-Musculo-Squelettique-Lab BioNR, Department of Health Sciences, Centre Intersectoriel en Santé Durable (CISD), Module de Kinésiologie, Université du Québec à Chicoutimi, Saguenay, QC, Canada.

⁸ Department of Spine Surgery and Neuromodulation, Poitiers University Hospital, Poitiers, France.

⁹ Institut Pprime UPR 3346, CNRS – Université de Poitiers – ISAE-ENSMA , Poitiers, France.

¹⁰ Department of Orthopaedic Surgery and Traumatology, Centre Hospitalier Universitaire de Poitiers, Poitiers, France.

¹¹ ABS Lab, Poitiers University, Poitiers, France.

¹² Physical and Rehabilitation Medicine Unit, Poitiers University Hospital, University of Poitiers, Poitiers, France.

¹³ Department of Clinical Geriatric, University Hospital Center, Limoges, France

¹⁴ UPSAV, Department of Clinical Geriatric, University Hospital Center, Limoges, France

Corresponding author

Maxime BILLOT

PRISMATICS Lab

Poitiers University Hospital - 2, rue de la Milétrie - 86021 POITIERS – FRANCE

maxime.billot@chu-poitiers.fr

Phone: +33 (0)5 49 44 32 24

Fax: +33 (0)5 49 44 32 18

Acknowledgments

The authors would like to thank Jeffrey Arsham for his revision of the English-language.

Disclosures

The authors have indicated that they have no conflicts of interest with regard to the content of this article.

- 1 **Long-term efficacy of a home care hypnosis program in elderly persons suffering from**
- 2 **chronic pain: a twelve-month follow-up**
- 3
- 4 Running head: Long-term hypnosis pain relief in elderly

5 **Abstract**

6 Purpose: Pain is a major public health concern in the aging population. However, medication
7 brings about negative effects that compel health care professionals to seek alternative
8 management techniques to alleviate pain. Hypnosis has been recognized as an effective
9 technique to manage pain, but its long-term efficacy has yet to be examined in older adults.
10 The aim was to assess the effectiveness, over a 12-month period, of home care hypnosis in
11 elderly participants suffering from chronic pain.

12 Design: Retrospective single-group longitudinal study.

13 Methods: Fourteen elderly women (mean age 81 years) with chronic pain participated in the
14 home care hypnosis program. All participants presented chronic pain (≥ 6 months) with
15 average pain score $>4/10$. Participants took part in seven 15-min hypnosis sessions within 12
16 months. The Brief Pain Inventory questionnaire was used to evaluate pain perception and pain
17 interference at baseline, and at 3, 6 and 12-month follow-up period.

18 Results: Hypnosis home care program significantly decreased pain perception and pain
19 interference compared to baseline after 3 months (-29% and -40%, $p < 0.001$), and remained
20 lower at 6 (-31% and -54%, $p < 0.001$) and 12 (-31% and -47%, $p < 0.001$) months.

21 Conclusions: Seven sessions of 15 min allocated throughout a 12-month period produced
22 clinically significant decreases in pain perception and pain interference.

23 Clinical Implications: Hypnosis could be considered as an optimal additional way for health
24 practitioners to manage chronic pain in an elderly population with long-term efficacy. This
25 study offers new long-term perspectives to improve chronic pain management at home in
26 elderly populations with a low-cost non-pharmacological intervention.

27

28 Keywords: Aging, hypnoanalgesia, pain perception, pain interference, alternative and
29 complementary medicine.

30 **Introduction**

31 The growing elderly population estimated at 7% between 2000 and 2030 in Europe (Ferrucci
32 et al., 2008), associated with life expectancy increase (an estimated 2 to 7 years from 2010 to
33 2030) (Kontis et al., 2017), renders it necessary to maintain optimal health conditions in
34 order to restrict hospitalizations and institutionalization. However, prevalence of chronic pain
35 increases with age, affecting 26%-86% of people aged 75-84 years and 40%-79% of those
36 aged >85 years (Domenichiello & Ramsden, 2019; Helme & Gibson, 2001; Patel et al., 2013).
37 Chronic pain dramatically alters health and quality of life (Abdulla et al., 2013; Kaye et al.,
38 2014), and generates financial and social burdens estimated at several billion dollars/euros per
39 year (Phillips, 2009). As a result, geriatric chronic pain population, presenting pain for more
40 than 3 months (Lynch, 2000), experience sleep disturbances and depressed states (Zis et al.,
41 2017) that may lead to decreased physical activity, gait impairment and/or greater risk of
42 falling (Corsi et al., 2018; Kaye et al., 2014). To manage chronic pain, the first indication and
43 the most frequently used intervention remains pharmacological (Kaye et al., 2014). While
44 medication can produce benefits, the literature reports dangerous side effects such as
45 addiction, misuse, drowsiness and/or cognitive dysfunction, functional impairments, etc.,
46 especially in the elderly population (Kaye et al., 2014; Passarelli et al., 2005; Veehof et al.,
47 1999). To avoid overmedication, complementary and alternative medicine techniques such as
48 hypnosis are nowadays strongly considered as a means of managing pain (Jensen & Patterson,
49 2006; Patterson & Jensen, 2003; Cuellar, 2005; Adachi et al., 2014; Montgomery et al., 2000;
50 Thompson et al., 2019).

51 Hypnosis has been defined as « a social interaction in which one person, designated as the
52 subject, responds to suggestions offered by another person, designated as the hypnotist, for
53 imaginative experiences involving alterations in conscious perception and memory, and the
54 voluntary control of action (page 385) » (Kihlstrom, 1985). Clinical hypnosis can be

55 provided throughout sessions by either a practitioner or oneself (i.e., self-hypnosis) (Cuellar,
56 2005; Jensen & Patterson, 2014; Jensen & Patterson, 2006). Clinical research confirms that
57 hypnosis enables reduction of pain intensity (Adachi et al., 2014; Montgomery et al., 2000;
58 Patterson & Jensen, 2003), notably in the elderly population (Ardigo et al., 2016; Ashton et
59 al., 1997; Billot et al., 2020b; Gay et al., 2002; Lang et al., 1996). More specifically, Billot et
60 al. (2020b) assessed the effectiveness of a short-term (12 weeks) home care hypnoanalgesia
61 program consisting of 3 hypnosis sessions of 15 minutes separated by 4 to 6 weeks, in elderly
62 women. Results showed a significant reduction of pain intensity and interference immediately
63 after the 12-week program. While there is no evidence yet of the long-term efficacy of a home
64 care hypnosis program in an elderly population, Jensen et al. (2008) examined pain intensity
65 and pain unpleasantness reduction during a 12-month follow-up period in 26 patients with
66 chronic pain (i.e., spinal cord injury, multiple sclerosis, amputation and postpolio syndrome
67 after treatment). After 10 sessions of 35 minutes of hypnoanalgesia spread across 12 weeks,
68 the authors reported significant pain reduction that persisted at 6, 9 and 12 months (Jensen et
69 al., 2005, 2008).

70

71 The aim of the current study was to assess the long-term effectiveness of a home care
72 hypnosis program in elderly persons suffering from chronic pain. In this retrospective study, 7
73 hypnosis sessions were provided throughout a 12-month period. Pain intensity and pain
74 interference were assessed at 3, 6 and 12 months. It was expected that hypnosis would be
75 effective as a means of managing pain over a long-term period in elderly people living at
76 home.

77 **Methods**

78 Sample

79 This study is a retrospective one-arm study with a 12-month follow-up. It represents the
80 continuation of a previous study assessing the short-term effect (3 months) of a hypnosis
81 home care program (Billot et al. 2020b). All the data were collected in daily practice activity.
82 All the patients had been initially enrolled in a clinical health care program that offered home
83 medical follow-up. More specifically, medical staff (a geriatrician and/or nurse) carried out 3
84 visits within a year (every 6 months), and thereafter one visit a year. When chronic pain was
85 identified by the geriatrician, the medical staff offered the patient the care of an occupational
86 therapist and/or a therapist specialized in motor behavior and neuropsychology. The therapist,
87 trained in clinical hypnosis, would determine whether the patient was able to learn hypnosis.
88 Data collection and analysis were performed between April 2016 and October 2017. All the
89 patients participating during the 18-month period of recruitment were women, all of whom
90 were diagnosed with chronic pain for a duration >6 months by the geriatrician. To be
91 included, patients had to be aged 65 years and older, to report a pain score of >4 on a
92 numerical pain rating scale (0: no pain to 10: worst pain you can imagine), and to be able to
93 understand the suggestions of the hypnotherapist. Exclusion criteria were life expectancy less
94 than 6 months and/or cognitive dysfunction. Participants received explanations of the study
95 and provided informed consent for using their clinical data for research purposes (February
96 2019). The study protocol was approved by the institutional ethics review board of Limoges
97 University Hospital (n°291-2019-57) and complied with the Declaration of Helsinki.

98

99 Experimental Protocol

100 Figure 1 illustrates the experimental protocol throughout the 12-month period. Patients took
101 part in seven 15-minute sessions conducted over a 12-month period. More specifically, the

102 hypnosis program consisted of 3 sessions over the first 3 months separated by 3 to 5 weeks.
103 Patients benefited from 2 additional sessions between 3 and 6 months, and 2 more sessions
104 between 6 and 12 months. According to our previous work, a 15-minute session is sufficient
105 to reduce pain significantly in this population (Billot et al., 2020b).

106

107 – Please insert figure 1 here –

108

109 Hypnosis Intervention

110 A therapist trained in clinical hypnosis conducted the 7 sessions at home (Figure 1). Before
111 starting the hypnosis program, patients were asked by the hypnotherapist to describe, as
112 clearly as possible, their pain sensation. This interview, using conversational hypnosis
113 technique with metaphors, analogies, paradoxes, and suggestions (Lynn & Kirsch, 2014),
114 helped the hypnotherapist to determine the best strategies to induce hypnosis and provide
115 individualized hypnotic suggestions (20-30 min). Each intervention was introduced by a 2-3
116 minute induction: “Please sit down as you will be seated when you practice this exercise
117 alone” and the patient was asked to focus her attention on specific sensations such as
118 breathing or visual cues. The hypnotherapist used conversational hypnosis during this
119 induction phase. The patient was asked to feel and to describe her pain sensation: “What does
120 this feel like? How does it feel? What do you feel?”. The therapist adapted the technique
121 following the response of the patient and used reification hypnotic techniques (modifying the
122 description of the metaphor used by the patient to describe his/her pain) and suggesting these
123 modifications during the 9 to 11 minutes of the session. If the patient described only one
124 sensation of pain (a burning sensation for example), the technique was based on modification
125 of sensorial perception through memories of good, comforting feelings. As an illustration, “I
126 put some ice on my burning sensation” or “I progressively move into the river, the river where

127 I could go as a child, and I feel the coolness of the water”. In other cases, when a patient could
128 progressively propose a clear image of an object and/or use a metaphor, for example “I feel
129 that my back is like worm-eaten wood”, the therapist would take the image of the patient and
130 make suggestions to transform the image into something less painful and better accepted. The
131 following phase was to turn the negative representation of the pain into a positive one: “the
132 barrier will be repaired and painted with a pleasant color”, and “the elastic will be cut”. The
133 two techniques were applied and the hypnotherapist adapted her vocabulary to the words
134 expressed by the participants to describe their sensations. To personalize the session, one
135 technique could be substituted with the other within a session and between the sessions.
136 Finally, posthypnotic suggestions were put forward to extend the effect of hypnosis on pain
137 and to provide skills in practicing self-hypnosis at home (2-3 min). All patients reported using
138 hypnosis as self-treatment at time intervals ranging from 3 times a week to daily use. At each
139 of the 8 home visits, comprising hypnosis sessions and assessment visit, the therapist checked
140 and collected potential adverse events connected with the practice.

141

142 Pain assessment

143 Pain perception and pain interference were assessed with the Brief Pain Inventory (BPI)
144 questionnaire (Cleeland & Ryan, 1994). All the participants filled out the questionnaire alone
145 in the presence of the therapist for the baseline, and without the therapist for the post-test
146 (M3, M6, M12). In the BPI questionnaire 4 items were dedicated to pain perception and 7
147 items to assessment of pain interference with general activity. For the pain perception section,
148 participants had to report a score between 0 (no pain) and 10 (the worst pain imagined) in
149 order to describe the intensity of (i) the worst pain they had in the past week, (ii) the least pain
150 they had in the past week, (iii) their pain perception on average, and (iv) the current pain they
151 had at the moment they were reading the questionnaire. For the pain interference section,

152 participants were asked to report the number of ways in which, over the previous week, pain
153 had interfered with their (i) general activity, (ii) walking capacity, (iii) normal work
154 (household), (iv) mood, (v) enjoying life, (vi) relationships with people, and (vii) sleep. Mean
155 score for each item, mean pain perception score (including the worst pain, the least pain, the
156 pain on average and the current pain), and mean pain interference with general activity score
157 (including pain interference with general activity, walking capacity, normal work (household),
158 mood, enjoying life, relationships with people, and sleep) were calculated. The relationship
159 between changes in mean pain perception and changes in the mean interference score was
160 analyzed.

161

162 Statistical Analysis

163 All statistical tests were performed with SigmaStat version 3.5 (Systat Software, Inc, Chicago,
164 Illinois). Descriptive statistical analysis methods, including means \pm Standard Deviation (SD),
165 were calculated for each parameter. All data are presented as means (\pm SD). Normality of data
166 was checked using the Kolmogorov-Smirnov test. Repeated measures ANOVA were used to
167 compare all BPI parameters between M0, M3, M6, and M12. When a significant main effect
168 was found, a least significant difference, Tukey post hoc test was used to identify differences
169 among the selected means. The standardized effect size was calculated using Cohen's *d* for
170 paired samples, adjusted for the correlation between the M0 and M3, M6, and M12, and using
171 the Hedge bias correction (Cohen, 1988). For all analyses, the level of significance was set at
172 $p < 0.05$.

173 **Results**

174 The study flowchart is presented in Figure 2. Out of the 21 patients initially included, 14
175 completed the 12-month hypnosis program and were analyzed. All included patients had good
176 cognitive capacity, with a score of ≥ 24 on the Mini Mental State Examination (MMSE)
177 (collected by the geriatrician or the nurse within the two months preceding the first hypnosis
178 session), except for 1 participant who scored 19. For that participant, the score was considered
179 by the geriatrician as sufficient to understand the instructions during the experiment after
180 adjustment for the level of education (Crum, 1993).

181 – Please insert figure 2 here –

182

183 Demographic Data

184 In our study, the mean age of participants was 80.9 ± 6.4 years with women aged from 65 to
185 87 years at the beginning of the study. Before the program, mean pain value was 6.8 ± 1.5 .
186 Patients suffered from osteoarthritis (n=9), neuralgia (n=2), dull pain (n=1), vertebral collapse
187 (n=1) and fracture of the neck of femur bone (n=1).

188

189 Pain Perception

190 Results are presented in Table 1 for mean score and in Table 2 for effect size. Statistical
191 analysis showed a main effect of the hypnosis program on pain perception ($p < 0.001$). Post
192 hoc analysis revealed a significant decrease from M0 to M3, M6, and M12 for the worst pain
193 (2.1, 2.3, and 1.9 points, $p < 0.001$), pain on average (1.7, 1.9, and 2.1 points, $p < 0.001$),
194 current pain (2.8, 2.9, and 2.6 points, $p < 0.001$) (Table 1). However, the least pain perception
195 score was not significantly different from M0 to M3 (0.9 points), M6 (1.0 points), and M12
196 (1.5 points) ($p = 0.061$). Pre-post intervention effect sizes were medium to large for pain on
197 average ($d \geq 0.68$), large for worst pain ($d \geq 0.89$) and current pain ($d \geq 0.99$), and small to

198 moderate for least pain ($d \geq 0.29$) (Table 2). The mean pain perception score decreased from
199 M0 to M3 (1.9 points), M6 (2.0 points), M12 (2.0 points) ($p < 0.001$) (Figure 3, white
200 symbol). For all the pain perception scores, our results did not show any significant difference
201 from M3 to M12.

202 – Please insert figure 3 here –

203

204 Pain Interference with General Activity

205 From M0 to M3, M6, and M12, Post hoc analysis showed a significant decrease in pain
206 interference with general activity (2.7, 3.1, and 3.0 points, $p < 0.001$), walking (2.9, 3.7, and
207 3.0 points, $p < 0.001$), normal work (2.9, 4.0, and 3.0 points; $p < 0.001$), mood (2.4, 3.5, and
208 3.0 points, $p < 0.001$), enjoying life (2.8, 4.0, and 3.6 points, $p < 0.001$), relationship with
209 people (2.5, 3.5, and 3.0 points, $p < 0.001$) and sleep (2.5, 3.3, and 3.4 points, $p < 0.001$). Pre-
210 post intervention effect sizes were large for pain interference with general activity ($d \geq 1.19$),
211 walking ($d \geq 1.14$), normal work ($d \geq 1.06$), mood ($d \geq 1.05$), enjoying life ($d \geq 0.81$),
212 relationships with people ($d \geq 0.91$), and moderate to large for sleep ($0.66 \leq d \leq 1.09$) (Table
213 2). Our analysis also showed that the mean pain interference score significantly decreased
214 from M0 to M3 (2.7 points), M6 (3.6 points), and M12 (3.1 points) ($p < 0.001$) (Figure 3, grey
215 symbol). For all the pain interference scores, our results did not show any significant
216 difference from M3 to M12.

217

218 Adverse Events

219 No adverse event related to the hypnosis program of self-hypnosis practice was reported at
220 any time during the 12-month follow-up period.

221 – Please insert Table 1 here –

222 – Please insert Table 2 here –

223 **Discussion**

224 In accordance with our hypothesis, this study showed that a home hypnosis program of 7
225 sessions throughout a 12-month period could be an effective means of managing pain. More
226 specifically, our results showed a significant pain decrease after 3 months, which remained
227 significantly lower at 6 and 12 months compared to baseline. These findings offer a new long-
228 term perspective on managing chronic pain at home in an elderly population with a non-
229 pharmacological treatment and a low-cost method.

230

231 On average we observed global pain perception reduction of ~30% in our elderly population
232 (mean age 80.9 years) after 7 sessions of hypnosis over a 12-month period, and it can be
233 considered as clinically significant, i.e. reduced by 30% or 2 points (Dworkin et al., 2008). In
234 a similar aged population (80.6 ± 8.2 years), Ardigo et al. (2016) reported pain relief (-15%)
235 after 3 hypnosis sessions in a 3-week program. Moreover, in a less elderly population (65
236 years), Gay et al. (2002) demonstrated that 8 sessions of a 8-week hypnosis program produced
237 50% pain reduction in population presenting with osteoarthritis. These findings suggest that
238 hypnosis could be an effective way to relieve pain in older adults, and might be modulated by
239 the age of the participant (“young” or “old” elderly) and number of sessions. Future studies
240 are needed to determine age-related efficacy and “dose-response” of a hypnosis intervention
241 in an elderly population.

242

243 While Gay et al. (2002) reported significant benefit of hypnosis intervention (8 sessions
244 within 8 weeks) compared to a control group in population presenting with osteoarthritis after
245 a 3-month follow-up period, no significant benefit was found after 6 months. The authors
246 suggest that the decrease of the therapeutic effect 6 months after the hypnosis intervention
247 might be explained by a lack of instructions for self-hypnosis at home. Our findings showed

248 that the hypnosis intervention decreases pain perception after 3 months (1.9 points, 29%) and
249 remains steady after 6 (2.0 points, 31%) and 12 months (2.0 points, 31%) (Figure 3).
250 Hypnosis efficacy may last longer by providing self-hypnosis cues by means of several
251 booster sessions. Jensen et al. (2008) investigated the long-term efficacy of 10 hypnosis
252 sessions plus self-hypnosis (with or without tapes) in 26 patients (aged 28-79 years).
253 Although the authors did not report pain relief at 12 months in the whole sample population, ~
254 23% maintained pain relief improvement for at least 12 months and 81% reported using self-
255 hypnosis. While our study did not monitor precisely the use of self-hypnosis, all patients
256 reported using hypnosis by themselves. In addition, our findings suggest that a continuum of
257 hypnosis exposure with a hypnotherapist (4 sessions in 9 months), which can be considered as
258 booster sessions, is an effective way of maintaining hypnosis efficacy in an older population.
259 On the other hand, as there are not further reductions in pain after 3 months despite additional
260 interventions, we cannot rule out the possibility that our hypnosis program showed ceiling
261 effect. To date, there is no evidence in the literature to assume that adding more or less
262 hypnosis sessions would achieve greater results. Investigation of hypnosis “dose-response” is
263 needed to address this question. Finally, while our hypnosis intervention focused on pain, the
264 hypnosis intervention reported in the Gay et al. (2002) study never directly targeted pain. We
265 consequently suggest that specific, rather than non-specific interventions, may provide better
266 outcomes.

267

268 While recent literature emphasizes the critical importance of physical activity in maintaining
269 mobility in older adults (Billot, et al., 2020a; Dent et al., 2019), pain could largely interfere
270 with these opportunities (Billot et al., 2018; Cecchi et al., 2009; Eggermont et al., 2014; Ling
271 et al., 2003; Rohel et al., 2021). Accordingly, Eggermont et al. (2014) reported that pain
272 interference was associated with at least twice the risk of mobility difficulty in 634

273 community-dwelling older adults aged 65 and older. The authors concluded that multisite or
274 widespread pain and pain interference are the best predictors of mobility difficulty. Our study
275 showed that a hypnosis program achieved significant pain interference decrease, most likely
276 due to pain perception relief, especially with improved general activity and walking after 3, 6,
277 and 12 months (from 34 to 51%). Similarly, Tan et al. (2015) observed pain interference
278 reduction after a 8-week hypnosis program (-41%) in chronic low back pain patients (25–83
279 years). This finding was maintained at 6 months (-34%). While more studies are needed to
280 determine the effect of hypnosis on physical capacity and mobility, we can suggest that a
281 hypnosis intervention focused on pain might also provide new opportunities to prevent gait
282 impairment, falls and sedentary lifestyle in an older population.

283

284 Previous studies have reported that pain interference modification is related to psychological
285 distress (McCaffrey et al., 2018; Miró et al., 2009; Nieto et al., 2012). It has been also well-
286 documented that individuals with a higher level of anxiety/depression reported more pain than
287 those with a lower level of anxiety/depression (Casten et al., 1995; Gagliese & Melzack,
288 1997; Parmelee et al., 1991; Turk et al., 1995). The relationship between pain perception and
289 psychological distress represents a genuine vicious circle (Zis et al., 2017), where both factors
290 have bidirectional incidence on each other (Casten et al., 1995). The emotional burden of
291 chronic pain increases from 2.5 to 4.1 times the risk of depression, especially among women
292 (Zis et al., 2017). In a recent meta-analysis including 20 studies, Chen et al. (2017) reported
293 that hypnosis, focused on mental health problems, helps to reduce general anxiety
294 experienced by cancer patients after treatment. Our study showed that the major pain
295 interferences with regard to mood (6.4/10), life enjoyment (7.2/10) and relationships with
296 people (4.9/10) reported before the hypnosis intervention were significantly reduced after 3
297 months (37-51%) and that the reduction remained significant after 6 (55-71%) and 12 months

298 (47-61%). While our hypnosis program focused on pain, it could be carefully suggested that it
299 may also be of benefit for mental health problems.

300

301 The literature clearly reports that chronic pain induces sleep disturbance (Lautenbacher et al.,
302 2006; Morin et al., 1998). However, anxiety/depression, pain perception and sleep disturbance
303 are known to be involved in a vicious circle and to share common neurobiological systems,
304 particularly the central serotonergic neurotransmission (Foo & Mason, 2003). Our hypnosis
305 program decreased pain interference with sleep after 3 months (2.5 points, 45%), 6 months
306 (3.3 points, 59%), and 12 months (3.4 points, 61%). After 8 weekly hypnosis sessions, Tan et
307 al. (2015) reported that quality of sleep was improved after the intervention, but was not
308 maintained after a 6-month follow-up period in chronic low back pain patients. A key factor
309 in maintaining the effect of hypnosis on sleep might be the recurrence of face-to-face
310 sessions, as provided in our study. Consequently, we suggest that a hypnosis program focused
311 on pain might be an alternative means of managing pain disorders and that face-to-face
312 sessions may be necessary to maintain the effects over a long-term period.

313

314 Limitations

315 Since our study design is retrospective and based on a health care program provided at home,
316 it may be considered a pragmatic clinical trial with no control group and with limited sample
317 size. Future research is needed to provide stronger evidence of hypnosis effectiveness in older
318 adults with a randomized controlled trial and calculation of sample size.

319 Although the design limits the significance of the results, this is the first study showing that a
320 12-month home hypnosis program in older adults is effective in relieving pain. Our findings
321 provide promising perspectives for managing pain at home and indirectly for preventing
322 hospitalization or institutionalization (Stuck et al., 2002). Treatment of chronic pain

323 represents a financial burden increasing healthcare utilization, services and costs (Keogh &
324 Herdenfeldt, 2002). The literature reports that after the age of 65 years, medication
325 prescription increases and pharmacological treatment (NSAIDs, muscle relaxants, opioids,
326 etc.) can be very expensive (Bicket & Mao, 2015). Although our study design did not allow us
327 to provide any modification of medication intake, several studies have shown that a hypnosis
328 treatment program could reduce drug consumption (Domenichiello & Ramsden, 2019;
329 Thornberry et al., 2007), notably in osteoarthritis (Gay et al., 2002). Furthermore, it is of
330 interest for patients and clinicians that the current project did not report any adverse effect of
331 the hypnosis sessions delivered either with a professional or by self-use. Further studies are
332 needed to evaluate drug intake and the medico-economic impact of a safe hypnosis program
333 at home in the elderly population with a prospective controlled-randomized trial.

334 A further limitation is related to the fact that only women were included in our study, which
335 consequently cannot be extrapolated to the overall population. While male recruitment was
336 theoretically possible, only elderly women suffering from pain were identified over the 18-
337 month period of recruitment. Over-representation of women affected by chronic pain has also
338 been reported in the literature (Abdulla et al., 2013; Bicket & Mao, 2015; Breivik et al., 2006;
339 Fillingim, 2013, 2017; Fillingim et al., 2009). Studies have demonstrated that women suffer
340 from more painful areas, worse pain intensity, greater pain interference with function, more
341 disability days, more anxiety/depression, and less self-efficacy (“personal conviction that one
342 can successfully perform certain required behaviors in a given situation”(Turk & Okifuji,
343 2002) page 3) than men (Stubbs et al., 2010; Turk & Okifuji, 2002). In a study comparing
344 hypnosis and relaxation, Gay et al. (2002) recruited 36 patients suffering from osteoarthritis,
345 women represented 100% of the population included in the hypnosis group. The greater pain
346 reported in women than in men could be partially explained by lower pain threshold and
347 tolerance (Fillingim et al., 2009; Stubbs et al., 2010). Furthermore, biological and

348 psychosocial factors could explain gender differences. It has indeed been hypothesized that
349 gonadal hormones have a role in pain perception, as estrogen and progesterone seem to
350 contribute to a higher level of pain among women (Bartley & Fillingim, 2013). The literature
351 also reports more anxiety and depression in the female population, which appears to correlate
352 with increased pain, greater pain sensitivity and poorer adjustment to chronic pain (Stubbs et
353 al., 2010). Women are more concerned by catastrophism (Bartley & Fillingim, 2013;
354 Fillingim, 2000), which is a cognitive way of coping with negative thoughts on the future
355 (Keefe et al., 1989), with more pain-related disability and reinjury fears (Stubbs et al., 2010),
356 and develop different ways of coping (Keogh & Herdenfeldt, 2002; Stubbs et al., 2010) than
357 men.

358

359 Clinical Implications

360 Hypnosis programs performed by nurse and/or paramedical staff at home provide new
361 opportunities for managing pain and avoiding a decrease in pain-related physical activity and
362 anxiety/depression in a preventive/curative way or as routine home care. In this way, hypnosis
363 training for nurse and/or paramedical staff can lead to improved pain management and could
364 be integrated in therapeutic education programs for the elderly population. Hypnosis may be
365 an effective intervention for pain management that could be offered as a safe alternative to
366 medication, particularly when concerns are expressed about the efficacy, addictive potential,
367 or side effects of a drug treatment for an individual.

368

369 Conclusion

370 This study highlighted the positive impact of a home care hypnosis program on pain
371 perception and pain interference in a short- (3 months) and long-term period (6 and 12
372 months) in older women with chronic pain. This complementary intervention may provide an

373 effective approach to cope with the current aging of the population and the attendant public
374 health issues. With a specific pain-related approach, hypnosis could also be an effective way
375 to relieve related functional symptoms including poor mobility, psychological distress, and
376 sleep. Hypnosis may prove a potentially helpful additional care provided by health
377 practitioners, to be an effective way of providing long-term management of managing chronic
378 pain in an elderly population. Further studies are needed to assess the underlying mechanisms
379 of long-term hypnosis effects in older adults and its medico-economic impact on society.

380 **References**

- 381 Abdulla, A., Adams, N., Bone, M., Elliott, A. M., Gaffin, J., Jones, D., Knaggs, R., Martin,
382 D., Sampson, L., Schofield, P., & British Geriatric Society. (2013). Guidance on the
383 management of pain in older people. *Age and Ageing*, *42 Suppl 1*, i1-57.
384 <https://doi.org/10.1093/ageing/afs200>
- 385 Adachi, T., Fujino, H., Nakae, A., Mashimo, T., & Sasaki, J. (2014). A Meta-Analysis of
386 Hypnosis for Chronic Pain Problems : A Comparison Between Hypnosis, Standard
387 Care, and Other Psychological Interventions. *International Journal of Clinical and
388 Experimental Hypnosis*, *62*(1), 1-28. <https://doi.org/10.1080/00207144.2013.841471>
- 389 Ardigo, S., Herrmann, F. R., Moret, V., Déramé, L., Giannelli, S., Gold, G., & Pautex, S.
390 (2016). Hypnosis can reduce pain in hospitalized older patients : A randomized
391 controlled study. *BMC Geriatrics*, *16*(1), 14. <https://doi.org/10.1186/s12877-016-0180-y>
- 393 Ashton, C., Whitworth, G. C., Seldomridge, J. A., Shapiro, P. A., Weinberg, A. D., Michler,
394 R. E., Smith, C. R., Rose, E. A., Fisher, S., & Oz, M. C. (1997). Self-hypnosis reduces
395 anxiety following coronary artery bypass surgery. A prospective, randomized trial.
396 *The Journal of Cardiovascular Surgery*, *38*(1), 69-75.
- 397 Bartley, E. J., & Fillingim, R. B. (2013). Sex differences in pain : A brief review of clinical
398 and experimental findings. *British Journal of Anaesthesia*, *111*(1), 52-58.
399 <https://doi.org/10.1093/bja/aet127>
- 400 Bicket, M. C., & Mao, J. (2015). Chronic Pain in Older Adults. *Anesthesiology Clinics*, *33*(3),
401 577-590. <https://doi.org/10.1016/j.anclin.2015.05.011>
- 402 Billot, M., Calvani, R., Urtamo, A., Sánchez-Sánchez, J. L., Cicolari-Micaldi, C., Chang, M.,
403 Roller-Wirnsberger, R., Wirnsberger, G., Sinclair, A., Vaquero-Pinto, N., Jyväkorpi,
404 S., Öhman, H., Strandberg, T., Schols, J. M. G. A., Schols, A. M. W. J., Smeets, N.,
405 Topinkova, E., Michalkova, H., Bonfigli, A. R., ... Freiburger, E. (2020a). Preserving
406 Mobility in Older Adults with Physical Frailty and Sarcopenia : Opportunities,
407 Challenges, and Recommendations for Physical Activity Interventions. *Clinical
408 Interventions in Aging*, *15*, 1675-1690. <https://doi.org/10.2147/CIA.S253535>
- 409 Billot, M., Jaglin, P., Rainville, P., Rigoard, P., Langlois, P., Cardinaud, N., Tchalla, A., &
410 Wood, C. (2020b). Hypnosis Program Effectiveness in a 12-week Home Care
411 Intervention To Manage Chronic Pain in Elderly Women : A Pilot Trial. *Clinical
412 Therapeutics*, *42*(1), 221-229. <https://doi.org/10.1016/j.clinthera.2019.11.007>
- 413 Billot, M., Neige, C., Gagné, M., Mercier, C., & Bouyer, L. J. (2018). Effect of Cutaneous
414 Heat Pain on Corticospinal Excitability of the Tibialis Anterior at Rest and during
415 Submaximal Contraction. *Neural Plasticity*, *2018*, 8713218.
416 <https://doi.org/10.1155/2018/8713218>
- 417 Breivik, H., Collett, B., Ventafridda, V., Cohen, R., & Gallacher, D. (2006). Survey of
418 chronic pain in Europe : Prevalence, impact on daily life, and treatment. *European
419 Journal of Pain*, *10*(4), 287-287. <https://doi.org/10.1016/j.ejpain.2005.06.009>
- 420 Casten, R. J., Parmelee, P. A., Kleban, M. H., Lawton, P. M., & Katz, I. R. (1995). The
421 relationships among anxiety, depression, and pain in a geriatric institutionalized
422 sample: *Pain*, *61*(2), 271-276. [https://doi.org/10.1016/0304-3959\(94\)00185-H](https://doi.org/10.1016/0304-3959(94)00185-H)
- 423 Cecchi, F., Molino-Lova, R., Di Iorio, A., Conti, A. A., Mannoni, A., Lauretani, F.,
424 Benvenuti, E., Bandinelli, S., Macchi, C., & Ferrucci, L. (2009). Measures of physical

425 performance capture the excess disability associated with hip pain or knee pain in
426 older persons. *The Journals of Gerontology. Series A, Biological Sciences and*
427 *Medical Sciences*, 64(12), 1316-1324. <https://doi.org/10.1093/gerona/glp125>

428 Chen, P.-Y., Liu, Y.-M., & Chen, M.-L. (2017). The Effect of Hypnosis on Anxiety in
429 Patients With Cancer : A Meta-Analysis. *Worldviews on Evidence-Based Nursing*,
430 14(3), 223-236. <https://doi.org/10.1111/wvn.12215>

431 Cleeland, C. S., & Ryan, K. M. (1994). Pain assessment : Global use of the Brief Pain
432 Inventory. *Annals of the Academy of Medicine, Singapore*, 23(2), 129-138.

433 Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd éd.).

434 Corsi, N., Roberto, A., Cortesi, L., Nobili, A., Mannucci, P. M., & Corli, O. (2018).
435 Prevalence, characteristics and treatment of chronic pain in elderly patients
436 hospitalized in internal medicine wards. *European Journal of Internal Medicine*, 55,
437 35-39. <https://doi.org/10.1016/j.ejim.2018.05.031>

438 Crum, R. M. (1993). Population-Based Norms for the Mini-Mental State Examination by Age
439 and Educational Level. *JAMA: The Journal of the American Medical Association*,
440 269(18), 2386. <https://doi.org/10.1001/jama.1993.03500180078038>

441 Cuellar, N. G. (2005). Hypnosis for pain management in the older adult. *Pain Management*
442 *Nursing : Official Journal of the American Society of Pain Management Nurses*, 6(3),
443 105-111. <https://doi.org/10.1016/j.pmn.2005.05.004>

444 Dent, E., Martin, F. C., Bergman, H., Woo, J., Romero-Ortuno, R., & Walston, J. D. (2019).
445 Management of frailty : Opportunities, challenges, and future directions. *Lancet*
446 *(London, England)*, 394(10206), 1376-1386. [https://doi.org/10.1016/S0140-](https://doi.org/10.1016/S0140-6736(19)31785-4)
447 [6736\(19\)31785-4](https://doi.org/10.1016/S0140-6736(19)31785-4)

448 Domenichiello, A. F., & Ramsden, C. E. (2019). The silent epidemic of chronic pain in older
449 adults. *Progress in Neuro-Psychopharmacology & Biological Psychiatry*, 93,
450 284-290. <https://doi.org/10.1016/j.pnpbp.2019.04.006>

451 Dworkin, R. H., Turk, D. C., Wyrwich, K. W., Beaton, D., Cleeland, C. S., Farrar, J. T.,
452 Haythornthwaite, J. A., Jensen, M. P., Kerns, R. D., Ader, D. N., Brandenburg, N.,
453 Burke, L. B., Cella, D., Chandler, J., Cowan, P., Dimitrova, R., Dionne, R., Hertz, S.,
454 Jadad, A. R., ... Zavisic, S. (2008). Interpreting the clinical importance of treatment
455 outcomes in chronic pain clinical trials : IMMPACT recommendations. *The Journal of*
456 *Pain: Official Journal of the American Pain Society*, 9(2), 105-121.
457 <https://doi.org/10.1016/j.jpain.2007.09.005>

458 Eggermont, L. H. P., Leveille, S. G., Shi, L., Kiely, D. K., Shmerling, R. H., Jones, R. N.,
459 Guralnik, J. M., & Bean, J. F. (2014). Pain characteristics associated with the onset of
460 disability in older adults : The maintenance of balance, independent living, intellect,
461 and zest in the Elderly Boston Study. *Journal of the American Geriatrics Society*,
462 62(6), 1007-1016. <https://doi.org/10.1111/jgs.12848>

463 Ferrucci, L., Giallauria, F., & Guralnik, J. M. (2008). Epidemiology of Aging. *Radiologic*
464 *clinics of North America*, 46(4), 643-v. <https://doi.org/10.1016/j.rcl.2008.07.005>

465 Fillingim, R. B. (2000). Sex, gender, and pain : Women and men really are different. *Current*
466 *Review of Pain*, 4(1), 24-30. <https://doi.org/10.1007/s11916-000-0006-6>

467 Fillingim, R. B. (2013). Complex associations among sex, anxiety and pain. *Pain*, 154(3),
468 332-333. <https://doi.org/10.1016/j.pain.2012.12.013>

- 469 Fillingim, R. B. (2017). Individual differences in pain : Understanding the mosaic that makes
470 pain personal. *Pain*, *158*(1), S11-S18.
471 <https://doi.org/10.1097/j.pain.0000000000000775>
- 472 Fillingim, R. B., King, C. D., Ribeiro-Dasilva, M. C., Rahim-Williams, B., & Riley, J. L.
473 (2009). Sex, Gender, and Pain : A Review of Recent Clinical and Experimental
474 Findings. *The Journal of Pain*, *10*(5), 447-485.
475 <https://doi.org/10.1016/j.jpain.2008.12.001>
- 476 Foo, H., & Mason, P. (2003). Brainstem modulation of pain during sleep and waking. *Sleep*
477 *Medicine Reviews*, *7*(2), 145-154. <https://doi.org/10.1053/smr.2002.0224>
- 478 Gagliese, L., & Melzack, R. (1997). Chronic pain in elderly people. *Pain*, *70*(1), 3-14.
479 [https://doi.org/10.1016/s0304-3959\(96\)03266-6](https://doi.org/10.1016/s0304-3959(96)03266-6)
- 480 Gay, M.-C., Philippot, P., & Luminet, O. (2002). Differential effectiveness of psychological
481 interventions for reducing osteoarthritis pain : A comparison of Erickson hypnosis and
482 Jacobson relaxation. *European Journal of Pain*, *6*(1), 1-16.
483 <https://doi.org/10.1053/eujp.2001.0263>
- 484 Helme, R. D., & Gibson, S. J. (2001). The epidemiology of pain in elderly people. *Clinics in*
485 *Geriatric Medicine*, *17*(3), 417-431. [https://doi.org/10.1016/S0749-0690\(05\)70078-1](https://doi.org/10.1016/S0749-0690(05)70078-1)
- 486 Jensen, M. P., Barber, J., Hanley, M. A., Engel, J. M., Romano, J. M., Cardenas, D. D., Kraft,
487 G. H., Hoffman, A. J., & Patterson, D. R. (2008). Long-Term Outcome of Hypnotic-
488 Analgesia Treatment for Chronic Pain in Persons with Disabilities. *International*
489 *Journal of Clinical and Experimental Hypnosis*, *56*(2), 156-169.
490 <https://doi.org/10.1080/00207140701849486>
- 491 Jensen, M. P., Hanley, M. A., Engel, J. M., Romano, J. M., Barber, J., Cardenas, D. D., Kraft,
492 G. H., Hoffman, and, A. J., & Patterson, D. R. (2005). Hypnotic Analgesia for Chronic
493 Pain in Persons with Disabilities : A Case Series Abstract. *International Journal of*
494 *Clinical and Experimental Hypnosis*, *53*(2), 198-228.
495 <https://doi.org/10.1080/00207140590927545>
- 496 Jensen, M. P., & Patterson, D. R. (2014). Hypnotic approaches for chronic pain management :
497 Clinical implications of recent research findings. *American Psychologist*, *69*(2),
498 167-177. <https://doi.org/10.1037/a0035644>
- 499 Jensen, M., & Patterson, D. R. (2006). Hypnotic Treatment of Chronic Pain. *Journal of*
500 *Behavioral Medicine*, *29*(1), 95-124. <https://doi.org/10.1007/s10865-005-9031-6>
- 501 Kaye, A. D., Baluch, A. R., Kaye, R. J., Niaz, R. S., Kaye, A. J., Liu, H., & Fox, C. J. (2014).
502 Geriatric pain management, pharmacological and nonpharmacological considerations.
503 *Psychology & Neuroscience*, *7*(1), 15-26. <https://doi.org/10.3922/j.psns.2014.1.04>
- 504 Keefe, F. J., Brown, G. K., Wallston, K. A., & Caldwell, D. S. (1989). Coping with
505 rheumatoid arthritis pain : Catastrophizing as a maladaptive strategy: *Pain*, *37*(1),
506 51-56. [https://doi.org/10.1016/0304-3959\(89\)90152-8](https://doi.org/10.1016/0304-3959(89)90152-8)
- 507 Keogh, E., & Herdenfeldt, M. (2002). Gender, coping and the perception of pain: *Pain*, *97*(3),
508 195-201. [https://doi.org/10.1016/S0304-3959\(01\)00427-4](https://doi.org/10.1016/S0304-3959(01)00427-4)
- 509 Kihlstrom, J. F. (1985). Hypnosis. *Annual Review of Psychology*, *36*(1), 385-418.
510 <https://doi.org/10.1146/annurev.ps.36.020185.002125>

511 Kontis, V., Bennett, J. E., Mathers, C. D., Li, G., Foreman, K., & Ezzati, M. (2017). Future
512 life expectancy in 35 industrialised countries : Projections with a Bayesian model
513 ensemble. *The Lancet*, 389(10076), 1323-1335. [https://doi.org/10.1016/S0140-](https://doi.org/10.1016/S0140-6736(16)32381-9)
514 [6736\(16\)32381-9](https://doi.org/10.1016/S0140-6736(16)32381-9)

515 Lang, E. V., Joyce, J. S., Spiegel, D., Hamilton, D., & Lee, K. K. (1996). Self-hypnotic
516 relaxation during interventional radiological procedures : Effects 012 pain perception
517 and intravenous drug use. *International Journal of Clinical and Experimental*
518 *Hypnosis*, 44(2), 106-119. <https://doi.org/10.1080/00207149608416074>

519 Lautenbacher, S., Kundermann, B., & Krieg, J.-C. (2006). Sleep deprivation and pain
520 perception. *Sleep Medicine Reviews*, 10(5), 357-369.
521 <https://doi.org/10.1016/j.smrv.2005.08.001>

522 Ling, S. M., Fried, L. P., Garrett, E. S., Fan, M.-Y., Rantanen, T., & Bathon, J. M. (2003).
523 Knee osteoarthritis compromises early mobility function : The Women's Health and
524 Aging Study II. *The Journal of Rheumatology*, 30(1), 114-120.

525 Lynch, D. (2000). *Geriatric pain*. In : Raj PP, ed. *Practical Management of Pain* (3rd éd.).
526 Lynn, S. J., & Kirsch, I. (2014). Clinical Hypnosis. In *The Encyclopedia of Clinical*
527 *Psychology* (p. 1-6). American Cancer Society.
528 <https://doi.org/10.1002/9781118625392.wbecp520>

529 McCaffrey, S. A., Black, R. A., Butler, S. F., & Inflexxion, Inc. (2018). Psychometric
530 evaluation of the PainCAS Interference with Daily Activities,
531 Psychological/Emotional Distress, and Pain scales. *Quality of Life Research: An*
532 *International Journal of Quality of Life Aspects of Treatment, Care and*
533 *Rehabilitation*, 27(3), 835-843. <https://doi.org/10.1007/s11136-017-1766-3>

534 Miró, J., Raichle, K. A., Carter, G. T., O'Brien, S. A., Abresch, R. T., McDonald, C. M., &
535 Jensen, M. P. (2009). Impact of biopsychosocial factors on chronic pain in persons
536 with myotonic and facioscapulohumeral muscular dystrophy. *The American Journal of*
537 *Hospice & Palliative Care*, 26(4), 308-319.
538 <https://doi.org/10.1177/1049909109335146>

539 Montgomery, G. H., Duhamel, K. N., & Redd, W. H. (2000). A meta-analysis of hypnotically
540 induced analgesia : How effective is hypnosis? *International Journal of Clinical and*
541 *Experimental Hypnosis*, 48(2), 138-153. <https://doi.org/10.1080/00207140008410045>

542 Morin, C. M., Gibson, D., & Wade, J. (1998). Self-reported sleep and mood disturbance in
543 chronic pain patients. *The Clinical Journal of Pain*, 14(4), 311-314.
544 <https://doi.org/10.1097/00002508-199812000-00007>

545 Nieto, R., Raichle, K. A., Jensen, M. P., & Miró, J. (2012). Changes in pain-related beliefs,
546 coping, and catastrophizing predict changes in pain intensity, pain interference, and
547 psychological functioning in individuals with myotonic muscular dystrophy and
548 facioscapulohumeral dystrophy. *The Clinical Journal of Pain*, 28(1), 47-54.
549 <https://doi.org/10.1097/AJP.0b013e31822019b1>

550 Nigam, Y., Knight, J., Bhattacharya, S., & Bayer, A. (2012). Physiological Changes
551 Associated with Aging and Immobility. *Journal of Aging Research*, 2012, 1-2.
552 <https://doi.org/10.1155/2012/468469>

553 Parmelee, P. A., Katz, I. R., & Lawton, M. P. (1991). The relation of pain to depression
554 among institutionalized aged. *Journal of Gerontology*, 46(1), P15-21.
555 <https://doi.org/10.1093/geronj/46.1.p15>

- 556 Passarelli, M. C. G., Jacob-Filho, W., & Figueras, A. (2005). Adverse Drug Reactions in an
557 Elderly Hospitalised Population : Inappropriate Prescription is a Leading Cause.
558 *Drugs & Aging*, 22(9), 767-777. <https://doi.org/10.2165/00002512-200522090-00005>
- 559 Patel, K. V., Guralnik, J. M., Dansie, E. J., & Turk, D. C. (2013). Prevalence and impact of
560 pain among older adults in the United States : Findings from the 2011 National Health
561 and Aging Trends Study: *Pain*, 154(12), 2649-2657.
562 <https://doi.org/10.1016/j.pain.2013.07.029>
- 563 Patterson, D. R., & Jensen, M. P. (2003). Hypnosis and clinical pain. *Psychological Bulletin*,
564 129(4), 495-521. <https://doi.org/10.1037/0033-2909.129.4.495>
- 565 Phillips, C. J. (2009). The Cost and Burden of Chronic Pain. *Reviews in Pain*, 3(1), 2-5.
566 <https://doi.org/10.1177/204946370900300102>
- 567 Rohel, A., Bouffard, J., Patricio, P., Mavromatis, N., Billot, M., Roy, J.-S., Bouyer, L.,
568 Mercier, C., & Masse-Alarie, H. (2021). The effect of experimental pain on the
569 excitability of the corticospinal tract in humans : A systematic review and meta-
570 analysis. *European Journal of Pain (London, England)*.
571 <https://doi.org/10.1002/ejp.1746>
- 572 Sieck, G. C. (2003). Physiology of aging. *Journal of Applied Physiology*, 95(4), 1333-1334.
573 <https://doi.org/10.1152/jappphysiol.00718.2003>
- 574 Stubbs, D., Krebs, E., Bair, M., Damush, T., Wu, J., Sutherland, J., & Kroenke, K. (2010).
575 Sex Differences in Pain and Pain-Related Disability among Primary Care Patients with
576 Chronic Musculoskeletal Pain. *Pain Medicine*, 11(2), 232-239.
577 <https://doi.org/10.1111/j.1526-4637.2009.00760.x>
- 578 Stuck, A. E., Egger, M., Hammer, A., Minder, C. E., & Beck, J. C. (2002). Home visits to
579 prevent nursing home admission and functional decline in elderly people : Systematic
580 review and meta-regression analysis. *JAMA*, 287(8), 1022-1028.
581 <https://doi.org/10.1001/jama.287.8.1022>
- 582 Tan, G., Rintala, D. H., Jensen, M. P., Fukui, T., Smith, D., & Williams, W. (2015). A
583 randomized controlled trial of hypnosis compared with biofeedback for adults with
584 chronic low back pain : RCT of hypnosis versus biofeedback for CLBP. *European
585 Journal of Pain*, 19(2), 271-280. <https://doi.org/10.1002/ejp.545>
- 586 Thompson, T., Terhune, D. B., Oram, C., Sharangparni, J., Rouf, R., Solmi, M., Veronese, N.,
587 & Stubbs, B. (2019). The effectiveness of hypnosis for pain relief : A systematic
588 review and meta-analysis of 85 controlled experimental trials. *Neuroscience &
589 Biobehavioral Reviews*, 99, 298-310. <https://doi.org/10.1016/j.neubiorev.2019.02.013>
- 590 Thornberry, T., Schaeffer, J., Wright, P. D., Haley, M. C., & Kirsh, K. L. (2007). An
591 exploration of the utility of hypnosis in pain management among rural pain patients.
592 *Palliative & Supportive Care*, 5(2), 147-152.
593 <https://doi.org/10.1017/s1478951507070216>
- 594 Turk, D. C., Okifuji, A., & Scharff, L. (1995). Chronic pain and depression : Role of
595 perceived impact and perceived control in different age cohorts. *Pain*, 61(1), 93-101.
596 [https://doi.org/10.1016/0304-3959\(94\)00167-d](https://doi.org/10.1016/0304-3959(94)00167-d)
- 597 Turk, Dennis C., & Okifuji, A. (2002). Psychological factors in chronic pain : Evolution and
598 revolution. *Journal of Consulting and Clinical Psychology*, 70(3), 678-690.
599 <https://doi.org/10.1037/0022-006X.70.3.678>

- 600 Veehof, L. J. G., Stewart, R. E., Meyboom-de Jong, B., & Haaijer-Ruskamp, F. M. (1999).
601 Adverse drug reactions and polypharmacy in the elderly in general practice. *European*
602 *Journal of Clinical Pharmacology*, 55(7), 533-536.
603 <https://doi.org/10.1007/s002280050669>
- 604 Zis, P., Daskalaki, A., Bountouni, I., Sykioti, P., Varrassi, G., & Paladini, A. (2017).
605 Depression and chronic pain in the elderly : Links and management challenges.
606 *Clinical Interventions in Aging, Volume 12*, 709-720.
607 <https://doi.org/10.2147/CIA.S113576>

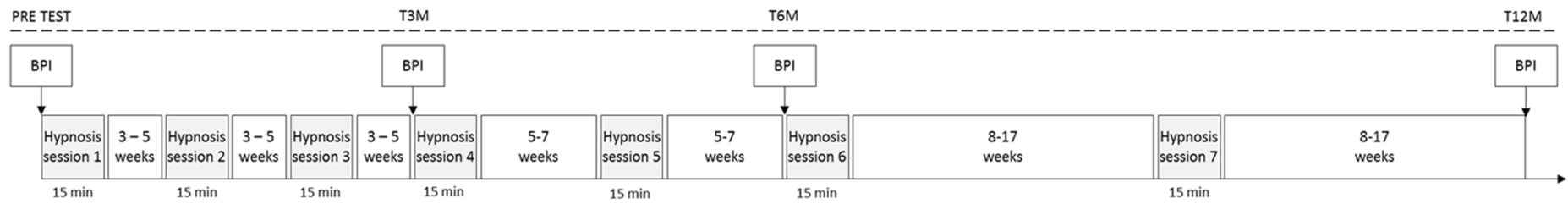


Figure 1. Experimental protocol of the hypnosis program. The brief Pain Inventory (BPI) questionnaire was delivered before (M0) and at 3 (M3), 6 (M6), and 12 (M12) months after the first session.

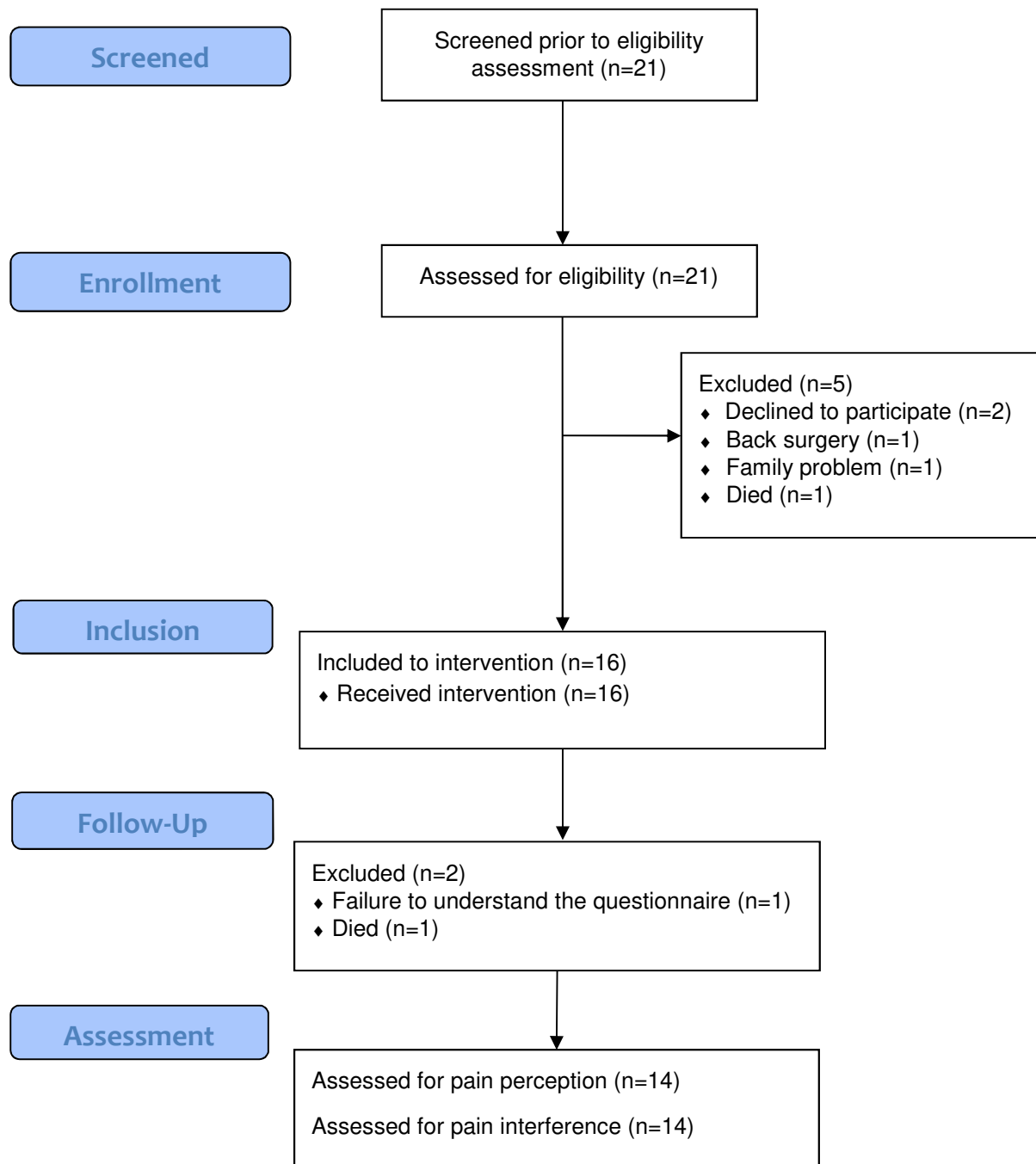


Figure 2. Participants included in the study.

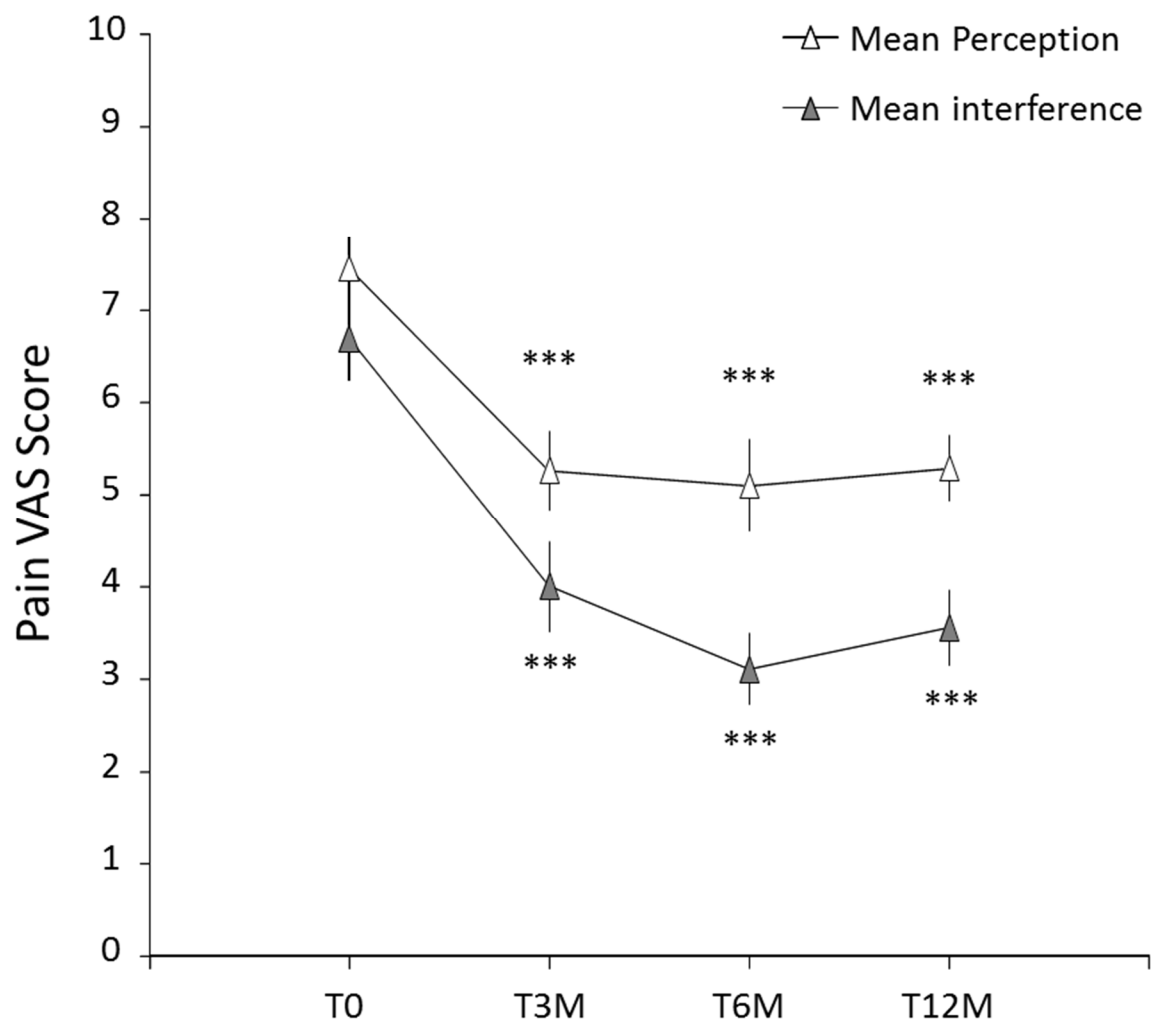


Figure 3. Mean perception (white triangle) and mean interference (grey triangle) of the Brief Pain Inventory (BPI) VAS score at M0 (before), M3 (3 months), M6 (6 months), and M12 (12 months) of the hypnosis program. *** $p < 0.001$ significant difference with M0. VAS: Visual Analog Scale.