

# **Clinical and subjective oral health status of care home residents in Europe: a systematic review**

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## **Brief summary:**

A systematic review was performed on clinical and subjective oral health outcomes of care home residents in Europe, showing a high prevalence of oral health problems in care home settings in Europe, irrespective of the country or healthcare system.

1 **Abstract**

2 Objective: Several studies demonstrated the poor oral health of care home residents in Europe  
3 but there is no systematic overview of the relevant literature. The objective of this study was  
4 to systematically review the evidence on the clinical and subjective oral health outcomes of  
5 care home residents in Europe.

6 Design: The study design is a systematic review.

7 Methods and participants: All included publications presented data on clinical and/or  
8 subjective oral health outcomes in care home residents in Europe with no restrictions for  
9 language or study design. MEDLINE, Embase and CINAHL, were searched, including  
10 publications from January 2010 onwards. Data extraction and quality assessment (Qualsyst  
11 tool) was performed by two researchers independently. Findings were synthesized  
12 narratively, lack in data homogeneity restricted the relevance of a meta-analysis.

13 Results: Eighty-three papers from 18 countries were included in the systematic review, with a  
14 sample size ranging from 39 to 92,827 participants. Their mean age was over 80 years. The  
15 residents had few natural teeth, with less than a third a functional natural dentition.  
16 Removable dentures were present in half to 80% of residents. A high prevalence of dental  
17 caries was reported. Oral hygiene was insufficient, for both natural teeth and removable  
18 dentures. Few residents had a healthy periodontium. Clinical treatment needs were found in  
19 the majority of residents. Perceived treatment needs were high with at least one third of care  
20 home residents reporting a need for care due to poor oral health. A fifth to half of the residents  
21 reported negative impacts of their oral condition on their everyday lives.

22 Conclusion and implications: This systematic review clearly highlights the poor oral health and  
23 high burden of oral conditions among care home residents across Europe, irrespective of  
24 country or healthcare system. There is need for substantial policy actions to improve oral  
25 health in care homes.

26 Funding: The authors confirm that they received no specific funding for this work.

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28

29 **Introduction**

30

31 The oral health of care home residents is an increasingly important public health concern.<sup>1-5</sup>  
32 Oral Health, as defined by WHO, is the state of the mouth, teeth and orofacial structures that  
33 enables individuals to perform essential functions, such as eating, breathing and speaking, and  
34 encompasses psychosocial dimensions, such as self-confidence, well-being and the ability to  
35 socialize and work without pain, discomfort and embarrassment. Oral health varies over the  
36 life course from early life to old age, is integral to general health and supports individuals in  
37 participating in society and achieving their potential.<sup>6</sup> As society ages, the number of frail care-  
38 dependent older people at risk for poor oral health increases.<sup>7</sup> Poor oral health negatively  
39 impacts on the quality of life of older people, affecting their ability to eat, speak and interact  
40 socially, and is a risk factor for several systemic diseases such as aspiration pneumonia.<sup>8-15</sup>

41 In the last decade, several epidemiologic studies were published on the oral health status of  
42 care home residents in Europe and across the world. In 2019, Wong et al. published a  
43 worldwide systematic review on oral health of care home residents, in which epidemiological  
44 data was searched for in combination (Boolean operator AND) with oral health determinants.  
45 As the presence of oral health determinants in the publication was used as an inclusion  
46 criterion, the majority of the relevant literature on epidemiologic data from Europe was not  
47 included in the above mentioned review.<sup>16</sup> Moreover, the relevant studies are quite  
48 heterogenous in their methodological features, while the organization and characteristics of  
49 care homes, including aspects of oral healthcare provision, vary considerably according to  
50 context. Therefore, there is a need for a systematic review focusing on oral health outcomes  
51 that includes all relevant evidence and provides a comprehensive picture on the oral health  
52 status of care home residents in a European context. This would provide essential background  
53 information for health and social care policy makers to inform future policies and  
54 interventions for this vulnerable group of older adults. The aim of this systematic review is to  
55 give a broad overview of clinical and subjective oral health outcomes of care home residents  
56 in Europe.

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58

## 59 **Methods**

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61 This systematic review followed the Preferred Reporting Items of the Systematic Review and  
62 Meta-Analysis (PRISMA) guidelines.<sup>17</sup> The protocol was registered and published on  
63 PROSPERO (CRD42021226842) and the search strategy was developed by the first author in  
64 collaboration with the Knowledge Center for Health at XXXX university (XXXX)<sup>18</sup> and reviewed  
65 by the second and last authors (EP, BJ). Relevant search term identification was performed  
66 using thesauri MeSH (PubMed), Emtree (Embase) and Yale MeSH Analyzer. Pubmed  
67 PubReminer was used as a text mining tool to identify extra possible search terms. The search  
68 strategy was manually adapted for each database and can be found in supplementary file 1.  
69 The search was carried out in MEDLINE (via PubMed interface), Embase (via embase.com  
70 interface) and CINAHL (via EBCSOhost interface), including publications from January 2010  
71 onwards. The last update was run in December 2022. References of included papers were  
72 hand-searched. Subsequently, grey literature was also searched using Mednar, Opengrey and  
73 Open Access Theses and Dissertations. Also, conference abstracts were included in the search.  
74 In addition, in order to identify all possible regional or national data, an email request for  
75 reports or unpublished data was sent to all European Chief Dental Officers in November 2020,  
76 followed by a final reminder in September 2021.

### 77 Inclusion and exclusion criteria

78 All included publications presented data on clinical and/or subjective oral health outcomes in  
79 care home residents in Europe without restrictions for language or study design. Care home  
80 residents were defined as residents living in long-term care facilities for older adults. Studies  
81 in psychiatric facilities and facilities for persons with disabilities were excluded. Only study  
82 samples with a mean age above 65 years were included.

### 83 Study selection, data extraction and quality assessment

84 First, title and abstract of the identified publications were screened for potential inclusion by  
85 the first reviewer (LJ). The software program Endnote was used for deduplication. Second, all  
86 abstracts were imported into the web application Rayyan.<sup>19</sup> The full-text articles of these  
87 potentially eligible studies were assessed by two independent reviewers (LJ and EP). The

88 reason for exclusion was recorded using a fixed order of exclusion criteria. If the text was in a  
89 language not known to any of the authors, support of online translation was used to assess  
90 eligibility. Conflicts were resolved by consensus, including the expertise of a third reviewer  
91 (BJ) when needed. The inter-rater agreement for study selection was  $k=0.62$ , which represents  
92 a substantial agreement.<sup>20</sup>

93 The data was extracted by two independent reviewers (LJ and EP) using a pre-piloted  
94 extraction form. All outcomes are listed in Table 1. Initial discrepancies were discussed  
95 between the two reviewers and were all resolved by consensus. When possible and beneficial,  
96 the primary investigators were contacted for clarification by e-mail.

97 The same two independent reviewers performed the quality assessment of each study using  
98 the QualSyst tool for quantitative studies. Quallsyst was chosen as a quality assessment tool  
99 as it was developed to be applicable for a range of study designs (Supplementary file 2).<sup>21</sup> The  
100 tool consists of 14 items evaluating a range of methodological outcomes and enabling the  
101 reviewers to assign a numerical score to each paper, with a higher score denoting higher  
102 quality. In all stages, discrepancies were resolved by discussion. Given the data collection  
103 difficulties frequently occurring in residential care settings, all authors agreed not to penalize  
104 studies for suboptimal sampling strategies and representativeness if sufficient information on  
105 the selection process was available.

106

## 107 **Results**

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### 109 Characteristics of included studies and participants

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111 The flow-diagram of the study selection can be found in Figure 1. A total of 83 reports, collated  
112 into 68 studies, originating from 18 different European countries were included: Austria (2),  
113 Belgium (4), Croatia (2), Finland (5), Spain (5), United Kingdom (7), France (2), Germany (15),  
114 Italy (6), Lithuania (1), Sweden (3), The Netherlands (7), Poland (3), Portugal (1), Slovenia (1),  
115 Switzerland (2), Norway (1) and Iceland (1). Most studies were conducted in care homes (60),  
116 others in a combination of assisted nursing facilities and a care home (4), assisted nursing

117 facilities (1), or geriatric residences (3). Most study designs were cross-sectional (59), six were  
118 RCTs and three cohort reports were also included. The total number of participants in this  
119 systematic review exceeds 150,000, with a large sample size range of 39 to 92,827 residents  
120 among the included studies. The mean age of the combined participants is over 80, with a  
121 range of 21 to 109 years. It was not possible to calculate the exact mean age of all included  
122 participants due to some studies not reporting the mean age, or only reporting the mean age  
123 of different groups within the study. Participants diagnosed with dementia or mild cognitive  
124 impairment were included in the majority of the reports (45/83), they were excluded in 8  
125 studies, while in 29 studies it was unclear whether the sample included those residents.

126 An overview of the excluded studies can be found in supplementary Table 1.

### 127 Quality Assessment

128 Qualsyst total score ranged from 27.0-100.0%. The included studies performed poorly on the  
129 quality of the outcome measures, sampling, analytic methods, variance, controlling for  
130 confounding and reporting results in sufficient detail (see Table 2 and supplementary Table  
131 2).

### 132 Narrative synthesis of the oral health data

#### 133 *Clinical oral health*

134 There was large variation in the proportion of edentulous residents between the studies (19.0-  
135 80.5%) but in the majority of studies (34/54) it ranged from 40.0% to 60.0%.<sup>4,5,8,9,22-50</sup> Outliers  
136 could be seen in The Netherlands, where the prevalence of edentulousness ranged between  
137 73.0% and 80.0%.<sup>51-54</sup> In contrast, studies from Sweden, Norway and Switzerland reported  
138 respective prevalences of around 20.0%.<sup>2,55-59</sup>

139 Removable dentures were present in 40.0-85.0% of the residents.<sup>4,9,22-24,26,28,29,32,34,42-  
140 44,47,51,53,55,57,60-69</sup> The proportion of residents wearing complete dentures, both in the upper and  
141 lower jaw, varied from 33.0% to 46.0% whereas removable partial dentures were present in  
142 16.0% to 41.0% of the residents.<sup>4,9,23,24,62,63,67,67</sup>

143 The proportion of residents with a functional dentition (more than 20 natural teeth) ranged  
144 from 6.0% to 34.0%.<sup>4,24,38,39,41,41,45,56,60,61,70-72</sup> The mean number of remaining natural teeth among

145 the dentate residents (those with natural teeth) ranged from 9.8 to 20.0 teeth per person.  
146 4,5,22,24,31,33,45,50,51,54,66,73

147 Dental plaque levels were reported in 26 studies, using seven different methods or indices.  
148 Eight out of 26 studies reported on oral hygiene without the use of a validated index or  
149 methodology. Irrespective of the method used, oral hygiene was generally poor. The Sillness  
150 & Loë index <sup>74</sup> was used in six studies and varied from 1.47 to 2.43 (for reference, the index  
151 score ranges from 0 to 3, with higher scores denoting worse oral hygiene) . <sup>24,49,54,60,63,72</sup>

152 For the assessment of denture plaque levels, ten studies reported the Denture Hygiene index  
153 (DHI), and three studies used the Augsburg and Elahi index.<sup>75,76</sup> All studies reported high  
154 levels of plaque on the removable dentures. <sup>24,28,29,29,32-34,54,63,77-79</sup>

155 The proportion of dentate residents with untreated dental caries ranged from 23% to 82%  
156 with the majority (15 out of 17 studies) reporting caries activity in more than half of dentate  
157 residents. <sup>4,5,8,9,30,44,45,49-52,55,56,58,60,61,64,80</sup> The average number of decayed teeth varied from 0.53 to  
158 5.0 per person. <sup>4,5,8,30,35,40,42,45,48,49,49,55-58,60,61,64,67,70,71,77,79,81</sup> The mean number of filled teeth per  
159 person varied from 0.2 to 9.2. <sup>4,8,40,48,48,55,58,61,64,67,70,71,79</sup> Finally, an average of 0.9 to 3.5  
160 residual roots per resident was found.<sup>4,42,48,49,56,57</sup> Two studies reported the prevalence of  
161 dental abscess (through the PUFA index: pulpal involvement, ulceration, fistulae or abscesses)  
162 to be 15-26%.<sup>5,45</sup>

163 Few residents were seen with a healthy periodontium, but there was considerable variation  
164 in the prevalence of periodontal conditions. <sup>3,32-34,40,62,77</sup> Gingivitis was prevalent in 51.0% to  
165 78.0% of dentate residents, <sup>30,45,57</sup> while bleeding on probing was seen in 46.0% to 76.0% of  
166 residents.<sup>5,44,58</sup> Overall, periodontal diseases indices were very heterogenous, with some  
167 studies using the Community Periodontal Index<sup>40,71,82</sup>, or its predecessor the Community  
168 Periodontal Index of Treatment Needs<sup>32,34,60</sup>, others using the Periodontal Screening  
169 index<sup>35,48</sup>, the Basic Periodontal Examination<sup>83</sup>, while others reported tooth mobility<sup>8,84</sup> or  
170 periodontal health in general without using a validated instrument<sup>5,22,44,57,58</sup>.

171 Few studies assessed dry mouth clinically. A mean salivary flow rate of 0.20-0.29 ml/min was  
172 found by Van der Putten et al. and Brukiene et al, which is considered within the range of a  
173 normal salivary flow.<sup>85,86</sup> However, Van der Putten et al. noted hyposalivation in resting state

174 in 24.0% and in chewing-stimulated saliva in 60.0% of residents. Glazar et al. saw a reduced  
175 salivary flow rate in 47.8% of residents, with 27.2% presenting hyposalivation.<sup>64</sup> Two studies  
176 estimated dry mouth by the 'adhesiveness of dental mirror on the mucosa' and found 46.0-  
177 54% of the residents experiencing moderate ('slip resistance') and 11.0-14% severe  
178 hyposalivation ('mirror trapped in mucosa').<sup>57,87</sup>

179 Very few studies reported on the prevalence of denture stomatitis. Three publications stated  
180 10.0-15.0% of denture wearers were suffering from denture stomatitis.<sup>69,82,88</sup> Pressure ulcers  
181 or traumatic ulcers because of dentures were seen in 1.5% to 18.0% of older people.<sup>4,23,49,64,72</sup>

### 182 *Subjective oral health*

183 Two studies reported poor self-rated oral health in 35.0-45.0% of residents<sup>44,71</sup> and 16.0% to  
184 61.2% of residents described at least one problem with their teeth or mouth.<sup>8,10,30,60,61</sup>  
185 Prevalence data on oral pain or discomfort ranged between 6.0% and  
186 40.5%.<sup>5,22,25,45,46,49,58,61,79,87</sup> Considering the impact oral conditions had on the everyday lives  
187 of residents, 20.0-50.0% of residents reported their Oral Health Related Quality of Life  
188 (OHRQoL) was affected<sup>8,41,46-48,66</sup>. Several studies reported only a mean score for the OHRQoL  
189 instrument applied<sup>9,26,27,36,61,62,71,73,79,89</sup>.

190 Proportions of older people reporting eating difficulties ranged from 5 to 55%.<sup>10,25,43,45,65,87,90,91</sup>  
191 One study reported differences in the prevalence of eating difficulties between dentate and  
192 edentate residents; 16.9% and 29.1% respectively.<sup>(8)</sup> Chewing problems led to adapting the  
193 food structure (cutting their food in smaller pieces, pureed food) in 10.0% to 35.8% of  
194 residents.<sup>30,79</sup> In three studies from Finland, 11.0-20.0% of the residents reported swallowing  
195 problems<sup>25,50,87,91</sup> while in the United Kingdom, the self-reported swallowing quality was  
196 'good' for 73.0%, 'moderate' for 22.5% and 'bad' for 4.5% of the residents.<sup>79</sup> The prevalence  
197 of xerostomia (subjective feeling of a dry mouth) in care home residents varied between  
198 15.0%<sup>5,25,65,91</sup> and 59.0%<sup>64</sup>, with the majority of studies reporting 35.0-50.0%.<sup>8,60,92-94</sup>

199

### 200 *Treatment needs*

201 Clinical treatment needs, as determined by a dentist, were detected in the majority of  
202 residents. Prosthetic treatment needs, such as repair, rebasing or renewal of dentures, were



203 seen in 37.0-81.0% of residents.<sup>4,22,27,30,39,44,45,53,62</sup> The need for extractions varied from 30.0%  
204 to up to 68.0% of dentate residents<sup>22,30,39,44,45,</sup> with a Belgian study stating a mean of 3.0 (SD  
205 4.3) extractions necessary per dentate resident.<sup>4</sup> These findings are similar to Dutch studies,  
206 where in 13.0-34.0% of dentate residents, an extraction was deemed necessary.<sup>52,53</sup>  
207 Periodontal treatment needs were found in the vast majority of dentate residents (56.0-  
208 79.0%), covering the need for debridement or periodontal surgery.<sup>30,35,39,44,53</sup> Last, restorative  
209 treatment needs varied greatly, from 3.5% in Poland to 50.0% in The Netherlands.<sup>4,30,39,44,53</sup>  
210 Only one study reported the need for acute interventions (severe pain and/or suspected life-  
211 threatening inflammation), being necessary in only 2.4% (n = 22) of the residents.<sup>51</sup>

212 Oral health assessment instruments have been used as a needs assessment instrument for  
213 intramural care for older people, but also by researchers as a tool for data collection. Nine  
214 studies reported oral health outcomes using the OHAT (Oral Health Assessment Tool)<sup>26,28,47,67,</sup>  
215 the ROAG (Revised Oral Assessment Guide)<sup>2,27,29,80,</sup> and the RAI.MDS 2.0<sup>43,</sup> which adds the  
216 option of nursing staff collecting data. In the studies using OHAT, 20 to 46.8% of residents  
217 were having a 'healthy mouth' and 16.7 to 28% an unhealthy oral status. In a Swedish study  
218 using ROAG-J (Jönköping), 74% of Swedish residents presented with two or more problems.<sup>2</sup>

219 Perceived (subjective) treatment needs, determined by the residents, were described by ten  
220 studies<sup>5,8,9,22,30,39,45,60,61,90</sup> and varied between 27.0% of residents in a Polish study reporting  
221 being aware of dental treatment needs, to 39.9% of institutionalized older people in an Italian  
222 study perceiving need for oral care.<sup>39,61</sup> Perceived prosthetic treatment needs varied between  
223 6.4% and 34.4% depending on the outcome measure.<sup>8,22</sup>

224

225 Not all outcomes were narratively described, more details can be found in the tables with the  
226 summary of findings, see supplementary Tables 3.1-3.5.

## 227 **Conflicts of interest**

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229 There are no conflicts of interest to disclose.

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## 232 **Discussion**

233

234 The aim of this systematic review was to give a broad overview of clinical and subjective oral  
235 health outcomes of care home residents in Europe. The literature contained studies of variable  
236 quality and methodological limitations were encountered. Overall, care home residents  
237 presented with few natural teeth, and high prevalence of dental caries. Oral hygiene was  
238 insufficient, both for the natural teeth and for removable dentures and few residents were  
239 seen with a healthy periodontium. Perceived treatment needs were high, with at least a third  
240 of care home residents reporting poor oral health. The Global Burden of Disease 2019 Study  
241 stated that oral disorders are one of the main drivers of disability among adults aged 70 years  
242 and older.<sup>95</sup> Care home residents have poorer oral health than community-dwelling older  
243 persons<sup>11,96</sup> and especially compared to the overall population.<sup>97-99</sup> Moreover, cognitive  
244 impairment and even dementia are very common among care home residents and the  
245 majority of studies in this review included such residents; this is a further risk factor for oral  
246 health and complicates the provision of care to this vulnerable population<sup>100</sup>. In this context,  
247 the current body of evidence shows a heavy burden of oral health problems in care home  
248 settings across Europe, irrespective of differences in health care systems, organization of long-  
249 term care for older care-dependent people, and number of care home beds in proportion to  
250 their general population.<sup>101,102</sup>

251 As outlined in the introduction, Wong et al. (2019) conducted a systematic review on the oral  
252 health of care home residents worldwide, including studies that reported both on  
253 epidemiologic data and oral health determinants. Because of the inclusion criterion of  
254 determinants in their search strategy, this yielded just 11 studies from Europe; therefore, a  
255 major part of relevant European literature was not included in that review. The aim of this  
256 systematic review was to give a broad overview of all the available evidence on oral health  
257 outcomes of care home residents in Europe, thus including 83 publications, which was a  
258 strength as it covered the relevant literature comprehensively.

259 This review has focused only on studies originating from Europe. It is well acknowledged that  
260 there are different care characteristics, including staffing and provision, for institutionalized  
261 older adults between the different European countries, as long-term care and oral health are  
262 organized nationally or even regionally. However, there are also similarities in the overall  
263 context and policy formulation at European level. The European Pillar of Social Rights on long-

264 term care is calling for the “right to affordable long-term care services of good quality, in  
265 particular home-care and community-based services”, while public health is also within the  
266 policy remit at the European Union level.<sup>103</sup> The recent WHO Oral Health Action plan that also  
267 focuses on ageing and vulnerable groups will need to be tailored for Europe through  
268 cooperation of European countries (and institutions) with the WHO Regional Office for Europe  
269 and this presents an excellent opportunity for collaboration and action<sup>104</sup>. Within that context,  
270 it makes sense to focus on Europe rather than specific countries or even globally, and this  
271 review can help as a background for discussion on policies to improve the oral health of older  
272 adults in care homes in Europe, while also considering the local context.

273 As stated in the methods, residents from psychiatric facilities and persons with disabilities  
274 were excluded. Although these residents are also clearly vulnerable and at risk for poor oral  
275 health, the organization and provision of care in these facilities is fundamentally different than  
276 in a care home setting. For example, there is generally less focus on personal hygiene in  
277 psychiatric facilities, the age range of residents for both psychiatric and disability care is wider  
278 with also younger people cared for, and as such the risk profile is also different than in a care  
279 home population. Moreover, in the aforementioned institutions care is provided by a different  
280 range of professionals, and the social network surrounding residents with disabilities is also  
281 different, thereby also precluding the grouping of these distinct vulnerable population groups  
282 in the same category.

283 As is the case with most systematic reviews, there was considerable variation in quality  
284 between the included studies. This was partly due to the more relaxed threshold for inclusion  
285 of studies in this review. If the Quallsyst tool suggested quality threshold of 60% was followed,  
286 17.0% of the studies would have been excluded from the present review. As the data for some  
287 countries was very limited and the scope of this systematic review was to give a broad  
288 overview of the oral health of care home residents, including as many countries (and studies)  
289 as possible, some lower quality studies were included in the synthesis, most coming from  
290 countries underrepresented in the relevant literature (e.g. Iceland, Poland, Croatia, Lithuania).  
291 However, when comparing the overall results from the lower quality studies with the studies  
292 of acceptable quality, the outcomes within the same range and would not impact on our  
293 conclusions. Poor quality was most evident in the sampling strategy, where several studies  
294 used a convenience sample or failed to report adequately on the sampling methodology. Due

295 to the lack of representativeness of the majority of the samples used, inferences from the  
296 results of this systematic review to the wider target populations should be done carefully and  
297 acknowledging the methodological limitations. Moreover, measurement tools and methods  
298 varied across the different studies, therefore hindering comparisons between them. The  
299 employed measurement tools were often not validated, raising concerns about the usefulness  
300 of the collected information.

301 This systematic review did not contain a meta-analysis. For most outcome measures, a meta-  
302 analysis was impossible due to the large methodological variation in data collection. For some  
303 outcomes (e.g. edentulousness, number of natural teeth, untreated dental caries), there was  
304 an appropriate amount of data to allow for meta-analysis, but due to the limited  
305 representativeness of the samples from their respective countries and the over-  
306 representation of certain countries, a meta-analysis of these outcomes wouldn't have led to  
307 a useful summary measure for the European region.

308 The vast majority of studies reported on clinical measures, while there was generally a scarcity  
309 of subjective outcome measures. Patient Reported Outcome Measures (PROMs) are equally  
310 relevant for all age groups, and it could be argued that this is particularly the case for the older,  
311 care-dependent adults. However, including PROMs among a population with high prevalence  
312 of cognitive decline is also not without limitations. As this review demonstrated, a core  
313 outcome set would be beneficial for future research in order to compare and aggregate data  
314 of different countries. A set of standardized patient-centered outcome measures for oral  
315 health in care-dependent older people is currently being developed.<sup>105</sup>

316 Nevertheless, these results are the best estimates extracted from the available literature and  
317 they provide an overall picture of the oral health of care home residents that has considerable  
318 implications for public health and health and social care services. The findings of this review  
319 showed a need for substantial policy action to maintain good oral health across the life span,  
320 especially when becoming care-dependent and to assure access to oral health services for  
321 care home residents. First steps have been taken by United Nations, including dental care in  
322 the action area "integrated care", thus incorporating oral health in "the decade of healthy  
323 ageing (2021-2030)" policy.<sup>106</sup> This, and the current WHO Global Oral Health Strategy and  
324 Draft Action Plan on oral health should be an urgent call to action for policy makers, whose

325 work is needed to make oral health a structural part of person-centered integrated care for  
326 frail older adults.<sup>99</sup> The roll-out of comprehensive oral health promotion interventions should  
327 be supported by the European Union and its governments, where oral health care could be  
328 improved through the integration of oral health into broader system initiatives and the  
329 collaboration of different health and social care professionals. The workforce needed to  
330 integrate oral health in the care for dependent older persons, goes beyond oral health  
331 professionals, and will need a multidisciplinary approach including but not limited to nursing  
332 care staff, general practitioners, geriatricians, occupational therapists, speech therapists,  
333 nutritionists and social care workers. The role of potentially upskilled informal community  
334 caregivers will also be increasingly important in preventive care. <sup>107</sup>

335

### 336 **Conclusion**

337 There is a high prevalence of oral conditions and burden of oral health problems among care  
338 home residents across Europe, irrespective of the country or health and social care system.  
339 This evidence shows that oral health care needs should be seen as a priority for substantial  
340 policy action to promote oral health across the lifespan and improve oral healthcare provision  
341 in care homes through integrated care.

## **Supplementary files**

Supplementary file 1: Search strategy

Supplementary file 2: Qualsyst Tool for Quantitative studies: blanco

Supplementary table 1: Table of excluded studies

Supplementary table 2: Details of quality assessment with Qualsyst tool of included publications

Supplementary table 3.1-3.5: Summary of findings

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## **Tables & figures**

### **Legend**

Table 1: Oral health outcomes used in data extraction form

Table 2: Results of Qualsyst quality assessment of included publications

Figure 1: PRISMA 2020 Flow-diagram of study selection



**Table 1** Oral health outcomes used in data extraction form

<b>Study details</b>	Author Author contact details Bibliographic reference Country Study design Year of publication
<b>Information on participants</b>	Mean age Age range Setting Number of participants % of participants with dementia or MCI* Number of care homes Sex
<b>Clinical oral health outcomes</b>	% dentate Mean number natural teeth % edentulous % removable denture Oral hygiene: dental plaque Oral hygiene: denture plaque Oral hygiene: tongue plaque Oral debris DMFT † Caries (root caries) Retained roots Periodontal disease Gingival bleeding Calculus Denture stomatitis (candidiasis) Dry mouth Other oral pathologies Clinical treatment needs Aggregate measures Other clinical findings
<b>Subjective oral health outcomes</b>	Self-rated oral health OHRQoL‡ Perceived (subjective) treatment needs Xerostomia Oral pain or discomfort Oral hygiene habits Dental attendance patterns Chewings problems Swallowing problems Other subjective findings

\*Mild Cognitive Impairment

† Decayed, Missing, Filled Teeth

‡Oral Health Related Quality of Life

**Table 2** Results of Qualsyst quality assessment of included publications

QUALSYST CRITERIA	YES (2)	PARTIAL (1)	NO (0)	N/A	
1	Question / objective sufficiently described?	96%	2%	2%	
2	Study design evident and appropriate?	88%	8%	4%	
3	Method of subject/comparison group selection or source of information/input variables described and appropriate?	77%	13%	10%	
4	Subject and comparison group (if applicable) characteristics sufficiently described?	69%	24%	7%	
5	If interventional and random allocation was possible, was it reported?	6%	2%	1%	91%
6	If interventional and blinding of investigators was possible, was it reported?	5%	0%	6%	89%
7	If interventional and blinding of subjects was possible, was it reported?	1%	1%	6%	92%
8	Outcome and (if applicable) exposure measure(s) well defined and robust to measurement / misclassification bias? Means of assessment reported?	64%	31%	5%	
9	Sample size appropriate?	59%	28%	13%	
10	Analytic methods described/justified and appropriate?	67%	27%	6%	
11	Some estimate of variance is reported for the main results?	69%	16%	15%	
12	Controlling for confounding?	35%	8%	57%	
13	Results reported in sufficient detail?	62%	30%	8%	
14	Conclusion supported by the results?	77%	18%	5%	