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Association of care worker's quality of work life and change of functional performance of severely disabled elderly residents in nursing homes - A questionnaire study

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1 **Association of care worker's quality of work life and change of functional**

2 **performance of severely disabled elderly residents in nursing homes - A**

3 **questionnaire study.**

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30 **Abstract**

31 **Objectives:** There is growing concern regarding quality of work life (QWL) among

32 care staff in nursing homes. However, little is known about the impact of QWL on

33 nursing home residents' functional performance. This study examined the association

34 between QWL of care staff, defined as the combination of job satisfaction and

35 happiness, and change in functional performance of elderly people with severe

36 disabilities in nursing homes.

37 **Design:** This was a retrospective cohort study.

38 **Setting:** Eighteen nursing homes in Japan.

39 **Participants:** Data were collected from 1000 residents with required care level 3–5 and

40 412 care staff in nursing homes between October 2016 and March 2017.

41 **Primary and secondary outcome measures:** The primary outcome was the association

42 between changes in residents' functional performance over six months and the staff's

43 perception of QWL in nursing homes. Functional performance was measured using a

44 questionnaire with 52 items concerning activities of daily life, cognitive function, and

45 social participation at baseline and six months later. QWL of care staff was evaluated

46 using six items, including job satisfaction and happiness.

47 **Results:** Residents in nursing homes with happy care staff had a statistically lower

4

48 chance of deterioration (OR: 0.61, CI: 0.44–0.84). Among residents with required care

49 level 4, which corresponds to a moderate level of disability, the chance of improvement

50 increased with high job satisfaction of care staff (OR: 2.84, CI: 1.36–5.93).

51 **Conclusion:** These results suggest that QWL of care staff is associated with timewise

52 changes in functional performance of elderly people with severe disabilities in nursing

53 homes.

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Article Summary

Strengths and limitations of this study

- This is the first study to investigate the correlation between quality of work life of care staff and changes in functional performance of elderly people with severe disabilities in nursing homes.

- Data included perceptions of 412 care staff and functional performance assessments of 1000 residents at 18 nursing homes across Japan at two time points with an interval of six months.

- Residents' functional performance was structurally recorded using ICF staging®, a standardized and validated instrument that enables holistic, reproducible assessment of a person's functional status, including activities of daily living, cognitive function, and social participation, without the need for extensive training of users.

- The six-month observation period of this study was relatively short for capturing functional changes of residents and necessitated aggregating multifaceted functional performance changes into a single indicator.

6

74   **Competing interests:** None declared.

Introduction

In developed nations, population aging and increased life expectancy have resulted in increased demand for elder care and a shortage of care staff (1,2). There is growing concern regarding the impact of quality of work life (QWL) of care staff on the quality of care in nursing homes (3–5). QWL is an umbrella concept that encompasses a wide range of work-related issues, such as compensation, workload, empowerment, and autonomy (6). QWL can be assessed by care workers' subjective perceptions (7). Care workers' attitudes toward their work are based on their perceptions, which may affect the quality of care provided in nursing homes and whether the staff member remains in the job or resigns. Accordingly, we focused on the perception of QWL in this study.

In Canada and the US, the perception of QWL is often assessed using the concept of job satisfaction (6). In Japan, the perception of QWL is typically assessed with reference to global happiness (8). We assessed care worker's perceptions of QWL in terms of job satisfaction and global happiness.

A previous study examined the association between job satisfaction or happiness and patient satisfaction and medical injuries such as falls, pressure ulcers, and fever (9). However, little is known about the relationship between the perception of QWL and functional decline as a care outcome.

8

93   It is widely accepted that maintaining independence in activities of daily living

94 (ADLs) and engaging in society are critical for quality of their life as people age

95 (10,11). Dementia is reflected in deterioration in cognitive function (12). We assessed

96 functional performance holistically, using a combination of ADL, cognitive function,

97 and social participation.

98   The degree of disability and dependency varies among elderly people who live

99 in nursing homes and need long-term care (13). It is expected that care outcomes differ

100 according to the degree of required care. However, very few studies have stratified the

101 elderly according to the degree or level of required care; rather, most studied focused on

102 elderly individuals receiving extensive care. In Japan, elderly people with severe

103 disabilities are permitted to live in special nursing homes.

104   In this study, we examined how job satisfaction and global happiness of care

105 staff were related to changes in functional performance of elderly people with severe

106 disabilities in Japanese special nursing homes.

107 **Methods**

108 **Study design and participants**

109   This was a retrospective cohort study involving 21 special nursing homes that

110 use "CAREKARTE" developed by Fuji Data Systems. The nursing homes were

111 approached and their residents and care staff invited to participate in the study. Written

112 consent to participate in the study was obtained from each participant or the

113 participant's proxy family member if the participant had cognitive impairment. They

114 were informed that they could withdraw at any time and that all information related to

115 them would remain confidential. Anonymized data were obtained by the facilities.

116   All data were collected between Oct 2016 and Mar 2017. Residents' functional

117 performance was assessed by the care managers of the special nursing homes and

118 recorded in the care software. Age, sex, required care levels and risk events were

119 obtained from the residents' records. Required care levels were certified in public Long-

120 Term Care Insurance documents (14).

121   Functional performance of the residents was evaluated twice, with an interval

122 of six months. Occurrence of undesirable risk events within the last six months and an

123 electronic QWL survey of care staff were also assessed at the end of the six-month

124 period.

Patient and Public Involvement

126   Nursing home residents and care staff were not directly involved in the design

127 and conduct of this research. The authors plan to invite nursing home residents and care

128 staff for determining optimal strategy for disseminating the results of this study.

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129 **Outcome variables**

130 **Functional Performance: ICF staging®**

131   Functional performance of the residents was measured using ICF staging®

132 items. The ICF staging® items were developed by the Japan Association of Geriatric

133 Health Service Facilities (15). The ICF staging® items facilitate objective, simple, and

134 clear descriptions of elderly functional performance. Even amateur care staff and family

135 members can easily make assessments and notice minor changes (16). Table 1 shows

136 the 13 items of the ICF staging® for the categories of physical function, activity, and

137 participation, each of which consists of four questions, providing 52 items in total. The

138 ICF staging® items allow evaluation of not only ADLs but also cognitive function and

139 social participation (17). Therefore, we chose the ICF staging® to assess the functional

140 performances of the elderly participants due to its utility and holistic nature.

141

142 **Table 1.** Functional performance items in the ICF Staging®.

ADLs	01. Basic posture control
	02. Walking and moving function
	03. Eating function - Swallowing
	04. Eating function – Feeding and feeding assistance
	05. Toileting function
	06. Bathing function
	07. Personal care function - Oral care
	08. Personal care function - Self-care

11

Cognitive Function	09. Orientation
	10. Communication
	11. Mental activities
Social Participation	12. Leisure
	13. Socializing

143 Note: ADLs = Activities of Daily Living

144   Functional performance was measured twice, with a six-month interval

145 between measurements, and the data obtained from the care record software. The data

146 were compared between time points and evaluated for each resident as improved,

147 deteriorated, or no change. In this research, the primary outcome measure was change,

148 either deterioration or improvement, in any of the 52 ICF staging items. Note that

149 improvement and deterioration might coexist within an individual.

150 **Explanatory variables**

151 **Care staff QWL survey**

152   The care staff QWL survey assessed six items: global happiness (1 item), job

153 satisfaction (3 items), and perceived quality of care at the facility (2 items). Global

154 happiness was scored on a scale of 0–10, with zero representing "not happy at all" and

155 10 representing "very happy." Two job satisfaction items ("To what extent are you

156 satisfied with your work?" and "How rewarding is your work?") were scored on a scale

157 of 1–6, with one representing "not at all" and six representing "extremely." Frequency

158 of intentions to move care facilities was scored on a scale of 1–4, where one represented

159 "often" and four represented "not at all." Items addressing perceived quality of care at

160 the facility ("To what extent are you satisfied with the quality of care provided at the

161 nursing home at which you work?" and "To what extent would you recommend the

162 nursing home at which you work to your family and friends?") were scored on a scale of

163 1–5, where one represented "not at all" and five represented "extremely."

164 **Risk events**

165   Undesirable events recorded during this study were falls, pressure ulcers,

166 aspiration pneumonia,   and fever (9). Care managers identified the occurrence of these

167 events in the past six months by reviewing the care record.

168 **Data Analyses**

169   To adjust for multiplicity of items addressing QWL, two of six items were

170 selected and used for further analysis based on Kendall's rank correlation coefficient. As

171 we could not assume a linear relationship between the distribution of care staff

172 responses at each facility and the change in residents' functional performance, we used

173 a binary variable representing "high" and "low," with a threshold of the median, to

174 represent the level of care according to staff responses at each facility. Then, resident

175 data and staff data were combined for the facility and all analyses were conducted at the

176 level of residents.

13

177   Multivariable logistic regression was used to identify variables associated with

178   a change in one or more functional performance items during the six-month period.

179   Age, sex, required care level, four undesirable risk events, and two staff QWL items

180   were included in the model.

181   Both the descriptive characterization of the study cohort and the multivariable

182   logistic regression were conducted with and without stratification by required care level.

183   Statistical analysis was performed using JMP computer software (JMP® PRO 14.0.

184   SAS Institute Inc., USA). A p-value less than 0.05 was considered statistically

185   significant.

186   **Results**

187   **Baseline characteristics**

188   A total of 1,532 residents and 455 care workers from 21 special nursing homes

189   participated in this study (Figure1). The data of 1,292 residents were collected. The

190   reason for missing data at the stage was not clear, which may have been either death,

191   withdrawal, or administrative issues. Residents with required care levels of 3, 4, and 5

192   (n=1,136) were included for analysis. We excluded data on participants for which

193   functional performance data or care worker's responses to QWL items were missing.

194   The final number of valid datasets was 1,000 for residents and 412 for care workers.

14

195 The proportion of missing values was 3.1% for items addressing residents' functional

196 performance and 1.2% for QWL items among care staff.

197   Residents were assigned to one of the three required care levels with three

198 quarters having required care level 4 or 5 (Table 2a). Most residents (80.6%) were

199 female and more than half of the residents were aged 85–94. Baseline characteristics

200 and functional performance stratified by required care level are also displayed in Table

201 2b. Overall, functional performance declined as the degree of care need increased. Table

202 2c shows care workers' representative QWL items, happiness and job satisfaction,

203 tabulated according to residents' required care levels.

204   The most common undesirable risk events among the residents in a six-month

205 period were fever (18.3%) and falls (15.6%; Table 3). Pressure ulcers and aspiration

206 pneumonia were rarely experienced by the residents of the nursing homes.

207

208 **Table 2a.** Baseline characteristics of nursing home residents, by required care level.

Baseline Characteristics	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Sex				
Female	78.2%	79.7%	83.1%	80.6%
Male	21.8%	20.3%	16.9%	19.4%
Age groups, in years				

15

<80	12.6%	19.5%	19.1%	17.7%
80-84	14.6%	13.7%	18.6%	15.7%
85-89	28.9%	27.8%	27.9%	28.1%
90-94	33.1%	22.3%	21.3%	24.5%
95+	10.9%	16.7%	13.1%	14.0%

209 (No footnote for this table)

210

211 **Table2b.** Baseline functional performance of nursing home residents, by required care

212 level.

Baseline functional performance	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
ADLs				
1. Basic posture control				
1-1 Maintaining standing position	42.9%	14.9%	6.2%	18.4%
1-2 Moving between sitting positions	76.9%	44.2%	17.9%	42.3%
1-3 Maintaining sitting position (without assistance)	68.8%	36.1%	11.8%	34.9%
1-4 Rolling over	81.7%	54.8%	20.8%	48.7%
2. Walking and moving function				
2-1 Going out	1.7%	1.0%	0.6%	1.0%
2-2 Climbing up and down	4.3%	0.3%	0.8%	1.4%
2-3 Stable walking	42.9%	14.8%	3.9%	17.5%
2-4 Moving within facility	85.3%	61.7%	31.4%	56.2%
3. Eating function - Swallowing				
3-1 Chewing	76.6%	53.4%	24.1%	48.3%
3-2 Sucking	86.0%	70.2%	39.4%	62.8%
3-3 Swallowing (solid)	92.2%	81.2%	53.6%	73.8%
3-4 Swallowing (specially processed food)	93.4%	82.3%	70.9%	80.6%
4. Eating function – Feeding and feeding assistance				
4-1 Feeding him/her self	71.4%	47.4%	13.3%	40.9%

16

4-2 Dropping food and making mess	68.1%	68.9%	31.5%	54.8%
4-3 Special arrangement for feeding	29.6%	49.1%	56.8%	47.1%
4-4 Direct assistance for feeding	8.7%	22.5%	64.8%	34.6%
5. Toileting function				
5-1 Post-release cleanup	50.6%	28.2%	16.9%	29.4%
5-2 Dressing and undressing	56.5%	18.6%	4.2%	22.3%
5-3 Getting on and off western type toilet	65.2%	48.0%	19.1%	41.4%
5-4 Releasing on bed	17.9%	34.4%	49.4%	36.0%
6. Bathing function				
6-1 Stable movement in and out of bathtub and washing.	16.2%	3.4%	1.1%	5.6%
6-2 Bathing without assistance	7.5%	3.7%	0.9%	3.5%
6-3 Maintaining sitting position during bathing	74.3%	52.0%	20.1%	45.7%
6-4 Carrying out bathing	50.7%	70.2%	89.2%	72.6%
7. Personal care function - Oral care				
7-1 General oral care	48.7%	26.0%	6.5%	24.3%
7-2 Brushing teeth	39.3%	15.9%	4.0%	17.1%
7-3 Preparation for brushing teeth	66.4%	45.0%	14.7%	38.8%
7-4 Rinsing mouth	79.2%	58.3%	20.5%	49.0%
8. Personal care function – Self-care				
8-1 Trimming nails	3.9%	2.9%	1.1%	2.5%
8-2 Shaving, skincare, hair care	48.3%	27.2%	5.4%	24.3%
8-3 Washing face	71.9%	47.0%	14.4%	41.0%
8-4 Washing hands	55.0%	35.0%	9.1%	30.3%
Cognitive Functions				
9. Orientation				
9-1 Date	43.3%	22.0%	7.6%	21.8%
9-2 Name of place	48.1%	31.7%	11.2%	28.0%
9-3 Orientation toward other people	84.5%	69.8%	36.6%	61.2%
9-4 Own name	98.2%	89.8%	59.0%	80.5%
10. Communication				
10-1 Maintaining complicated human relationship	54.1%	36.8%	12.9%	32.2%
10-2 Understanding of written language	70.1%	50.8%	17.9%	43.3%
10-3 Everyday conversation	60.6%	46.6%	18.9%	39.8%
10-4 Understanding of spoken language	82.0%	74.4%	40.6%	63.8%
11. Cognitive function				
11-1 Time management	38.2%	24.0%	6.5%	21.0%

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11-2 Simple arithmetic	57.6%	36.0%	10.4%	31.7%
11-3 Long-term memory	44.2%	35.1%	12.4%	28.9%
11-4 State of consciousness	5.6%	7.6%	5.7%	6.4%
Social Participation				
12. Leisure				
12-1 Traveling	1.3%	11.1%	0.6%	0.5%
12-2 Traveling	22.0%	56.9%	3.4%	10.9%
12-3 Group Recreation	73.0%	63.7%	30.2%	51.0%
12-4 Watching TV	75.0%	4.5%	38.4%	57.1%
13. Socializing				
13-1 Socializing using means of communication devices	10.0%	7.1%	2.3%	5.0%
13-2 Going out	11.4%	35.2%	4.9%	7.3%
13-3 Conversing with friend	50.9%	87.1%	15.5%	31.7%
13-4 Conversing with someone close	96.9%	96.9%	51.9%	76.5%

213   Note: ADLs = Activities of Daily Living

214

215   Table 2c. Baseline characteristics of QWL representative items, by required care level.

Care staff QWL items	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Happiness				
High	59.0%	55.4%	47.8%	53.5%
Low	41.0%	44.6%	52.2%	46.5%
Job Satisfaction				
High	47.7%	51.4%	51.9%	50.7%
Low	52.3%	48.6%	48.1%	49.3%

216   (No footnote for this table)

217

218   Table 3. Occurrence of the risk events in six months, by required care level.

Risk events	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000, 100.0%)
Falls	22.6%	13.9%	12.8%	15.6%
Pressure ulcers	1.7%	2.8%	2.7%	2.5%
Aspiration pneumonia	1.7%	2.3%	2.7%	2.3%
Fever	17.6%	15.2%	22.1%	18.3%

219 (No footnote for this table)

220

Change in functional performance

222   There was no death or loss to follow-up among the residents. As shown in

223 Table 4, 12.7% of the residents exhibited improvement and 23.0% exhibited

224 deterioration. Among the residents, 6.8% were included in both "improved" and

225 "deteriorated" categories. The lower the required care level was, the higher the

226 proportion of both improvement and deterioration.

227

228 Table 4. Proportion of residents with improvement and deterioration.

Proportion of Improvement and deterioration	Required Care Level 3 (n=239, 23.9%)			Required Care Level 4 (n=395, 39.5%)			Required Care Level 5 (n=366, 36.6%)			Total (n=1,000, 100.0%)		
	Improved	Not improved	Total	Improved	Not improved	Total	Improved	Not improved	Total	Improved	Not improved	Total
Deteriorated	10.9%	16.7%	27.6%	6.1%	16.7%	22.8%	4.9%	15.3%	20.2%	6.8%	16.2%	23.0%
Not deteriorated	8.8%	63.6%	72.4%	6.1%	71.1%	77.2%	3.8%	76.0%	79.8%	5.9%	71.1%	77.0%
Total	19.7%	80.3%	100.0%	12.2%	87.9%	100.0%	8.7%	91.3%	100.0%	12.7%	87.3%	100.0%

19

229   (No footnote for this table)

230

231   **Multivariable logistic regression**

232   Results of the multivariable analyses are shown in Table 5a and 5b. The

233   residents with falls and fever had a statistically increased chance of deterioration (Table

234   5a). However, the residents who were in nursing homes with happy care staff had a

235   statistically lower chance of deterioration (OR: 0.61, CI 0.44–0.84). When stratified by

236   required care levels, the same trend was observed throughout, with a statistically

237   significant difference (OR: 0.36, CI 0.21-0.64) observed for required care level 4.

238   As shown in Table 5b, in the overall model, a statistically increased chance of

239   improvement was associated with the age groups 80–84 and 95+, as well as with

240   residents who had experienced falls. When stratifying the analyses by required care

241   level, there was no statistically significant increased chance for required care levels 3

242   and 5. For required care level 4, the chance of improvement increased with age (OR:

243   5.12 for age group 95+ compared to <80) and care worker job satisfaction (OR: 2.84,

244   CI: 1.36–5.93).

245

246   Table 5a. Multivariable logistic regression analysis for deterioration of residents'

247 functional performance.

Deterioration				
Characteristic	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Sex				
Male	0.71 (0.32-1.61)	1.43 (0.78-2.62)	1.70 (0.85-3.40)	1.31 (0.89-1.93)
Age groups, in years				
<80	1	1	1	1
80-84	1.88 (0.57-6.28)	0.51 (0.20-1.34)	0.64 (0.24-1.34)	0.84 (0.48-1.47)
85-89	1.16 (0.38-3.52)	0.84 (0.40-1.76)	1.18 (0.53-2.65)	1.07 (0.66-1.72)
90-94	1.42 (0.41-4.98)	0.89 (0.40-1.97)	1.83 (0.81-4.15)	1.25 (0.77-2.04)
95+	2.08 (0.57-7.55)	1.20 (0.53-2.70)	1.47 (0.58-3.73)	1.54 (0.90-2.64)
Risk events				
Fall	**2.12 (1.06-4.29)**	**2.08 (1.06-4.07)**	**2.38 (1.19-4.79)**	**2.25 (1.54-3.29)**
Pressure ulcers	1.25 (0.13-11.67)	1.92 (0.50-7.45)	0.26 (0.03-2.25)	0.90 (0.34-2.38)
Aspiration pneumonia	2.71 (0.34-21.49)	**5.25 (1.14-24.27)**	-	1.40 (0.57-3.39)
Fever	**2.79 (1.27-6.10)**	1.69 (0.86-3.35)	0.66 (0.87-3.18)	**1.81 (1.24-2.66)**
Care staff QWL				
Happiness				
Happy	0.54 (0.28-1.04)	**0.36 (0.21-0.64)**	0.86 (0.50-1.51)	**0.61 (0.44-0.84)**
Job satisfaction				
Satisfied	1.71 (0.90-3.26)	1.18 (0.70-2.00)	0.92 (0.53-1.59)	1.07 0.79-1.47)

248 Notes: To assess effect of care staff's happiness and job satisfaction on deterioration of

249 residents' functional performance adjusted for covariates, multivariable logistic

250 regression was conducted in the overall cohort and within each required care level. The

251 table summarizes odds ratios of each variable and their confidence intervals. Risk events,

21

252 care staff's happiness and job satisfaction were treated as binary variables. Bold indicate

253 statistical significance (p<0.05).

254

255 Table 5b. Multivariable logistic regression analysis for improvement of residents'

256 functional performance.

Improvement

Characteristic	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Sex				
Male	1.05 (0.44-2.51)	2.04 (0.95-4.40)	1.87 (0.74-4.76)	1.52 (0.95-2.45)
Age groups, in years				
<80	1	1	1	1
80-84	2.10 (0.54-8.09)	3.06 (0.97-9.75)	1.45 (0.36-5.87)	**2.24 (1.09-4.60)**
85-89	1.55 (0.45-5.42)	1.72 (0.58-5.11)	1.85 (0.53-6.53)	1.75 (0.90-3.43)
90-94	1.42 (0.41-4.98)	1.50 (0.44-5.07)	2.62 (0.73-9.35)	1.94 (0.98-3.85)
95+	0.80 (0.16-4.13)	**5.12 (1.65-15.88)**	2.13 (0.52-8.73)	**2.38 (1.14-4.96)**
Risk events				
Fall	2.08 (0.98-4.45)	2.10 (0.92-4.83)	1.97 (0.77-5.08)	**2.36 (1.51-3.70)**
Pressure ulcers	2.86 (0.32-25.16)	0.70 (0.07-6.94)	1.39 (0.77-5.08)	1.07 (0.35-3.26)
Aspiration pneumonia	1.46 (0.13-16.49)	2.75 (0.45-16.79)	-	0.78 (0.22-2.81)
Fever	2.00 (0.86-4.67)	0.51 (0.19-1.38)	1.30 (0.53-3.21)	1.15 (0.70-1.87)
QWL				
Happiness				
Happy	0.77 (0.37-1.61)	1.15 (0.56-2.37)	0.78 (0.36-1.70)	1.02 (0.68-1.53)
Job satisfaction				
Satisfied	0.73 (0.36-1.50)	**2.84 (1.36-5.93)**	0.92 (0.43-1.97)	1.14 (0.76-1.69)

257 Notes: To assess effect of care staff's happiness and job satisfaction on deterioration of

22

258 residents' functional performance adjusted for covariates, multivariable logistic

259 regression was conducted in the overall cohort and within each required care level. The

260 table summarizes odds ratios of each variable and their confidence intervals. Risk events,

261 care staff's happiness and job satisfaction were treated as binary variables. Bold indicate

262 statistical significance ($p<0.05$).

263

Discussion

265 This is the first study, to our knowledge, to examine the association between

266 changes in residents' functional performance and the job satisfaction and happiness of

267 care staff in nursing homes. The residents who were in nursing homes with happy care

268 staff had a statistically lower chance of deterioration. The authors believe this finding

269 can be applied to long-term care for the elderly in general.

270 The mechanism underlying the observed correlation between staff happiness

271 and residents' functional deterioration remains unclear; however, reports in related areas

272 suggest mutual influence. Happiness of care staff might promote maintenance of

273 residents' functional performance through provision of high quality care, and residents

274 who maintain their functional performance might promote the happiness of care staff

275 through professional fulfilment (18).

23

276   The results of the current study imply two approaches may be effective for

277   maintaining functional performance of residents, both of which are expected to promote

278   happiness of care staff and, in turn, promote high quality of care: (i) improvement of

279   care staff's working environment, and (ii) education of care staff in terms of

280   understanding and coping with physical, psychological, and social process of aging and

281   dying, as well as grief of the family of residents and care staff themselves, which may

282   mitigate the psychological stress associated with working with residents with severe

283   disabilities and prevent compassion fatigue.

284   The working environment of care staff in nursing homes has specific issues

285   that could be improved with organizational effort. Relationships with other staff

286   members and a poor career outlook have been reported to be among the major causes of

287   care staff turnover in Japan (19). Changing these QWL-related factors may improve

288   staff perceptions of the QWL and hence the quality of care provided in nursing homes.

289   Care staff in nursing homes must regularly cope with residents' functional

290   decline, burdens associated with the terminal stage of life, and death (20). In palliative

291   and intensive care settings, compassion fatigue is reported to be a serious causes of

292   nurse burnout (21–26). There are reports of compassion fatigue of family members of

293   elderly people with severe disabilities (27–29). Compassion fatigue may also impact

294   care staff in nursing homes (30,31). Organizational programs for preventing compassion

295   fatigue may help care staff in nursing homes to maintain their own psychological health

296   (32).

297   Detailed observations of the care process are needed to obtain insight into the

298   interaction between the happiness of care staff and residents' functional performance.

299   Although the detailed mechanisms are unknown, the results of this study imply that

300   long-term care for the elderly with severe disabilities can be improved by directing

301   attention to both the QWL of care staff and the functional performance of residents,

302   ideally creating a virtuous cycle.

303   **Long term care system and staff shortages in Japan**

304   Workforce shortages and the provision of sustainable workplaces for care

305   workers are crucial issues among advanced countries with aging populations. In Japan,

306   as the number of elderly people requiring nursing care increases, so does the need for a

307   large number of care workers. The Japanese government has estimated that by 2025, it

308   will be necessary to secure additional care workforce of 380,000, assure the quality of

309   care, and contain costs; nursing homes have experienced a serious shortage of care

310   workers (33). The job opening rate for care workers was more than 3.95 across the

311   nation in 2018 (33). There are long waiting lists for nursing homes, partly due to the

25

312   labour shortage (34). Therefore, the government and administrators of nursing homes

313   and service providers must determine how to maintain and improve work environments

314   to recruit and retain care workers.

315   Elderly people with disabilities can receive long-term care under a public long-

316   term care insurance (LTCI) system in Japan (14). There are various types of residential

317   care facilities for the elderly, including LTCI facilities such as special nursing homes,

318   geriatric health facilities, sanatoria, or integrated facilities for medical and long-term

319   care. Elderly people who need care are stratified by the degree of disability and

320   dependency and certified as requiring a care level from 1 to 5 (35).

321   **Quality of Work Life**

322   QWL is an umbrella concept, but most previous studies of nurses and care

323   workers have regarded QWL as a "subjective experience that is affected by personal

324   feelings and perception and is related to work environments" (36). Most studies have

325   focused on job satisfaction as a tool by which to assess QWL (6). Job satisfaction

326   among those who provide direct resident care in residential long-term care facilities is

327   influenced by empowerment and autonomy as individual factors and facility resources

328   and workload as organizational factors (34,37,38). Leadership in nursing homes has

329   been reported to be strongly associated with job satisfaction (36). Other studies of QWL

330   in healthcare settings have focused on happiness. Nurses' happiness can be attributed to

331   a number of personal factors and job environment characteristics (39).

332   Previous studies have illustrated that job satisfaction and happiness at work

333   affect the quality of care provided by care staff. Higher job satisfaction of care staff in

334   nursing homes is associated with lower rates of resident injuries and higher resident

335   satisfaction with care (9). Higher job satisfaction and happiness of care managers is

336   associated with clients' higher satisfaction and happiness with care (8). However, little

337   is known regarding the association between QWL-related items — job satisfaction and

338   happiness — and functional performance of elderly people.

339   In the current study, the perceptions of nursing home care staff were used to

340   assess their QWL. Wages, autonomy, empowerment and the nursing home facilities

341   have been reported as related to QWL among workers (13). These detailed factors and

342   care workers' perceptions should be combined to assess the QWL in nursing homes in

343   further studies.

344   **Assessment of Functional Performance**

345   This study used ICF staging as an assessment tool. This tool uses 13 items to

346   assess aspects of mobility; ADL such as toileting; cognitive function; and social

347   participation, such as leisure activity and social communication. Each item is composed

27

348   of four ICF codes with an associated threshold (52 ICF codes), and the user of the

349   assessment can obtain a variety of ICF function and participation information

350   effectively, using a limited number of items, thereby minimizing the burden of the care-

351   manager who collects the data.

352   This scale is used in more than one thousand Japanese intermediate facilities

353   and nursing homes. Previous studies have revealed the scale has high validity, test-retest

354   reliability, and sensitivity to change. However, this study's participants were stable and

355   even within the observation period of six months, few people exhibited change

356   according to the ICF staging. Although Mitnitski (40) insisted a frailty index should be

357   defined as the proportion of accumulated deficits, we labelled an elderly person as

358   exhibiting change if any of the items measured showed improvement or deterioration.

359   Some participants exhibited improvement and deterioration concurrently.

360   Functional performance was obtained via subjective ratings of care staff.

361   Measurement of walking ability and muscle strength, and more formal assessment of

362   cognitive function, would increase the objectivity of functional performance assessment

363   and allow more reliable conclusions to be drawn regarding the correlation between

364   QWL of care staff and resident functional performance (41).

365   The relatively short duration of observation, namely six months, led to there

366 being few residents who exhibited functional change, which necessitated an analytical

367 approach to maximize sensitivity to change; specifically, functional change was treated

368 as change in any of many items considered.

369   The mechanism underlying inconsistencies in the results with respect to

370 improvement across required care levels remains unknown. If a larger number of

371 residents were observed, this would allow for more reliable statistical analysis.

372   This study was conducted in Japanese special nursing homes and the target

373 group was elderly people with severe disabilities. Expanding the target group to the

374 elderly with mild disabilities or in different facilities and home care situations would

375 help foster deeper understanding of the association between the QWL of care workers

376 and changes in functional performance of elderly people.

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507 **Footnotes**

508 **Contributors:** SIS, NI, JO and HM contributed to the design and implementation of the

509 research. AT assisted in data cleaning. SIS and NI performed data analysis. SIS and NI

510 wrote the manuscript in consultation with JO and HM.

511 **Ethics approval:** This study was approved by the Ethical Review Board of the School

512 of Medicine, Keio University and is in compliance with the Declaration of Helsinki;

513 approval number 20170132 (01/15/2018).

514 **Data sharing statement:** The data used in this research are not publicly available due

515 to the consent with the participants.

516   **Patient consent for publication:** No required.

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Study flowchart

Residents

Care staff

```
┌─────────────────────────────────┐          ┌─────────────────────────────────┐
│ Residents in 21 nursing homes    │          │ Care staff in 21 nursing homes   │
│ between October 2016 and         │          │ between October 2016 and         │
│ March 2017                       │          │ March 2017                       │
│ n = 1,532                        │          │ n = 455                          │
└─────────────────────────────────┘          └─────────────────────────────────┘
```

Data provided — No — n = 240

Data provided — No — n = 37

Yes   n = 1,292

Required care level 3, 4 and 5 — No — n = 156

n = 412

Yes   n = 1,136

Functional performance and care workers' responses of QWL — Missing — n = 136

Not missing

n = 1,000

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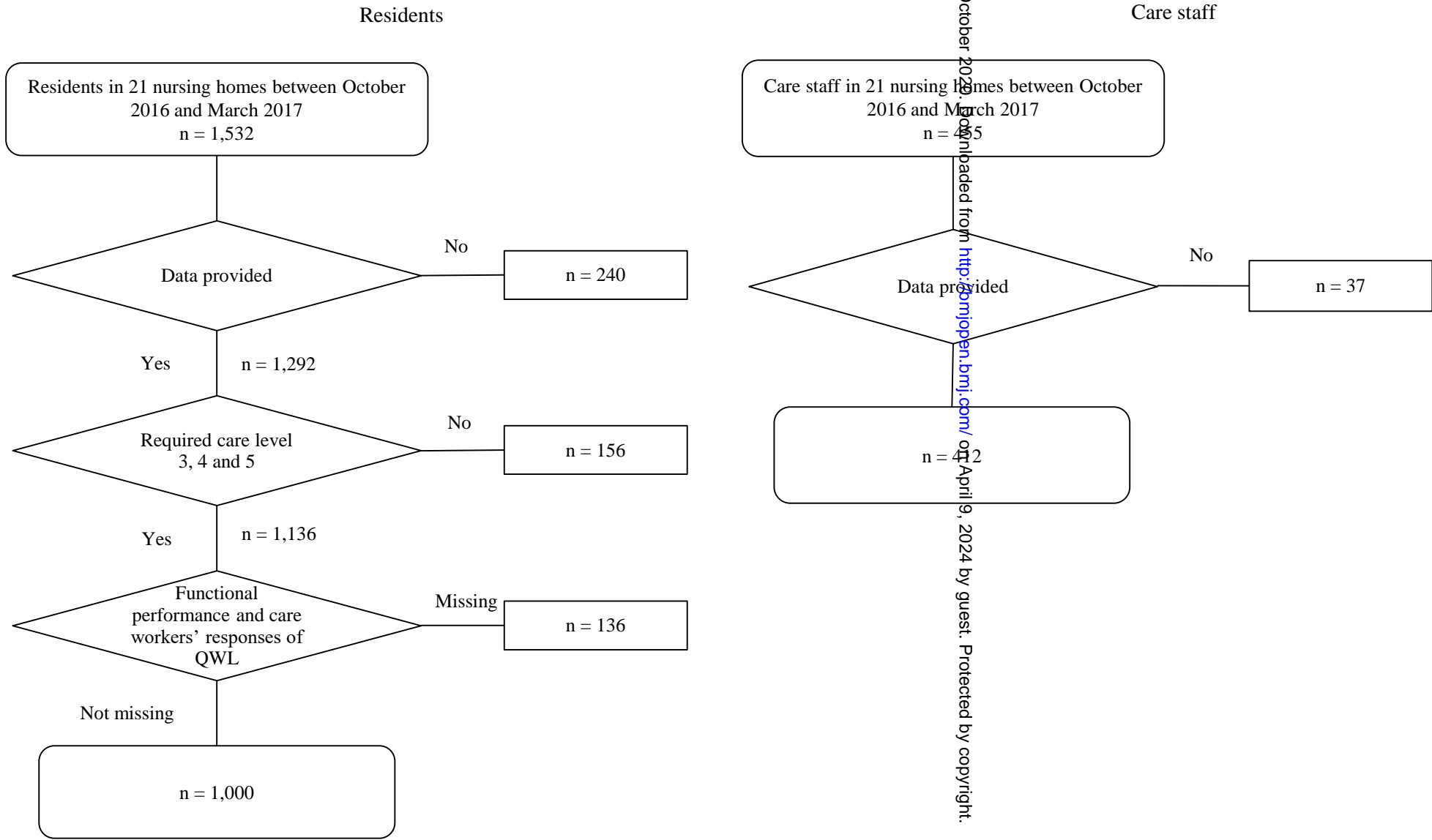
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Checklist for reporting a cohort study

This checklist is relevant to studies reporting cohort studies and is based on the STROBE guidelines. In a cohort study, one or more groups are closely monitored over a span of time. [Read more](#)

[Complete now](#)

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- 0 / 34 items completed

- [complete offline](#)

Instructions

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Download your completed checklist and include it as an extra file when you submit to a journal.

Title and abstract

1a

Title

Indicate the study's design with a commonly used term in the title or the abstract. [Read more](#)

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1b

Abstract

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Provide in the abstract an informative and balanced summary of what was done and what was found.   Read more

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Introduction

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Background / rationale

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Explain the scientific background and rationale for the investigation being reported. Read more

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Objectives

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State specific objectives, including any prespecified hypotheses.   Read more

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Methods

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Study design

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Present key elements of study design early in the paper.   Read more

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Setting

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Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection.   Read more

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6a

Eligibility criteria

Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up.   Read more

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6b

Eligibility criteria

For matched studies, give matching criteria and number of exposed and unexposed. Read more

page   nu

7.

Variables

Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.   Read more

9-12

8.

Data sources / measurement

For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.   Read more

8-9

9.

Bias

Describe any efforts to address potential sources of bias.   Read more

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Study size

Explain how the study size was arrived at.   Read more

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Quantitative variables

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Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why. [Read more](#)

| page | nι |

12a

Statistical methods

Describe all statistical methods, including those used to control for confounding. [Read more](#)

| 12-13 |

12b

Statistical methods

Describe any methods used to examine subgroups and interactions. [Read more](#)

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12c

Statistical methods

Explain how missing data were addressed. [Read more](#)

| 13 |

12d

Statistical methods

If applicable, explain how loss to follow-up was addressed. [Read more](#)

| page | nι |

12e

Statistical methods

Describe any sensitivity analyses. [Read more](#)

| page | nι |

Results

13a

Participants

Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.   Read more

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13b

Participants

Give reasons for non-participation at each stage.   Read more

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13c

Participants

Consider use of a flow diagram.   Read more

> 13

14a

Descriptive data

Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.   Read more

> 13-14

14b

Descriptive data

Indicate number of participants with missing data for each variable of interest.   Read more

> page   number

14c

Descriptive data

Summarise follow-up time (eg, average and total amount).   Read more

page	nu

15.

Outcome data

Report numbers of outcome events or summary measures over time. Give information separately for exposed and unexposed groups if applicable.   [Read more](#)

17-18

16a

Main results

Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included.   [Read more](#)

18-21

16b

Main results

Report category boundaries when continuous variables were categorized.   [Read more](#)

14

16c

Main results

If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period.   [Read more](#)

page	nu

17.

Other analyses

Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses.   [Read more](#)

page	nu

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Discussion

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Key results

Summarise key results with reference to study objectives.   Read more

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19.

Limitations

Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.   Read more

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Interpretation

Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.   Read more

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Generalisability

Discuss the generalisability (external validity) of the study results.   Read more

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Other Information

22.

Funding

Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based.   Read more

| 5 |

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BMJ Open

Association of care worker's job satisfaction and global happiness with change of functional performance of severely disabled elderly residents in nursing homes: A cohort and questionnaire study in Japan

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2019-033937.R1
Article Type:	Original research
Date Submitted by the Author:	31-Jan-2020
Complete List of Authors:	Ikeda-Sonoda, Shino; Keio University School of Medicine Graduate School of Medicine, Department of Health Policy and Management Ichihara, Nao; The University of Tokyo, Department of Healthcare Quality Assessment Okochi, Jiro; Japanese Association of Geriatric Health Services Facilities, Takahashi, Arata; Keio University School of Medicine Graduate School of Medicine, Department of Health Policy and Management Miyata, Hiroaki; Keio University School of Medicine Graduate School of Medicine, Department of Health Policy and Management
Primary Subject Heading:	Health services research
Secondary Subject Heading:	Geriatric medicine
Keywords:	Nursing home, elderly with severe disabilities, quality of care, functional performance, care workers, quality of work life

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1 **Association of care worker's job satisfaction and global happiness with change of**

2 **functional performance of severely disabled elderly residents in nursing homes: A**

3 **cohort and questionnaire study in Japan.**

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24   **Keyword**

25   Nursing home, elderly with severe disabilities, quality of care, functional performance,

26   care workers, quality of work life, job satisfaction, global happiness

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3

ABSTRACT

Objectives: There is growing concern regarding quality of work life (QWL) among

care staff in nursing homes. However, little is known about the impact of QWL on

nursing home residents' functional performance. Recent literature suggests that job

satisfaction and happiness of healthcare workers reflect their perceived QWL and

impact the quality of their care. This study examined the association between job

satisfaction and global happiness with change in functional performance of severely

disabled elderly residents in nursing homes.

Design: A retrospective cohort study of nursing home residents combined with a

questionnaire survey of their care staff.

Setting: Eighteen nursing homes in Japan.

Participants: Data were collected from 1,000 residents with a required care level of 3–

5 and 412 care staff in nursing homes between October 2016 and March 2017.

Outcomes and explanatory variables: Functional performance was structurally

assessed with ICF Staging, composed of 52 items concerning activities of daily life,

cognitive function, and social participation at baseline and six months later.

Deterioration and improvement of functional performance were dichotomously defined

as such change in any of the items. QWL of care staff was evaluated with a

questionnaire including questions about job satisfaction and global happiness.

4

48 **Results:** Functional performance deteriorated and improved in 23.0% and 12.7% of

49 residents, respectively. Global happiness of care staff was associated with lower

50 probability of residents' deterioration (adjusted odds ratio (aOR), 0.61; confidence

51 interval (CI), 0.44–0.84). There was no significant correlation between job satisfaction

52 or happiness of care staff and improvement of residents' functional performance.

53 **Conclusion:** These results suggest that QWL of care staff is associated with changes in

54 functional performance of elderly people with severe disabilities in nursing homes.

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ARTICLE SUMMARY

Strengths and limitations of this study

- This is the first study to investigate the correlation between quality of work life, specifically job satisfaction and global happiness, of care staff and changes in functional performance of elderly people with severe disabilities in nursing homes.

- Data included functional performance assessments of 1,000 residents at 18 nursing homes across Japan at two time points at an interval of six months (retrospective cohort study) and perceptions of 412 care staff at these nursing homes (questionnaire survey).

- Residents' functional performance was structurally recorded using ICF Staging, a standardized and validated instrument that enables holistic, reproducible assessment of a person's functional status, including activities of daily living, cognitive function, and social participation, without the need for extensive training of users.

- The six-month observation period of this study was relatively short for capturing functional changes of residents and necessitated aggregating multifaceted functional performance changes into binary indicators of deterioration and improvement.

6

79   **Competing interests:** None declared.

7

INTRODUCTION

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In developed nations, population aging and increased life expectancy have

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resulted in increased demand for elderly care and a shortage of care workers.(1,2)

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Care worker shortage in Japan

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In Japan, as the number of elderly people requiring nursing care increases, so

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does the need for a large number of care workers. A care worker is defined as a person

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who provides direct care in long-term care settings, including nursing homes, and they

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compose 41.3% of the workers in the long-term care settings; 62.6% of the care workers

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work full time and 60.7% of them have a national license.(3) The Japanese government

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has estimated that by the year 2025, it will be necessary to secure an additional care

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workforce of 380,000 while assuring the quality of care and containing costs; nursing

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homes have experienced a serious shortage of care workers.(4) The job opening rate for

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care workers was more than 3.95 across the nation in 2018.(4) There are long waiting

92

lists for special nursing homes, partly due to the labour shortage.(5) Therefore, the

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government and administrators of nursing homes and service providers must determine

94

how to maintain and improve work environments to recruit and retain care workers.

95

Quality of Work Life

96

There is growing concern regarding the impact of quality of work life (QWL)

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perceived by care staff on the quality of care in nursing homes.(6–8) QWL is an

98

umbrella concept that encompasses a wide range of work-related issues.(8) Some

99

8

100   studies have considered QWL as a broad set of beneficial outcomes of working life.(9)

101   The other studies have described QWL as the quality of interaction between individuals

102   and every dimension of work.(9) In some previous studies, perceived QWL was

103   assessed using job satisfaction and global happiness.(8,10)

104   There are a number of reports on factors that affect job satisfaction of

105   healthcare workers. A previous study in nursing homes showed that internal factors

106   which affect job satisfaction about perceived job characteristics are supervisor support,

107   workload, financial rewards, career rewards, quality of co-workers, perceived quality of

108   care and team care. The same study showed that external factors with such impact are

109   contingency factors (e.g., being a primary breadwinner), personal characteristics (e.g.,

110   age, sex), organizational factors (e.g., type of ownership) and economic factors.(11)

111   Other studies revealed that job satisfaction among those who provide direct resident

112   care in residential long-term care facilities is influenced by empowerment and

113   autonomy as individual factors, and by facility resources and workload as

114   organizational factors.(5,12,13) Some other studies of QWL in healthcare settings have

115   focused on global happiness.(10) Nurses' happiness can be attributed to a number of

116   personal factors and job environment characteristics.(14)

9

117   Previous studies have illustrated that job satisfaction and global happiness

118 affect the quality of care provided by care staff through job commitment.(15)

119   Job commitment of care staff in nursing homes is important for their care

120 communities to provide better quality of care through "culture change".(15–19) "The

121 philosophy of the culture change movement embraces the person-centered concept,"

122 while also supporting the improvement of work conditions for staff. The culture change

123 process encourages frontline caregivers to work with their supervisors to implement

124 more person-centered approaches to care. Care communities attempt to integrate the

125 wishes and preferences of residents, as well as their care needs, for respecting privacy,

126 dignity, comfort, and choice in such human activities as eating, toileting, and

127 bathing.(20) Also, care workers respond to residents' health changes appropriately

128 through communication among care communities.(20)

129   It has been reported that job satisfaction of long-term care staff is correlated

130 with health-related outcomes of the residents. Higher job satisfaction of care staff in

131 nursing homes is associated with lower rates of resident injuries and residents' higher

132 satisfaction and well-being.(15,21) Higher job satisfaction and global happiness of care

133 managers is associated with clients' higher satisfaction and happiness with care.(10)

134 However, little is known regarding the association between QWL-related concepts,

10

135   specifically job satisfaction and global happiness, and functional performance of elderly

136   people with severe disabilities.

137   **Functional performance of elderly people with severe disabilities**

138   The degree of disability and dependency varies among elderly people who live

139   in nursing homes.(22) It is expected that elderly people with different degrees of

140   disability and dependency have different tendencies of deterioration or improvement in

141   their functional performance. Also, it is reasonably assumed that people with different

142   degrees of disability and dependency have their functional performance affected by

143   different factors. However, very few studies have focused on care outcomes of the

144   elderly people with severe disabilities.

145   **Long-Term Care Insurance system in Japan**

146   In Japan, elderly people with disabilities are eligible for receiving long-term

147   care under the public long-term care insurance (LTCI) system.(23) There are various

148   types of residential care facilities for the elderly, including LTCI facilities such as

149   special nursing homes, geriatric health facilities, sanatoria, or integrated facilities for

150   medical and long-term care. Elderly people who need care are stratified by the degree of

151   disability and dependency and certified as requiring a care level from 1 (mild) to 5

152   (severe).(24) Those with moderate to severe disabilities, with a required care level of 3–

153   5, are permitted to reside in special nursing homes. Typically, a person with a required

11

154 care level of 3 (moderate) needs full assistance for standing, walking, dining, toileting,

155 and bathing. A typical person with a required care level of 5 (severe) needs full

156 assistance for most essential activities for survival, e.g., nutrition intake, excretion,

157 maintenance of skin condition, and avoidance of pressure ulcers, with a limited ability

158 to comprehend their surroundings and communicate with others.

159 **Aim of this study**

160 The aim of this study was to examine how job satisfaction and global happiness

161 of care staff were correlated with changes in functional performance of elderly people

162 with severe disabilities in Japanese special nursing homes.

163 A conceptual model of the correlation between care staff's QWL and

164 functional performance of residents in nursing homes is shown in Figure 1.

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171 **Methods**

172 **Study design and participants**

173 This was a retrospective cohort study of residents of special nursing homes,

174 combined with a questionnaire survey with care staff at the nursing homes.

12

175   For efficient and accurate data collection, nursing homes which have a specific

176   information system "CAREKARTE" implemented were asked to participate in the

177   study. CAREKARTE was developed by Fuji Data Systems, Japan, and integrates

178   functionalities for care recording and operational management.

179   The residents and care staff of the nursing homes that agreed to cooperate were

180   invited to participate in the study. Written consent to participate in the study was

181   obtained from each resident or the resident's proxy family member if the resident had

182   cognitive impairment and had difficulty communicating with other people. Consent

183   from staff was obtained through the aforementioned software. They were informed that

184   they could withdraw at any time and that all information related to them would remain

185   confidential. Data were anonymized at the nursing homes and sent to the investigators.

186   Only residents with a required care level of 3, 4, or 5 were included in the study, as

187   required care levels 3, 4, and 5 represent moderate to severe disability typical for

188   residents in special nursing homes.

Data Collection

190   All data were collected from October 2016 through March 2017. Residents' age, sex,

191   and required care levels were obtained from the care records. Residents' functional

192   performance was assessed by the care managers and recorded in the aforementioned

193   software at an interval of six months. Occurrence of undesirable risk events within the

13

194 same six months was also reported by the care managers through review of the care

195 record. An electronic survey with care staff on their perceived QWL was also conducted

196 at the end of the six-month period.

197 **Patient and Public Involvement**

198   Nursing home residents and care staff were not directly involved in the design

199 and conduct of this research, however, the authors have a constant relationship with

200 residents, care workers, and managers of nursing homes and their insights have been

201 incorporated in the design of this study. The authors plan to formally invite nursing

202 home residents and care staff for determining optimal strategy for disseminating the

203 results of this study.

204 **Outcome variables**

205 **Functional Performance: ICF Staging**

206   Concerning functional performances of elderly people, it is widely accepted

207 that maintaining independence in activities of daily living (ADL) and cognitive

208 functions and engaging in society are critical for people's quality of life as they

209 age.(25–27)

210   In this study, functional performance of the residents was measured using the

211 ICF Staging. The ICF Staging is an instrument to evaluate functional performance of

212 elderly people developed by the Japan Association of Geriatric Health Service

213 Facilities, and it is structured in line with the World Health Organization (WHO)

14

214   International Classification of Functioning, Disability and Health (ICF) codes.(28)

215   Table 1 shows the 13 categories of the ICF Staging items in the domains of ADL,

216   cognitive function, and social participation, each of which consists of four questions

217   corresponding to an ICF code, composing 52 items in total.(29) The ICF Staging

218   facilitates objective and multifaceted descriptions of elderly functional performance

219   efficiently and without the need for extensive training.(30)

220   The ICF Staging is regularly used in more than one thousand Japanese

221   intermediate facilities and nursing homes.(28) Previous studies have revealed this

222   instrument has high validity, test-retest reliability, and sensitivity to change.(30–33)

223

224   **Table 1. Functional performance items in the ICF Staging.**

ADL	01. Basic posture control
	02. Walking and moving function
	03. Eating function - Swallowing
	04. Eating function – Feeding and feeding assistance
	05. Toileting function
	06. Bathing function
	07. Personal care function - Oral care
	08. Personal care function - Self-care
Cognitive Function	09. Orientation
	10. Communication
	11. Mental activities
Social Participation	12. Leisure
	13. Socializing

225   Note: ADL = Activities of daily living

15

226

227   Functional performance was measured twice at an interval of six months. The

228 data on a resident were compared between time points and evaluated either as improved,

229 deteriorated, or no change. In this study, the primary outcome measure was change,

230 either deterioration or improvement, in any of the 52 ICF Staging items. Note that

231 improvement and deterioration might coexist within an individual.

232

233 **Explanatory variables**

234 **Care staff QWL survey**

235   The care staff QWL survey included six items: job satisfaction, global

236 happiness, psychological rewards, intention to leave, and perceived quality of care at the

237 facility (2 items). Global happiness was scored on a scale of 0–10, with zero

238 representing "not happy at all" and 10 representing "very happy." Job satisfaction and

239 psychological rewards items ("To what extent are you satisfied with your work?" and

240 "How psychologically rewarding is your work?") were scored on a scale of 1–6, with

241 one representing "not at all" and six representing "extremely." Frequency of intentions

242 to leave from the current care facilities was scored on a scale of 1–4, where one

243 represented "often" and four represented "not at all." Items addressing perceived quality

244 of care at the facility ("To what extent are you satisfied with the quality of care provided

16

245 at the nursing home at which you work?" and "To what extent would you recommend

246 the nursing home at which you work to your family and friends?") were scored on a

247 scale of 1–5, where one represented "not at all" and five represented "extremely."

248 Previous studies have shown that career rewards, intentions to leave, and

249 perceived quality of care are elements composing staff job satisfaction.(12,34,35) In this

250 study, we assumed that job satisfaction and global happiness represent major aspects of

251 QWL of care staff in nursing homes.

252 Responses to each item on the questionnaire were summarized as follows to

253 create a facility-level binary indicator. First, the response of each care staff member was

254 recoded either as "high" (equal to or above a pre-specified threshold) or "low" (below

255 the threshold). The threshold for job satisfaction, on a scale of 1–6, was 4 and that for

256 global happiness, answered in a scale of 0–10, was 5. Second, responses within each

257 facility were summarized either as "high proportion" (proportion of "high" responses

258 equal to or above the median across facilities) or "low proportion" (proportion of "high"

259 responses below the median across facilities).

260 **Risk events**

261 As risk events, falls, new pressure ulcers, aspiration pneumonia, and fever were

262 recorded.(21) Care managers identified the occurrence of these events after the six-

263 month period by reviewing the care record.

17

Statistical Analyses

264

265   Survey responses of care staff at each facility were converted to facility-level

266 binary indicators, as described earlier, and combined with the resident data. All

267 analyses, except when indicated, were conducted in a unit of residents.

268   Correlation of deterioration and improvement of functional performance with

269 resident features, risk events, and job satisfaction and global happiness of care staff was

270 assessed using Pearson's Chi square test.

271   Multivariable logistic regression was used to estimate effects of care staff's job

272 satisfaction and global happiness on functional performance adjusted for other

273 covariates. Age, sex, required care level, risk events, and job satisfaction and global

274 happiness of care staff were included in the model.

275   Analysis of distribution of variables, analysis of bivariate correlations, and the

276 multivariable logistic regression were all conducted with and without stratification with

277 required care level. Statistical analysis was performed using JMP computer software

278 (JMP® Pro 14.3. SAS Institute Inc., USA). A p-value less than 0.05 was considered

279 statistically significant.

280   The STROBE cohort reporting guidelines were used.(36)

281

282 **RESULTS**

283 **Baseline characteristics**

284   A total of 1,532 residents and 455 care workers from 21 special nursing homes

285 participated in this study (Figure 2). The data of 1,292 residents were collected. The

286 reason for missing data at this stage was not clear, which may have been either death or

287 administrative issues. Residents with required care levels of 3, 4, and 5 (n=1,136) were

288 included in the analysis. We excluded data on residents for which functional

289 performance data or care worker's responses were missing. As a result, 1,000 residents

290 with 412 corresponding care workers from eighteen special nursing homes were

291 included in the analysis. The proportion of missing values was 3.1% for items on

292 residents' functional performance and 1.2% for QWL items among care staff.

293

294

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297

298   The proportion of residents with required care level 3, 4 and 5 are 23.9%,

299 39.5%, and 36.6%, respectively (Table 2a). Most residents (80.6%) were female and

300 more than half of the residents were aged 85–94. Baseline functional performance is

301 summarized in Table 2b. Percentages here indicate the proportion of residents capable

19

302   of each ICF Staging item both in the overall analysis cohort and within residents with a

303   specific required care level. It is shown that higher required care level is associated with

304   more limited ability in most items of functional performance.

305

306   **Table 2a. Sex and age of nursing home residents**

Baseline Characteristics	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Sex				
Female	78.2%	79.7%	83.1%	80.6%
Male	21.8%	20.3%	16.9%	19.4%
Age groups, in years				
<80	12.6%	19.5%	19.1%	17.7%
80-84	14.6%	13.7%	18.6%	15.7%
85-89	28.9%	27.8%	27.9%	28.1%
90-94	33.1%	22.3%	21.3%	24.5%
95+	10.9%	16.7%	13.1%	14.0%

307   (No legend for this table)

308

309   **Table 2b. Baseline functional performance of nursing home residents**

Baseline functional performance	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
ADL				
1. Basic posture control				
1-1 Maintaining standing position	42.9%	14.9%	6.2%	18.4%

20

1-2 Moving between sitting positions	76.9%	44.2%	17.9%	42.3%
1-3 Maintaining sitting position (without assistance)	68.8%	36.1%	11.8%	34.9%
1-4 Rolling over	81.7%	54.8%	20.8%	48.7%
2. Walking and moving function				
2-1 Going out	1.7%	1.0%	0.6%	1.0%
2-2 Climbing up and down	4.3%	0.3%	0.8%	1.4%
2-3 Stable walking	42.9%	14.8%	3.9%	17.5%
2-4 Moving within facility	85.3%	61.7%	31.4%	56.2%
3. Eating function – Swallowing				
3-1 Chewing	76.6%	53.4%	24.1%	48.3%
3-2 Sucking	86.0%	70.2%	39.4%	62.8%
3-3 Swallowing (solid)	92.2%	81.2%	53.6%	73.8%
3-4 Swallowing (specially processed food)	93.4%	82.3%	70.9%	80.6%
4. Eating function – Feeding and feeding assistance				
4-1 Feeding him/herself	71.4%	47.4%	13.3%	40.9%
4-2 Dropping food and making mess	68.1%	68.9%	31.5%	54.8%
4-3 Special arrangement for feeding	29.6%	49.1%	56.8%	47.1%
4-4 Direct assistance for feeding	8.7%	22.5%	64.8%	34.6%
5. Toileting function				
5-1 Post-release cleanup	50.6%	28.2%	16.9%	29.4%
5-2 Dressing and undressing	56.5%	18.6%	4.2%	22.3%
5-3 Getting on and off western type toilet	65.2%	48.0%	19.1%	41.4%
5-4 Releasing on bed	17.9%	34.4%	49.4%	36.0%
6. Bathing function				
6-1 Stable movement in and out of bathtub and washing.	16.2%	3.4%	1.1%	5.6%
6-2 Bathing without assistance	7.5%	3.7%	0.9%	3.5%
6-3 Maintaining sitting position during bathing	74.3%	52.0%	20.1%	45.7%
6-4 Carrying out bathing	50.7%	70.2%	89.2%	72.6%
7. Personal care function - Oral care				
7-1 General oral care	48.7%	26.0%	6.5%	24.3%
7-2 Brushing teeth	39.3%	15.9%	4.0%	17.1%
7-3 Preparation for brushing teeth	66.4%	45.0%	14.7%	38.8%
7-4 Rinsing mouth	79.2%	58.3%	20.5%	49.0%
8. Personal care function – Self-care				
8-1 Trimming nails	3.9%	2.9%	1.1%	2.5%
8-2 Shaving, skincare, hair care	48.3%	27.2%	5.4%	24.3%

21

8-3 Washing face	71.9%	47.0%	14.4%	41.0%
8-4 Washing hands	55.0%	35.0%	9.1%	30.3%
Cognitive Functions				
9. Orientation				
9-1 Date	43.3%	22.0%	7.6%	21.8%
9-2 Name of place	48.1%	31.7%	11.2%	28.0%
9-3 Orientation toward other people	84.5%	69.8%	36.6%	61.2%
9-4 Own name	98.2%	89.8%	59.0%	80.5%
10. Communication				
10-1 Maintaining complicated human relationship	54.1%	36.8%	12.9%	32.2%
10-2 Understanding of written language	70.1%	50.8%	17.9%	43.3%
10-3 Everyday conversation	60.6%	46.6%	18.9%	39.8%
10-4 Understanding of spoken language	82.0%	74.4%	40.6%	63.8%
11. Cognitive function				
11-1 Time management	38.2%	24.0%	6.5%	21.0%
11-2 Simple arithmetic	57.6%	36.0%	10.4%	31.7%
11-3 Long-term memory	44.2%	35.1%	12.4%	28.9%
11-4 State of consciousness	5.6%	7.6%	5.7%	6.4%
Social Participation				
12. Leisure				
12-1 Traveling	1.3%	11.1%	0.6%	0.5%
12-2 Going out from the nursing home	22.0%	56.9%	3.4%	10.9%
12-3 Group Recreation	73.0%	63.7%	30.2%	51.0%
12-4 Watching TV	75.0%	4.5%	38.4%	57.1%
13. Socializing				
13-1 Socializing using means of communication devices	10.0%	7.1%	2.3%	5.0%
13-2 Going out	11.4%	35.2%	4.9%	7.3%
13-3 Conversing with friend	50.9%	87.1%	15.5%	31.7%
13-4 Conversing with someone close	96.9%	96.9%	51.9%	76.5%

310   Note: Percentage of residents who is capable of each item. ADLs = Activities of Daily

311   Living

312

313   Table 3 summarizes care staff's responses. The median and interquartile range

314 of job satisfaction were 4 (4–5) out of 6 and those of global happiness were 7 (6–8) out

315 of 10.

316

317 **Table 3 Care Staff's QWL items and answers.**

Staff QWL items	Median (Interquartile Range)
Global Happiness	
Are you happy? (0-10, not happy to very happy)	7 (6-8)
Job Satisfaction	
To what extent are you satisfied with you work? (1-6, not at all to extremely)	4 (4-5)
Psychological rewards	
How psychologically rewarding is your work? (1-6, not at all to extremely)	5 (4-5)
Frequency of Intentions to leave	
How often do you feel you want leave from the current care facilities? (1-4, often to not at all)	2 (2-3)
Quality of care at the nursing home	
To what extent are you satisfied with the quality of care provided at the nursing home at which you work? (1-5, not at all to extremely)	4 (3-4)
To what extent would you recommend this nursing home at which you work to your family and friends? (1-5, not at all to extremely)	4 (3-4)

318

319 (Legend) Distribution of care staff's responses (N=412). Note that this analysis was

320 conducted in the unit of care staff members, not residents.

321   Table 4 shows distribution of care staffs' job satisfaction and global happiness

322 summarized in the unit of residents.

323

23

324 **Table 4. Job satisfaction and global happiness of care staff.**

	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Job Satisfaction	47.70%	51.40%	51.90%	50.70%
Global Happiness	59.00%	55.40%	47.80%	53.50%

325

326   (Legend) Distribution of care staff's responses. Note that this analysis was conducted

327 in the unit of residents (N=1,000). Job satisfaction and happiness are represented by

328 facility-level binary indicators (1 if the proportion of above-threshold responses is equal

329 to or above the across-facilities median, 0 if it is below median).

330

331   The most common undesirable risk events among the residents in the six-

332 month period of observation were fever (18.3%) and falls (15.6%; Table 5). Incidence

333 of new pressure ulcers and aspiration pneumonia were relatively low.

334

335 **Table 5. Occurrence of risk events**

Risk events	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000, 100.0%)
Falls	22.6%	13.9%	12.8%	15.6%
Pressure ulcers	1.7%	2.8%	2.7%	2.5%
Aspiration pneumonia	1.7%	2.3%	2.7%	2.3%
Fever	17.6%	15.2%	22.1%	18.3%

336 (No footnote for this table)

337

24

Change in functional performance

As shown in Table 6a and 6b, 23.0% of the residents exhibited deterioration

and 12.7% exhibited improvement. The overlap between deterioration and improvement

of functional status was summarized in Appendix Table 1. Regarding ADL, both

deterioration and improvement were more frequent in residents with lower required care

levels. Cognitive function more frequently deteriorated and less frequently improved in

residents with higher required care levels. Social participation rarely improved in

residents with the required care level 5. As the proportion of change was highest in

ADL, the "overall" deterioration and improvement most reflected that in ADL.

Table 6a. Proportion of residents with deterioration.

Deterioration	Required care level 3 (n=239, 23.9%)	Required care level 4 (n=395, 39.5%)	Required care level 5 (n=366, 36.6%)	Total (n=1,000, 100.0%)
ADL	17.6%	17.5%	13.4%	16.0%
Cognitive Function	5.0%	6.1%	8.2%	6.6%
Social Participation	6.3%	6.6%	5.2%	6.0%
Total	27.6%	22.8%	20.2%	23.0%

(Legend) Proportion of residents with deterioration in any of the 52 items on functional

performance assessment tool (ICF Staging).

Table 6b. Proportion of residents with improvement.

Improvement	Required care level 3 (n=239, 23.9%)	Required care level 4 (n=395, 39.5%)	Required care level 5 (n=366, 36.6%)	Total (n=1,000, 100.0%)
ADL	11.7%	6.6%	5.7%	7.5%
Cognitive Function	7.1%	3.3%	2.7%	4.0%
Social Participation	4.2%	4.1%	0.8%	2.9%

Total	19.7%	12.2%	8.7%	12.7%

354

355   (Legend) Proportion of residents with improvement in any of the 52 items on

356   functional performance assessment tool (ICF Staging).

357

358

359   **Bivariate correlation analysis**

360   Correlation of change of functional performance with resident features, risk

361   events during the observation period, and care staff job satisfaction and global

362   happiness, is summarized in Table 7a and 7b. Residents who had either a fall or fever

363   were more likely to deteriorate. Residents of facilities with a high proportion of happy

364   care staff were less likely to deteriorate. Residents who had a fall were also more likely

365   to improve.

366

367   **Table 7a. Correlation of deterioration of functional performance with resident**
368   **features, risk events, and care staff happiness and job satisfaction (bivariate**
369   **analysis).**

	Required Care Level 3	Required Care Level 4	Required Care Level 5	Total
	(n=239, 23.9%)	(n=395, 39.5%)	(n=366, 36.6%)	(n=1,000)
Resident features				
Sex				
Male	0.46 (0.17-1.25)	1.61 (0.88-2.97)	1.08 (0.51-2.27)	1.08 (0.71-1.64)
Age groups, in years				
<80	1	1	1	1

80-84	3.12 (0.76-12.8)	0.56 (0.20-1.57)	0.69 (0.25-1.93)	0.91 (0.49-1.66)
85-89	1.35 (0.34-5.38)	1 (0.47-2.13)	1.03 (0.44-2.46)	1.03 (0.61-1.74)
90-94	1.61 (0.42-6.17)	1 (0.45-2.20)	1.43 (0.60-3.43)	1.18 (0.70-2.00)
95+	3.32 (0.76-14.48)	0.80 (0.33-1.95)	1.38 (0.52-3.71)	1.27 (0.70-2.29)
Risk events				
Fall	1.60 (0.75-3.42)	1.68 (0.84-3.33)	**2.80 (1.38-5.66)**	**1.95 (1.30-2.94)**
Pressure ulcers	-	2.97 (0.84-10.44)	-	0.98 (0.33-2.91)
Aspiration pneumonia	1.68 (0.17-16.53)	**4.18 (1.09-16.01)**	0.61(0.08-4.90)	1.86 (0.72-4.79)
Fever	1.46 (0.64-3.35)	1.86 (0.96-3.58)	1.51 (0.79-2.86)	**1.59 (1.07-2.38)**
Care staff responses				
Job satisfaction	1.26 (0.64-2.49)	0.70 (0.41-1.19)	0.84 (0.48-1.48)	0.86 (0.61-1.20)
Global happiness	0.64 (0.33-1.27)	**0.49 (0.29-0.85)**	0.94 (0.53-1.66)	**0.67 (0.48-0.94)**

370

371 Footnote) Bivariate correlation analysis. Odds ratios are presented with their 95%

372 confidence intervals. Job satisfaction and happiness are represented by facility-level

373 binary indicators (1 if the proportion of above-threshold responses is equal to or above

374 the across-facilities median, 0 if it is below median).

375

376 **Table 7b. Correlation of improvement of functional performance with resident**
377 **features, risk events, and care staff happiness and job satisfaction (bivariate**
378 **analysis).**

	Required Care Level 3	Required Care Level 4	Required Care Level 5	Total
	(n=239, 23.9%)	(n=395, 39.5%)	(n=366, 36.6%)	(n=1,000)
Resident features				
Sex				
Male	0.82 (0.37-1.83)	1.55 (0.78-3.10)	1.42 (0.59-3.45)	1.27 (0.81-1.99)
Age groups, in years				
<80	1	1	1	1
80-84	2.25 (0.61-8.23)	2.37 (0.79-7.10)	1.31 (0.34-5.10)	2.00 (0.99-4.03)
85-89	1.65 (0.50-5.52)	1.45 (0.52-4.04)	1.60 (0.47-5.40)	1.66 (0.86-3.18)
90-94	1.65 (0.50-5.41)	1.02 (0.33-3.18)	2.15 (0.63-7.33)	1.75 (0.90-3.39)
95+	1.18 (0.26-5.28)	3.19 (1.15-8.84)	1.92 (0.49-7.55)	2.29 (1.13-4.63)

Risk events				
Fall	**2.37 (1.19-4.76)**	2.05 (0.97-4.31)	2.06 (0.84-5.07)	**2.36 (1.53-3.65)**
Pressure ulcers	4.22(0.58-30.79)	0.72 (0.09-5.73)	1.16 (0.14-9.50)	1.32 (0.45-3.91)
Aspiration pneumonia	1.37 (0.14-13.47)	**2.11 (0.43-10.47)**	-	1.03 (0.30-3.52)
Fever	2.15 (1.01-4.56)	0.78 (0.31-1.91)	1.19 (0.51-2.76)	1.24 (0.78-1.96)
Care staff responses				
Job satisfaction	0.55 (0.29-1.07)	**2.56 (1.33-4.93)**	0.80 (0.39-1.66)	1.06 (0.73-1.54)
Global happiness	0.92 (0.48-1.76)	1.39 (0.75-2.59)	0.84 (0.40-1.74)	1.12 (0.77-1.63)

379

380 (Footnote: Bivariate correlation analysis. Odds ratios are presented with their 95%

381 confidence intervals.) Job satisfaction and happiness are represented by facility-level

382 binary indicators (1 if the proportion of above-threshold responses is equal to or above

383 the across-facilities median, 0 if it is below median).

384

385

386 Correlation of change of subdomains of functional performance, i.e., ADL,

387 cognitive function, and social participation, with care staff job satisfaction and

388 happiness is summarized in Table 8a and 8b.

389

390 **Table 8a. Correlation between deterioration of subdomains of functional**
391 **performance and staff QWL.**

	ADL	Cognitive Function	Social Participation
Job Satisfaction	0.91 (0.65-1.28)	0.80 (0.48-1.32)	0.86 (0.61-1.20)
Global Happiness	0.72 (0.52-1.02)	0.86 (0.52-1.42)	0.92 (0.55-1.56)

392

393   (Footnote) Bivariate correlation analysis. Odds ratios are presented with their 95%

394   confidence intervals. Job satisfaction and happiness are represented by facility-level

395   binary indicators (1 if the proportion of above-threshold responses is equal to or above

396   the across-facilities median, 0 if it is below median).

397

398   **Table 8b. Correlation between improvement of subdomains of functional**
399   **performance and staff QWL.**

	ADL	Cognitive Function	Social Participation
Job Satisfaction	0.99 (0.62-1.59)	1.06 (0.56-2.01)	1.97 (0.89-4.36)
Global Happiness	1.06 (0.66-1.69)	0.71 (0.37-1.34)	1.06 (0.73-1.54)

400

401   (Footnote) Bivariate correlation analysis. Odds ratios are presented with their 95%

402   confidence intervals. Job satisfaction and happiness are represented by facility-level

403   binary indicators (1 if the proportion of above-threshold responses is equal to or above

404   the across-facilities median, 0 if it is below median).

405

406

407   **Multivariable logistic regression**

408   Results of the multivariable regression are shown in Table 9a and 9b. The

409   residents in nursing homes with high proportion of happy care staff had a statistically

410   lower chance of deterioration (OR: 0.61, CI 0.44–0.84). When stratified by required

29

411 care levels, the same trend was observed throughout, with a statistically significant

412 difference (OR: 0.36, CI 0.21-0.64) observed in required care level 4.

413   As shown in Table 9b, in analyses stratified by required care level, there was

414 no statistically significant increased chance for required care levels 3 and 5. For

415 required care level 4, the chance of improvement increased with age (OR: 5.12 for age

416 group 95+ compared to <80) and care worker job satisfaction (OR: 2.84, CI: 1.36–5.93).

417

418 **Table 9a. Multivariable logistic regression analysis for deterioration of residents'**
419 **functional performance.**

	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Resident features				
Sex				
Male	0.71 (0.32-1.61)	1.43 (0.78-2.62)	1.70 (0.85-3.40)	1.31 (0.89-1.93)
Age groups, in years				
<80	1	1	1	1
80-84	1.88 (0.57-6.28)	0.51 (0.20-1.34)	0.64 (0.24-1.34)	0.84 (0.48-1.47)
85-89	1.16 (0.38-3.52)	0.84 (0.40-1.76)	1.18 (0.53-2.65)	1.07 (0.66-1.72)
90-94	1.42 (0.41-4.98)	0.89 (0.40-1.97)	1.83 (0.81-4.15)	1.25 (0.77-2.04)
95+	2.08 (0.57-7.55)	1.20 (0.53-2.70)	1.47 (0.58-3.73)	1.54 (0.90-2.64)
Risk events				
Fall	**2.12 (1.06-4.29)**	**2.08 (1.06-4.07)**	**2.38 (1.19-4.79)**	**2.25 (1.54-3.29)**
Pressure ulcers	1.25 (0.13-11.67)	1.92 (0.50-7.45)	0.26 (0.03-2.25)	0.90 (0.34-2.38)
Aspiration pneumonia	2.71 (0.34-21.49)	**5.25 (1.14-24.27)**	-	1.40 (0.57-3.39)
Fever	**2.79 (1.27-6.10)**	1.69 (0.86-3.35)	0.66 (0.87-3.18)	**1.81 (1.24-2.66)**
Care staff responses				

Job satisfaction	1.71 (0.90-3.26)	1.18 (0.70-2.00)	0.92 (0.53-1.59)	1.07 (0.79-1.47)
Global happiness	0.54 (0.28-1.04)	**0.36 (0.21-0.64)**	0.86 (0.50-1.51)	**0.61 (0.44-0.84)**

420

421   Notes: To assess effect of care staff's happiness and job satisfaction on deterioration of

422   residents' functional performance adjusted for covariates, multivariable logistic

423   regression was conducted in the overall cohort and within each required care level. The

424   table summarizes odds ratios of each variable and their confidence intervals. Job

425   satisfaction and happiness are represented by facility-level binary indicators (1 if the

426   proportion of above-threshold responses is equal to or above the across-facilities

427   median, 0 if it is below median).

428

429   **Table 9b. Multivariable logistic regression analysis for improvement of residents'**
430   **functional performance.**

Characteristic	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Resident features				
Sex				
Male	1.05 (0.44-2.51)	2.04 (0.95-4.40)	1.87 (0.74-4.76)	1.52 (0.95-2.45)
Age groups, in years				
<80	1	1	1	1
80-84	2.10 (0.54-8.09)	3.06 (0.97-9.75)	1.45 (0.36-5.87)	**2.24 (1.09-4.60)**
85-89	1.55 (0.45-5.42)	1.72 (0.58-5.11)	1.85 (0.53-6.53)	1.75 (0.90-3.43)
90-94	1.42 (0.41-4.98)	1.50 (0.44-5.07)	2.62 (0.73-9.35)	1.94 (0.98-3.85)
95+	0.80 (0.16-4.13)	**5.12 (1.65-15.88)**	2.13 (0.52-8.73)	**2.38 (1.14-4.96)**

31

Risk events				
Fall	2.08 (0.98-4.45)	2.10 (0.92-4.83)	1.97 (0.77-5.08)	**2.36 (1.51-3.70)**
Pressure ulcers	2.86 (0.32-25.16)	0.70 (0.07-6.94)	1.39 (0.77-5.08)	1.07 (0.35-3.26)
Aspiration pneumonia	1.46 (0.13-16.49)	2.75 (0.45-16.79)	-	0.78 (0.22-2.81)
Fever	2.00 (0.86-4.67)	0.51 (0.19-1.38)	1.30 (0.53-3.21)	1.15 (0.70-1.87)
Care staff responses				
Job satisfaction	0.73 (0.36-1.50)	**2.84 (1.36-5.93)**	0.92 (0.43-1.97)	1.14 (0.76-1.69)
Global happiness	0.77 (0.37-1.61)	1.15 (0.56-2.37)	0.78 (0.36-1.70)	1.02 (0.68-1.53)

431

432   Notes: To assess effect of care staff's happiness and job satisfaction on deterioration of

433   residents' functional performance adjusted for covariates, multivariable logistic

434   regression was conducted in the overall cohort and within each required care level. The

435   table summarizes odds ratios of each variable and their confidence intervals. Job

436   satisfaction and happiness are represented by facility-level binary indicators (1 if the

437   proportion of above-threshold responses is equal to or above the across-facilities

438   median, 0 if it is below median).

439

440   **DISCUSSION**

441   This is the first study, to our knowledge, to examine the association between

442   changes in residents' functional performance and the job satisfaction and happiness of

443   care staff in nursing homes. The residents in nursing homes with high proportion of

444   happy care staff had a statistically lower chance of deterioration. The authors believe

445   that similar association may exist in other settings in long-term care for the elderly.

446   Although specific domains or categories of functional performance correlated

447   with job satisfaction or happiness of care staff were not identified, the observed

448   correlation between staff happiness and residents' functional deterioration theoretically

449   implies that, as described in the Introduction section, happy staff tend to highly commit

450   to their job. Organizational culture may change in their nursing home, which promotes

451   maintenance of residents' functional performance through provision of adequate

452   communication and high-quality care.(15,16,19,20,37) Also, either high quality care

453   leading to residents' favourable outcomes, or residents' functional performance itself

454   being maintained or improved, might in turn promote the happiness of care staff

455   through professional fulfilment.(38)

456   The results here are not robust, possibly due to a limited number of

457   observations for examining this correlation. In subgroup analyses on residents with each

458   required care level, statistically significant differences were observed only in the

459   residents with a required care level of 4. A possible explanation is that, in general, many

460   of the residents with a required care level of 3 have health problems which are still not

461   completely stable and exercise a major influence on their functional performance

33

462   outcome, and residents with a required care level of 5 may tend to be irreversibly

463   disabled with static diseases. Observation of a larger number of residents would allow

464   for more reliable statistical analysis. Alternatively, a study design with a stronger focus

465   on residents whose functional performance can theoretically be influenced by quality of

466   care, such as excluding bed-ridden residents and those who have just been discharged

467   from a hospital, may make it possible to more efficiently examine the correlation under

468   discussion.

469   The results of this study imply that improvement of care staff's working

470   environment might lead to higher quality of care and, in turn, maintenance or

471   improvement of residents' functional performance.(5,15,16,20,21,34,39)

472   The working environment of care staff in nursing homes has specific issues

473   that could be improved with organizational efforts. Relationships with other staff

474   members and a poor career outlook have been reported to be among the major causes of

475   care staff turnover in Japan.(40) Changing these QWL-related factors may improve staff

476   perceptions of the QWL, which may promote their commitment to their job. It will lead

477   to cultural change and hence improved quality of care provided in nursing homes. The

478   authors believe that evaluation of effectiveness of such an approach deserves further

479   study.

34

480   The authors also envision an alternative approach to improving functional

481 outcome of residents in nursing homes, which is to educate the care staff on physical,

482 psychological, and social process of aging and dying, as well as grief of the family of

483 residents and care staff themselves. Training on how to cope with aging and dying

484 should also be provided. We believe such education and training might mitigate the

485 psychological stress associated with working with residents with severe disabilities and

486 prevent compassion fatigue(41–45).

487   Care staff in nursing homes must regularly cope with residents' functional

488 decline, burdens associated with the terminal stage of life, and death.(41) In palliative

489 and intensive care settings, compassion fatigue is reported to be a serious causes of

490 nurse burnout.(42,46–50) There are reports of compassion fatigue of family members of

491 elderly people with severe disabilities.(43,51,52) Compassion fatigue may also impact

492 care staff in nursing homes.(44,45) Organizational programs for preventing compassion

493 fatigue may help care staff in nursing homes to maintain their own psychological

494 health.(53) The effectiveness of such an approach remains an open question requiring

495 further study.

496   Detailed observations of the care process are needed to obtain further insight

497 into the interaction between the happiness of care staff and residents' functional

35

498 performance. Although the detailed mechanisms are unknown, the results of this study

499 imply that long-term care for the elderly with severe disabilities could be improved by

500 directing attention to both the QWL of care staff and the functional performance of

501 residents, ideally creating a virtuous cycle.

502

503 **Limitations**

504   In this study, only the perceptions of nursing home care staff were used to

505 assess their QWL. More detailed and objective factors should be combined to assess the

506 QWL in nursing homes in future studies.

507   In addition, many of this study's participants were relatively stable and even

508 within the observation period of six months, only a small portion of them exhibited

509 change according to the ICF Staging. Although Mitnitski (54) insisted a frailty index

510 should be defined as the proportion of accumulated deficits, we labelled an elderly

511 person as exhibiting change if any of the items measured showed improvement or

512 deterioration. Some participants exhibited improvement and deterioration concurrently.

513   Even though functional performance was assessed with a validated instrument,

514 the assessment may have been affected by inter-rater variation. Measurement of walking

515 ability and muscle strength, and more formal assessment of cognitive function, would

516 increase the objectivity of functional performance assessment and allow more reliable

36

517 conclusions to be drawn regarding the correlation between QWL of care staff and

518 resident functional performance(55).

519   This study was conducted in Japanese special nursing homes and the target

520 group was elderly people with moderate to severe disabilities. Expanding the target

521 group to the elderly with mild disabilities or in different facilities and home care

522 situations would help foster deeper understanding of the association between the QWL

523 of care workers and changes in functional performance of elderly people.

524

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Acknowledgments

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46

691 **Footnotes**

692 **Contributors:** SIS planned and designed the research, collected data, drafted and

693 revised the manuscript and its accompanying materials. NI provided advices on study

694 design and data collection, revised the manuscript and its accompanying materials, and

695 approved them for submission. JO provided advices on study design based on domain

696 knowledge and expertise in research on long-term care. AT provided support on

697 summarizing data. HM provided administrative support and general advice.

698 **Ethics approval:** This study was approved by the Ethical Review Board of the School

699 of Medicine, Keio University and is in compliance with the Declaration of Helsinki;

700 approval number 20170132 (01/15/2018).

701 **Data sharing statement:** The authors' agreement with participants of the study

702 precludes sharing of data used for this study outside the predetermined study group.
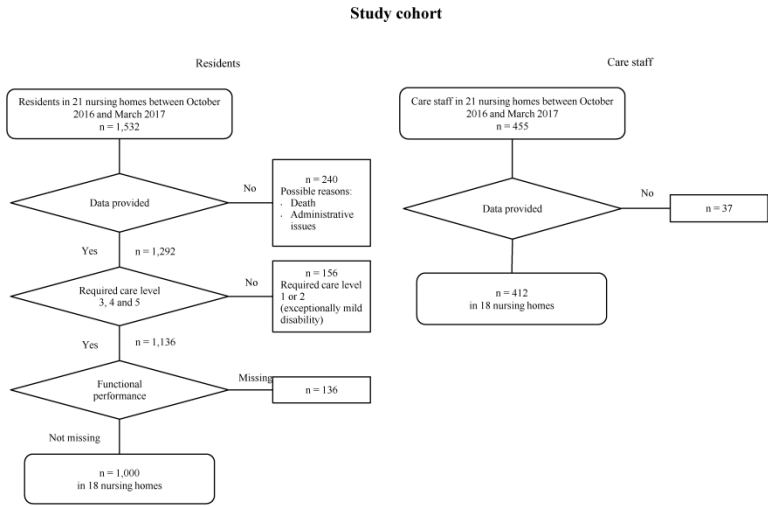
703 **Patient consent for publication:** No required.

704

705 **Figure legend/caption**

706 **Figure 1. Conceptual model of correlation between care staff's QWL and**

707 **residents' functional performance**

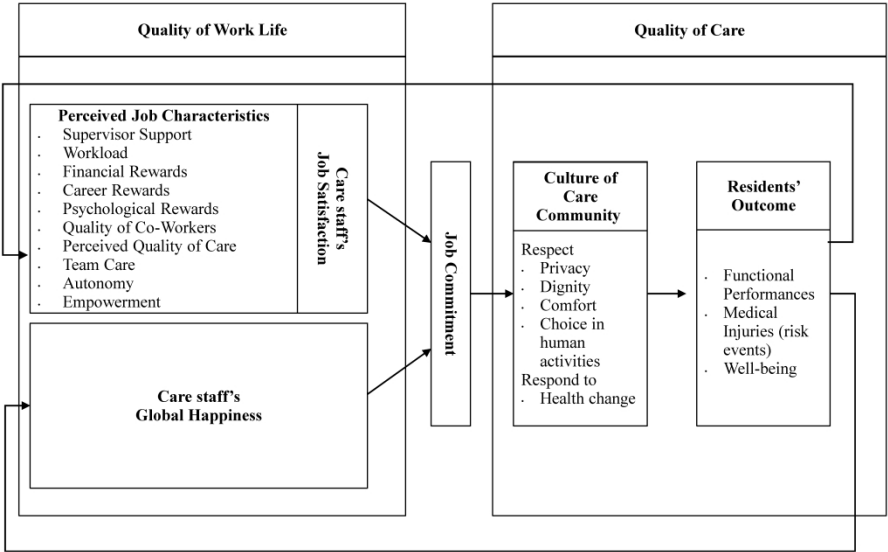708 (Legend) None

709 **Figure 2. Study Cohort**

710 (Legend) None

Study cohort

Residents   Care staff

Residents in 21 nursing homes between October
2016 and March 2017
n = 1,532

Care staff in 21 nursing homes between October
2016 and March 2017
n = 455

Data provided — No → n = 240
Possible reasons:
· Death
· Administrative issues

Data provided — No → n = 37

Yes   n = 1,292

Required care level
3, 4 and 5 — No → n = 156
Required care level
1 or 2
(exceptionally mild
disability)

n = 412
in 18 nursing homes

Yes   n = 1,136

Functional
performance — Missing → n = 136

Not missing

n = 1,000
in 18 nursing homes

Conceptual model of correlation between care staff's QWL and residents' functional performance

Appendix Table 1. Proportion of Improvement and deterioration

	Required Care Level 3 (n=239, 23.9%)			Required Care Level 4 (n=395, 39.5%)			Required Care Level 5 (n=366, 36.6%)			Total (n=1,000, 100.0%)		
	Improved	Not improved	Total	Improved	Not improved	Total	Improved	Not improved	Total	Improved	Not improved	Total
Deteriorated	10.9%	16.7%	27.6%	6.1%	16.7%	22.8%	4.9%	15.3%	20.2%	6.8%	16.2%	23.0%
Not deteriorated	8.8%	63.6%	72.4%	6.1%	71.1%	77.2%	3.8%	76.0%	79.8%	5.9%	71.1%	77.0%
Total	19.7%	80.3%	100.0%	12.2%	87.9%	100.0%	8.7%	91.3%	100.0%	12.7%	87.3%	100.0%

The number shows the percentage of each sub-group by required care levels.

Reporting checklist for cohort study.

Based on the STROBE cohort guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

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In your methods section, say that you used the STROBE cohort reporting guidelines, and cite them as:

von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.

		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary	3-4

of what was done and what was found

Introduction

| Background / rationale | #2 | Explain the scientific background and rationale for the investigation being reported | 7-11 |
| Objectives | #3 | State specific objectives, including any prespecified hypotheses | 7-11 |

Methods

Study design	#4	Present key elements of study design early in the paper	11
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	11-16
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up.	12
Eligibility criteria	#6b	For matched studies, give matching criteria and number of exposed and unexposed	n/a
Variables	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	13-16
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	12-16

Bias	#9	Describe any efforts to address potential sources of bias	17
Study size	#10	Explain how the study size was arrived at	18
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	17
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	17
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	17
Statistical methods	#12c	Explain how missing data were addressed	18
Statistical methods	#12d	If applicable, explain how loss to follow-up was addressed	18
Statistical methods	#12e	Describe any sensitivity analyses **(No sensitivity analysis was conducted.)**	n/a

Results

Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	18
Participants	#13b	Give reasons for non-participation at each stage	18

Participants	#13c	Consider use of a flow diagram	Figure 2
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	18-21
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	18
Descriptive data	#14c	Summarise follow-up time (eg, average and total amount)	12
Outcome data	#15	Report numbers of outcome events or summary measures over time. Give information separately for exposed and unexposed groups if applicable.	24-25
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	28-31
Main results	#16b	Report category boundaries when continuous variables were categorized **(No continuous variables were categorized)**	n/a
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period **(No quantitative analysis was conducted regarding relative risk or risk difference.)**	n/a

Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	25-31

Discussion

Key results	#18	Summarise key results with reference to study objectives	31-32
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	32-33, 35-36
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	31-35
Generalisability	#21	Discuss the generalisability (external validity) of the study results	31-36

Other Information

Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	6

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Association of care worker's job satisfaction and global happiness with change of functional performance of severely disabled elderly residents in nursing homes: A cohort and questionnaire study in Japan

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1

1 **Association of care worker's job satisfaction and global happiness with change of**

2 **functional performance of severely disabled elderly residents in nursing homes: A**

3 **cohort and questionnaire study in Japan.**

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24 **Keyword**

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3

ABSTRACT

Objectives: There is growing concern regarding quality of work life (QWL) among care staff in nursing homes. However, little is known about the impact of QWL on nursing home residents' functional performance. Recent literature suggests that job satisfaction and happiness of healthcare workers reflect their perceived QWL and impact the quality of their care. This study examined the association between job satisfaction and global happiness with change in functional performance of severely disabled elderly residents in nursing homes.

Design: A retrospective cohort study of nursing home residents combined with a questionnaire survey of their care staff.

Setting: Eighteen nursing homes in Japan.

Participants: Data were collected from 1,000 residents with a required care level of 3–5 and 412 care staff in nursing homes between October 2016 and March 2017.

Outcomes and explanatory variables: Functional performance was structurally assessed with ICF Staging, composed of 52 items concerning activities of daily life, cognitive function, and social participation at baseline and six months later. Deterioration and improvement of functional performance were dichotomously defined as such change in any of the items. QWL of care staff was evaluated with a questionnaire including questions about job satisfaction and global happiness.

4

48   **Results:** Functional performance deteriorated and improved in 23.0% and 12.7% of

49   residents, respectively. Global happiness of care staff was associated with lower

50   probability of residents' deterioration (adjusted odds ratio (aOR), 0.61; confidence

51   interval (CI), 0.44–0.84). There was no significant correlation between job satisfaction

52   or happiness of care staff and improvement of residents' functional performance.

53   **Conclusion:** These results suggest that QWL of care staff is associated with changes in

54   functional performance of elderly people with severe disabilities in nursing homes.

55

56

5

57 **ARTICLE SUMMARY**

58 **Strengths and limitations of this study**

59 ● This is the first study to investigate the correlation between quality of work life,

60 specifically job satisfaction and global happiness, of care staff and changes in

61 functional performance of elderly people with severe disabilities in nursing homes.

62 ● Data included functional performance assessments of 1,000 residents at 18 nursing

63 homes across Japan at two time points at an interval of six months (retrospective

64 cohort study) and perceptions of 412 care staff at these nursing homes

65 (questionnaire survey).

66 ● Residents' functional performance was structurally recorded using ICF Staging, a

67 standardized and validated instrument that enables holistic, reproducible assessment

68 of a person's functional status, including activities of daily living, cognitive

69 function, and social participation, without the need for extensive training of users.

70 ● The six-month observation period of this study was relatively short for capturing

71 functional changes of residents and necessitated aggregating multifaceted

72 functional performance changes into binary indicators of deterioration and

73 improvement.

74

6

79   **Competing interests:** None declared.

7

80 **INTRODUCTION**

81   In developed nations, population aging and increased life expectancy have

82 resulted in increased demand for elderly care and a shortage of care workers.(1,2)

83 **Care worker shortage in Japan**

84   In Japan, as the number of elderly people requiring nursing care increases, so

85 does the need for a large number of care workers. A care worker is defined as a person

86 who provides direct care in long-term care settings, including nursing homes, and they

87 compose 41.3% of the workers in the long-term care settings; 62.6% of the care workers

88 work full time and 60.7% of them have been licensed as Certified Care Workers, a

89 national qualification which is granted by the government, while this qualification is not

90 legally required in care worker jobs.(3)(4) The Japanese government has estimated that

91 by the year 2025, it will be necessary to secure an additional care workforce of 380,000

92 while assuring the quality of care and containing costs; nursing homes have experienced

93 a serious shortage of care workers.(5) The job opening rate for care workers was more

94 than 3.95 across the nation in 2018.(5) There are long waiting lists for special nursing

95 homes, partly due to the labour shortage.(6) Therefore, the government and

96 administrators of nursing homes and service providers must determine how to maintain

97 and improve work environments to recruit and retain care workers.

8

Quality of Work Life

98

99   There is growing concern regarding the impact of quality of work life (QWL)

100   perceived by care staff on the quality of care in nursing homes.(7–9) QWL is an

101   umbrella concept that encompasses a wide range of work-related issues.(9) Some

102   studies have considered QWL as a broad set of beneficial outcomes of working life.(10)

103   The other studies have described QWL as the quality of interaction between individuals

104   and every dimension of work.(10) In some previous studies, perceived QWL was

105   assessed using job satisfaction and global happiness.(9,11)

106   There are a number of reports on factors that affect job satisfaction of

107   healthcare workers. A previous study in nursing homes showed that internal factors

108   which affect job satisfaction about perceived job characteristics are supervisor support,

109   workload, financial rewards, career rewards, quality of co-workers, perceived quality of

110   care and team care. The same study showed that external factors with such impact are

111   contingency factors (e.g., being a primary breadwinner), personal characteristics (e.g.,

112   age, sex), organizational factors (e.g., type of ownership) and economic factors.(12)

113   Other studies revealed that job satisfaction among those who provide direct resident

114   care in residential long-term care facilities is influenced by empowerment and

115   autonomy as individual factors, and by facility resources and workload as

116   organizational factors.(6,13,14) Some other studies of QWL in healthcare settings have

9

117   focused on global happiness.(11) Nurses' happiness can be attributed to a number of

118   personal factors and job environment characteristics.(15)

119   Previous studies have illustrated that job satisfaction and global happiness

120   affect the quality of care provided by care staff through job commitment.(16) Care

121   communities with highly committed staff members endeavour to integrate the wishes,

122   preferences, and care needs of residents by respecting their privacy, dignity, comfort,

123   and choice in various activities.(17) Similarly, committed care workers are more likely

124   to respond to residents' health changes through appropriate communication among care

125   communities.(17)

126   It has been reported that job satisfaction of long-term care staff is correlated

127   with health-related outcomes of the residents. Higher job satisfaction of care staff in

128   nursing homes is associated with lower rates of resident injuries and residents' higher

129   satisfaction and well-being.(16,18) Higher job satisfaction and global happiness of care

130   managers is associated with clients' higher satisfaction and happiness with care.(11)

131   However, little is known regarding the association between QWL-related concepts,

132   specifically job satisfaction and global happiness, and functional performance of elderly

133   people with severe disabilities.

10

134 **Functional performance of elderly people with severe disabilities**

135 The degree of disability and dependency varies among elderly people who live

136 in nursing homes.(19) It is expected that elderly people with different degrees of

137 disability and dependency have different tendencies of deterioration or improvement in

138 their functional performance. Also, it is reasonably assumed that people with different

139 degrees of disability and dependency have their functional performance affected by

140 different factors. However, very few studies have focused on care outcomes of the

141 elderly people with severe disabilities.

142 **Long-Term Care Insurance system in Japan**

143 In Japan, elderly people with disabilities are eligible for receiving long-term

144 care under the public long-term care insurance (LTCI) system.(20) There are various

145 types of residential care facilities for the elderly, including LTCI facilities such as

146 special nursing homes, geriatric health facilities, sanatoria, or integrated facilities for

147 medical and long-term care. Elderly people who need care are stratified by the degree of

148 disability and dependency and certified as requiring a care level from 1 (mild) to 5

149 (severe).(21) Those with moderate to severe disabilities, or a required care level of 3–5,

150 are allowed to reside in special nursing homes which are specifically designed to

151 address their needs. Typically, a person with a required care level of 3 (moderate) needs

152 full assistance for standing, walking, dining, toileting, and bathing. A typical person

11

153 with a required care level of 5 (severe) needs full assistance for most essential activities

154 for survival, e.g., nutrition intake, excretion, maintenance of skin condition, and

155 avoidance of pressure ulcers, with a limited ability to comprehend their surroundings

156 and communicate with others.

157 **Aim of this study**

158   The aim of this study was to examine how job satisfaction and global happiness

159 of care staff were correlated with changes in functional performance of elderly people

160 with severe disabilities in Japanese special nursing homes.

161   A conceptual model of the correlation between care staff's QWL and

162 functional performance of residents in nursing homes is shown in Figure 1.

163

164 **Methods**

165 **Study design**

166   This was a retrospective cohort study of residents of special nursing homes,

167 combined with a questionnaire survey with care staff at the nursing homes.

168 **Participants and settings**

169   The residents and care staff of the nursing homes that agreed to cooperate were

170 invited to participate in the study. Written consent to participate in the study was

171 obtained from each resident, or his or her proxy family member if the resident had

172 cognitive impairment and was deemed by the care manager to be unable to give

12

173 informed consent. Consent from staff was obtained through the software described

174 below. They were informed that they could withdraw at any time and that all

175 information related to them would remain confidential. Data were anonymized at the

176 nursing homes and sent to the investigators. Only residents with a required care level of

177 3, 4, or 5 were included in the study, as required care levels 3, 4, and 5 represent

178 moderate to severe disability typical for residents in special nursing homes.

179 For efficient and accurate data collection, nursing homes which have a specific

180 information system "CAREKARTE" implemented were asked to participate in the

181 study. CAREKARTE was developed by Fuji Data Systems, Japan, and integrates

182 functionalities for care recording and operational management.

183

184 **Measures**
185 **Outcome variables (functional performance): ICF Staging**

186 Concerning functional performances of elderly people, it is widely accepted

187 that maintaining independence in activities of daily living (ADL) and cognitive

188 functions and engaging in society are critical for people's quality of life as they

189 age.(22–24)

190 In this study, functional performance of the residents was measured using the

191 ICF Staging. The ICF Staging is an instrument to evaluate functional performance of

13

192 elderly people developed by the Japan Association of Geriatric Health Service

193 Facilities, and it is structured in line with the World Health Organization (WHO)

194 International Classification of Functioning, Disability and Health (ICF) codes.(25)

195 Table 1 shows the 13 categories of the ICF Staging items in the domains of ADL,

196 cognitive function, and social participation, each of which consists of four questions

197 corresponding to an ICF code, composing 52 items in total.(26) The ICF Staging

198 facilitates objective and multifaceted descriptions of elderly functional performance

199 efficiently and without the need for extensive training.(27)

200   The ICF Staging is regularly used in more than one thousand Japanese

201 intermediate facilities and nursing homes.(25) Previous studies have revealed this

202 instrument has high validity, test-retest reliability, and sensitivity to change.(27–30)

203

204 **Table 1. Functional performance items in the ICF Staging.**

ADL	01. Basic posture control
	02. Walking and moving function
	03. Eating function - Swallowing
	04. Eating function – Feeding and feeding assistance
	05. Toileting function
	06. Bathing function
	07. Personal care function - Oral care
	08. Personal care function - Self-care
Cognitive Function	09. Orientation
	10. Communication

14

		11. Mental activities
	Social Participation	12. Leisure
		13. Socializing

205   Note: ADL = Activities of daily living

206

207   **Explanatory variables #1: Care staff QWL survey**

208   The care staff QWL survey included six items: job satisfaction, global

209   happiness, psychological rewards, intention to leave, and perceived quality of care at the

210   facility (2 items). Global happiness was scored on a scale of 0–10, with zero

211   representing "not happy at all" and 10 representing "very happy." Job satisfaction and

212   psychological rewards items ("To what extent are you satisfied with your work?" and

213   "How psychologically rewarding is your work?") were scored on a scale of 1–6, with

214   one representing "not at all" and six representing "extremely." Frequency of intentions

215   to leave from the current care facilities was scored on a scale of 1–4, where one

216   represented "often" and four represented "not at all." Items addressing perceived quality

217   of care at the facility ("To what extent are you satisfied with the quality of care provided

218   at the nursing home at which you work?" and "To what extent would you recommend

219   the nursing home at which you work to your family and friends?") were scored on a

220   scale of 1–5, where one represented "not at all" and five represented "extremely."

15

221   Previous studies have shown that career rewards, intentions to leave, and

222   perceived quality of care are elements composing staff job satisfaction.(13,31,32) In this

223   study, we assumed that job satisfaction and global happiness represent major aspects of

224   QWL of care staff in nursing homes, and chose these two factors as explanatory

225   variables in the analysis of this study.

226

227   **Explanatory variables #2: Risk events**

228   As risk events, falls, new pressure ulcers, aspiration pneumonia, and fever were

229   recorded.(18)

230

231   **Procedure**

232   All data were collected from October 2016 through March 2017. Residents'

233   age, sex, and required care levels were obtained from the care records.

234   Residents' functional performance was assessed by the care managers and

235   recorded in the aforementioned software at an interval of six months. The data on a

236   resident were compared between time points and evaluated either as improved,

237   deteriorated, or no change. In this study, the primary outcome measure was change,

238   either deterioration or improvement, in any of the 52 ICF Staging items. Note that

239   improvement and deterioration might coexist within an individual.

16

240   Occurrence of undesirable risk events within the same six months was also

241   reported by the care managers through review of the care record.

242   An electronic survey with care staff on their perceived QWL was also

243   conducted at the end of the six-month period. Responses to each item on the

244   questionnaire were summarized as follows to create a facility-level binary indicator.

245   First, the response of each care staff member was recoded either as "high" (equal to or

246   above a pre-specified threshold) or "low" (below the threshold). The threshold for job

247   satisfaction, on a scale of 1–6, was 4 and that for global happiness, answered in a scale

248   of 0–10, was 5. Second, responses within each facility were summarized either as "high

249   proportion" (proportion of "high" responses equal to or above the median across

250   facilities) or "low proportion" (proportion of "high" responses below the median across

251   facilities).

252

253   **Resident and Public Involvement**

254   Nursing home residents and care staff were not directly involved in the design

255   and conduct of this research, however, the authors have a constant relationship with

256   residents, care workers, and managers of nursing homes. Their insights have been

257   incorporated into the design of this study through informal interviews with the

258   administrators and care managers of participating facilities. The authors plan to formally

17

259 invite nursing home residents and care staff for determining optimal strategy for

260 disseminating the results of this study.

261

262 **Statistical Analyses**

263   Survey responses of care staff at each facility were converted to facility-level

264 binary indicators, as described earlier, and combined with the resident data. All

265 analyses, except when indicated, were conducted in a unit of residents.

266   Correlation of deterioration and improvement of functional performance with

267 resident features, risk events, and job satisfaction and global happiness of care staff was

268 assessed using Pearson's Chi square test.

269   Multivariable logistic regression was used to estimate effects of care staff's job

270 satisfaction and global happiness on change in functional performance adjusted for

271 other covariates. Age, sex, required care level, risk events, and job satisfaction and

272 global happiness of care staff were included in the model.

273   Analysis of distribution of variables, analysis of bivariate correlations, and the

274 multivariable logistic regression were all conducted with and without stratification with

275 required care level. Statistical analysis was performed using JMP computer software

276 (JMP® Pro 14.3. SAS Institute Inc., USA). A p-value less than 0.05 was considered

277 statistically significant.

18

278   The STROBE cohort reporting guidelines were used.(33)

279

280 **RESULTS**

281 **Resident characteristics, staff responses, and risk events**

282   A total of 1,532 residents and 455 care workers from 21 special nursing homes

283 participated in this study (Figure 2). The data of 1,292 residents were collected. While

284 the reason for missing data at this stage is unclear, it may be attributed to either the

285 death of certain residents or administrative issues. Residents with required care levels of

286 3, 4, and 5 (n=1,136) were included in the analysis. We excluded the data of residents

287 with missing functional performance data or care worker responses. As a result, 1,000

288 residents with 412 corresponding care workers from 18 special nursing homes were

289 included in the analysis. The proportion of missing values was 3.1% for items on

290 residents' functional performance and 1.2% for items on the QWL of care staff.

291   The proportion of residents with required care levels of 3, 4 and 5 are 23.9%,

292 39.5%, and 36.6%, respectively (Table 2). Most residents (80.6%) were female and

293 more than half of the residents were aged 85–94. Baseline functional performance is

294 summarized in Appendix Table 1.

295

19

296 **Table 2. Sex and age of nursing home residents**

Baseline Characteristics	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Sex				
Female	78.2%	79.7%	83.1%	80.6%
Male	21.8%	20.3%	16.9%	19.4%
Age groups, in years				
<80	12.6%	19.5%	19.1%	17.7%
80-84	14.6%	13.7%	18.6%	15.7%
85-89	28.9%	27.8%	27.9%	28.1%
90-94	33.1%	22.3%	21.3%	24.5%
95+	10.9%	16.7%	13.1%	14.0%

297 (No legend for this table)

298

299   Appendix Table 2 summarizes the care staff's responses. The median and

300 interquartile range of job satisfaction were 4 (4–5) out of 6 and those of global

301 happiness were 7 (6–8) out of 10. Appendix Table 3 indicates the distribution of the

302 care staff's job satisfaction and global happiness summarized in the unit of residents.

303   As shown in Appendix Table 4, the most common undesirable risk events

304 among residents in the six-month period of observation were fever (18.3%) and falls

305 (15.6%).

306

20

307 **Change in functional performance**

308   As shown in Tables 3a and 3b, 23.0% of the residents exhibited deterioration

309 while 12.7% exhibited improvement, both in any of the functional performance items.

310 The overlap between deterioration and improvement of functional performance is

311 displayed in Appendix Table 5. Regarding ADL, both deterioration and improvement

312 were more frequent in residents with lower required care levels. Cognitive function

313 more frequently deteriorated and less frequently improved in residents with higher

314 required care levels. Social participation rarely improved in residents with the required

315 care level 5. As the proportion of change was highest in ADL, the residents' "overall"

316 deterioration and improvement most reflected that in ADL.

317

318 **Table 3a. Proportion of residents with deterioration**

Deterioration	Required care level 3 (n=239, 23.9%)	Required care level 4 (n=395, 39.5%)	Required care level 5 (n=366, 36.6%)	Total (n=1,000, 100.0%)
ADL	17.6%	17.5%	13.4%	16.0%
Cognitive Function	5.0%	6.1%	8.2%	6.6%
Social Participation	6.3%	6.6%	5.2%	6.0%
Total	27.6%	22.8%	20.2%	23.0%

319 (Legend) Proportion of residents with deterioration in any of the 52 items of the

320 functional performance assessment tool (ICF Staging).

321

322 **Table 3b. Proportion of residents with improvement**

Improvement	Required care level 3 (n=239, 23.9%)	Required care level 4 (n=395, 39.5%)	Required care level 5 (n=366, 36.6%)	Total (n=1,000, 100.0%)

21

ADL	11.7%	6.6%	5.7%	7.5%
Cognitive Function	7.1%	3.3%	2.7%	4.0%
Social Participation	4.2%	4.1%	0.8%	2.9%
Total	19.7%	12.2%	8.7%	12.7%

323   (Legend) Proportion of residents with improvement in any of the 52 items of the

324   functional performance assessment tool (ICF Staging).

325

326   **Bivariate correlation analyses and multivariable logistic regression analyses**

327   The correlation of change in residents' functional performance with care staff

328   job satisfaction and global happiness is presented in Tables 4a, 5a (unadjusted odds

329   ratios), 4b, and 5b (adjusted odds ratios). Similarly, the correlation of change in

330   functional performance with resident features and risk events is presented in Appendix

331   Tables 6a, 7a (unadjusted odds ratios), 6b, and 7b (adjusted odds ratios).

332   The correlation of change in subdomains of functional status (i.e., ADL,

333   cognitive function, and social participation) with care staff job satisfaction and

334   happiness is summarized in Appendix Tables 8a and 8b.

335   Appendix Table 9 summarizes tables on results of bivariate correlation analysis

336   and multivariable logistic regression analysis.

337

338   **Correlation between care staff's QWL and residents' deterioration**

339   As in Tables 4a and 4b, the residents of facilities with a high proportion of

340   happy care staff were less likely to deteriorate. The results are similar between bivariate

22

341 correlation analysis (unadjusted odds ratio (uOR): 0.67, CI 0.48-0.94, Table 4a) and

342 multivariable regression analysis (adjusted odds ratio (aOR): 0.61, CI 0.44–0.84, Table

343 4b).

344   When stratified by required care levels, the same trend was observed

345 throughout, with a statistically significant difference observed in required care level 4.

346 The results are similar between bivariate correlation analysis (uOR in required care

347 level 4: 0.49, CI 0.29-0.85, Table 4a) and multivariable regression analysis (aOR in

348 required care level 4: 0.36, CI 0.21-0.64, Table 4b).

349

350 **Table 4a. Correlation of deterioration in functional performance with care staff**

351 **job satisfaction and global happiness**

	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Job satisfaction	1.26 (0.64-2.49)	0.70 (0.41-1.19)	0.84 (0.48-1.48)	0.86 (0.61-1.20)
Global happiness	0.64 (0.33-1.27)	**0.49 (0.29-0.85)**	0.94 (0.53-1.66)	**0.67 (0.84-0.94)**

352 (Legend) Unadjusted odds ratios, obtained through bivariate correlation analysis, with

353 their 95% confidence intervals. Odds ratios of resident features and risk events are

354 presented in Appendix Table 6a.

23

355 **Table 4b. Multivariable logistic regression analysis of deterioration in residents'**

356 **functional performance**

	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Job satisfaction	1.71 (0.90-3.26)	1.18 (0.70-2.00)	0.92 (0.53-1.59)	1.07 (0.79-1.47)
Global happiness	0.54 (0.28-1.04)	**0.36 (0.21-0.64)**	0.86 (0.50-1.51)	**0.61 (0.44-0.84)**

357 (Legend) Adjusted odds ratios, obtained through multivariable logistic regression

358 analysis, with their 95% confidence intervals.

359 Job satisfaction and happiness are represented by facility-level binary indicators (1 if the

360 proportion of above-threshold responses is equal to or above the across-facilities

361 median, 0 if it is below the median).

362 The adjusted odds ratios of resident features and risk events are presented in Appendix

363 Table 6b.

364

365 **Correlation between care staff's QWL and residents' improvement**

366 As shown in Tables 5a and 5b, in the entire cohort, no significant correlation

367 was found between the improvement of residents' functional status and care staff job

368 satisfaction or global happiness.

369 In analyses stratified by required care level, correlation was observed between

370 chance of improvement and care staff job satisfaction in required care level 4. Similar

24

371 results are found in both bivariate correlation analysis (uOR in required care level 4:

372 2.56, CI 1.33-4.93, Table 5a) and multivariable logistic regression analysis (aOR in

373 required care level 4: 2.84, CI: 1.36-5.93, Table 5b).

374

375 **Table 5a. Correlation of improvement in functional performance with care staff**

376 **job satisfaction and global happiness**

	Required Care Level 3	Required Care Level 4	Required Care Level 5	Total
	(n=239, 23.9%)	(n=395, 39.5%)	(n=366, 36.6%)	(n=1,000)
Job satisfaction	0.55 (0.29-1.07)	**2.56 (1.33-4.93)**	0.80 (0.39-1.66)	1.06 (0.73-1.54)
Global happiness	0.92 (0.48-1.76)	1.39 (0.75-2.59)	0.84 (0.40-1.74)	1.12 (0.77-1.63)

377 (Legend) Unadjusted odds ratios, obtained through bivariate correlation analysis, with

378 their 95% confidence intervals. Odds ratios of resident features and risk events are

379 presented in Appendix Table 7a.

380

381 **Table 5b. Multivariable logistic regression analysis of the improvement of**

382 **residents' functional performance**

Characteristic	Required Care Level 3	Required Care Level 4	Required Care Level 5	Total
	(n=239, 23.9%)	(n=395, 39.5%)	(n=366, 36.6%)	(n=1,000)
Job satisfaction	0.73 (0.36-1.50)	**2.84 (1.36-5.93)**	0.92 (0.43-1.97)	1.14 (0.76-1.69)
Global happiness	0.77 (0.37-1.61)	1.15 (0.56-2.37)	0.78 (0.36-1.70)	1.02 (0.68-1.53)

25

383 (Legend) Adjusted odds ratios, obtained through multivariable logistic regression

384 analysis, with their 95% confidence intervals.

385 Job satisfaction and happiness are represented by facility-level binary indicators (1 if the

386 proportion of above-threshold responses is equal to or above the across-facilities

387 median, 0 if it is below the median).

388 The adjusted odds ratios of resident features and risk events are presented in Appendix

389 Table 7b.

390

391 **DISCUSSION**

392   This is the first study, to our knowledge, to examine the association between

393 changes in residents' functional performance and the job satisfaction and happiness of

394 care staff in nursing homes. The residents in nursing homes with high proportion of

395 happy care staff had a statistically lower chance of deterioration. The authors believe

396 that similar association may exist in other settings in long-term care for the elderly.

397   The observed correlation between staff happiness and residents' functional

398 deterioration theoretically implies that, as described in the Introduction section, happy

399 staff tend to highly commit to their job. Organizational culture may change in their

400 nursing home, which promotes maintenance of residents' functional performance

401 through provision of adequate communication and high-quality care.(16,17,34–36)

402 Also, either high quality care leading to residents' favourable outcomes, or residents'

403 functional performance itself being maintained or improved, might in turn promote the

404 happiness of care staff through professional fulfilment.(37)

405 The results here are not robust, possibly due to a limited number of

406 observations for examining this correlation. In subgroup analyses on residents with each

407 required care level, statistically significant differences were observed only in the

408 residents with a required care level of 4. A possible explanation is that, in general, many

409 of the residents with a required care level of 3 have health problems which are still not

410 completely stable and exercise a major influence on their functional performance

411 outcome, and residents with a required care of 5 may tend to be irreversibly

412 disabled with static diseases. Observation of a larger number of residents would allow

413 for more reliable statistical analysis. Alternatively, a study design with a stronger focus

414 on residents whose functional performance can theoretically be influenced by quality of

415 care, such as excluding bed-ridden residents and those who have just been discharged

416 from a hospital, may make it possible to more efficiently examine the correlation under

417 discussion.

418 The results of this study imply that improvement of care staff's working

419 environment might lead to higher quality of care and, in turn, maintenance or

27

420 improvement of the functional performance in residents of certain severity levels.(6,16–

421 18,31,34,38)

422   The working environment of care staff in nursing homes has specific issues

423 that could be improved with organizational efforts. Relationships with other staff

424 members and a poor career outlook have been reported to be among the major causes of

425 care staff turnover in Japan.(39) Changing these QWL-related factors may improve staff

426 perceptions of the QWL, which may promote their commitment to their job. It will lead

427 to cultural change and hence improved quality of care provided in nursing homes. The

428 authors believe that evaluation of effectiveness of such an approach deserves further

429 study.

430   The authors also envision an alternative approach to improving functional

431 outcome of residents in nursing homes, which is to educate the care staff on physical,

432 psychological, and social process of aging and dying, as well as grief of the family of

433 residents and care staff themselves. Training on how to cope with aging and dying

434 should also be provided. We believe such education and training might mitigate the

435 psychological stress associated with working with residents with severe disabilities and

436 prevent compassion fatigue(40–44).

28

437   Care staff in nursing homes must regularly cope with residents' functional

438   decline, burdens associated with the terminal stage of life, and death.(40) In palliative

439   and intensive care settings, compassion fatigue is reported to be a serious causes of

440   nurse burnout.(41,45–49) There are reports of compassion fatigue of family members of

441   elderly people with severe disabilities.(42,50,51) Compassion fatigue may also impact

442   care staff in nursing homes.(43,44) Organizational programs for preventing compassion

443   fatigue may help care staff in nursing homes to maintain their own psychological

444   health.(52) The effectiveness of such an approach remains an open question requiring

445   further study.

446   Detailed observations of the care process are needed to obtain further insight

447   into the interaction between the happiness of care staff and residents' functional

448   performance. Although the detailed mechanisms are unknown, the results of this study

449   imply that long-term care for the elderly with severe disabilities could be improved by

450   directing attention to both the QWL of care staff and the functional performance of

451   residents, ideally creating a virtuous cycle.

452

29

453   **Limitations**

454   In this study, only the perceptions of nursing home care staff were used to

455   assess their QWL. More detailed and objective factors should be combined to assess the

456   QWL in nursing homes in future studies.

457   In addition, many of this study's participants were relatively stable and even

458   within the observation period of six months, only a small portion of them exhibited

459   change according to the ICF Staging. Although Mitnitski (53) insisted a frailty index

460   should be defined as the proportion of accumulated deficits, we labelled an elderly

461   person as exhibiting change if any of the items measured showed improvement or

462   deterioration. Some participants exhibited improvement and deterioration concurrently.

463   Even though functional performance was assessed with a validated instrument,

464   the assessment may have been affected by inter-rater variation. Measurement of walking

465   ability and muscle strength, and more formal assessment of cognitive function, would

466   increase the objectivity of functional performance assessment and allow more reliable

467   conclusions to be drawn regarding the correlation between QWL of care staff and

468   resident functional performance(54).

469   This study was conducted in Japanese special nursing homes and the target

470   group was elderly people with moderate to severe disabilities. Expanding the target

471   group to the elderly with mild disabilities or in different facilities and home care

30

472   situations would help foster deeper understanding of the association between the QWL

473   of care workers and changes in functional performance of elderly people.

474

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629

Acknowledgments

631 We would like to thank our Advisory Group including Toru Takebayashi and Tomonori

632 Okamura. We are also grateful to the participating administrators, care staff and

633 residents of nursing homes, and Ken Ishikawa, the former head of the Japanese Council

634 of Senior Citizens Welfare Service, who made this study possible. Finally, we

635 acknowledge the contributions of Satoru Yoshie and Takanori Fujita who helped in the

636 early stages of the project.

637

Footnotes

639 **Contributors:** SIS planned and designed the research, collected and analyzed the data,

640 drafted and revised the manuscript and its accompanying materials. NI provided advices

641 on study design, data collection, and data analysis, revised the manuscript and its

642 accompanying materials, and approved them for submission. JO provided advices on

643 study design based on domain knowledge and expertise in research on long-term care.

644 AT provided support for summarizing the data. HM provided administrative support

645 and general advice.

40

646 **Ethics approval:** This study was approved by the Ethical Review Board of the School

647 of Medicine, Keio University and is in compliance with the Declaration of Helsinki;

648 approval number 20170132 (01/15/2018).

649 **Data sharing statement:** The authors' agreement with participants of the study

650 precludes sharing of data used for this study outside the predetermined study group.

651 **Patient consent for publication:** No required.

652

653 **Figure legend/caption**

654 **Figure 1. Conceptual model of correlation between care staff's QWL and**

655 **residents' functional performance**

656 (Legend) We hypothesized that care staff's job satisfaction and global happiness affect

657 the quality of care through job commitment; job commitment affects culture of care in

658 the facility; and affects functional performance.

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660 **Figure 2. Study Cohort**

661 (Legend) A total of 1,532 residents and 455 care workers from 21 special nursing

662 homes participated in this study. The analysis cohort included 1,000 residents with 412

663 corresponding care workers from 18 special nursing homes.
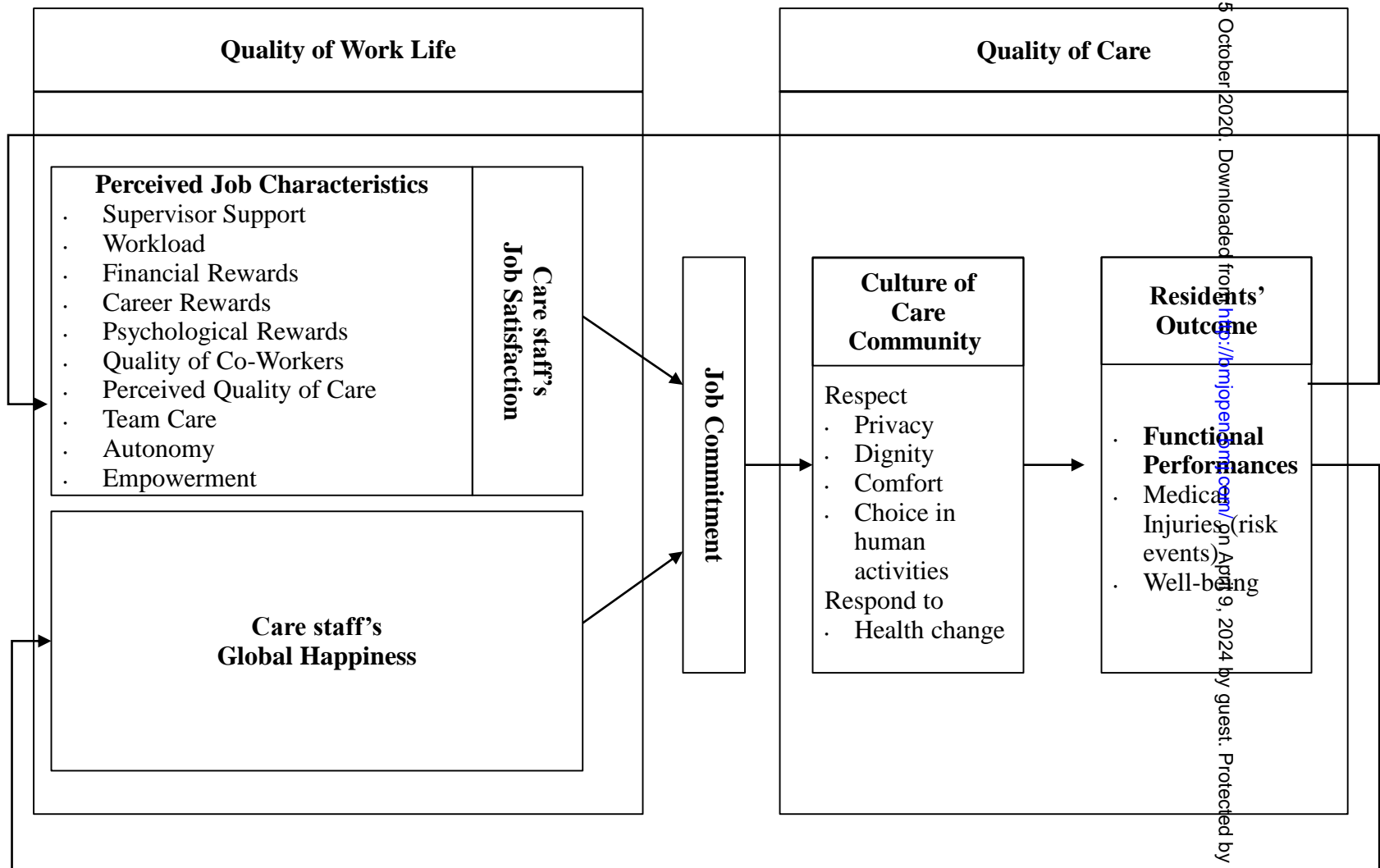
Figure 1. Conceptual model of correlation between care staff's QWL and residents' functional performance

(Legend) We hypothesized that care staff's job satisfaction and global happiness affect the quality of care through job commitment; job commitment affects culture of care in the facility; and affects functional performance.
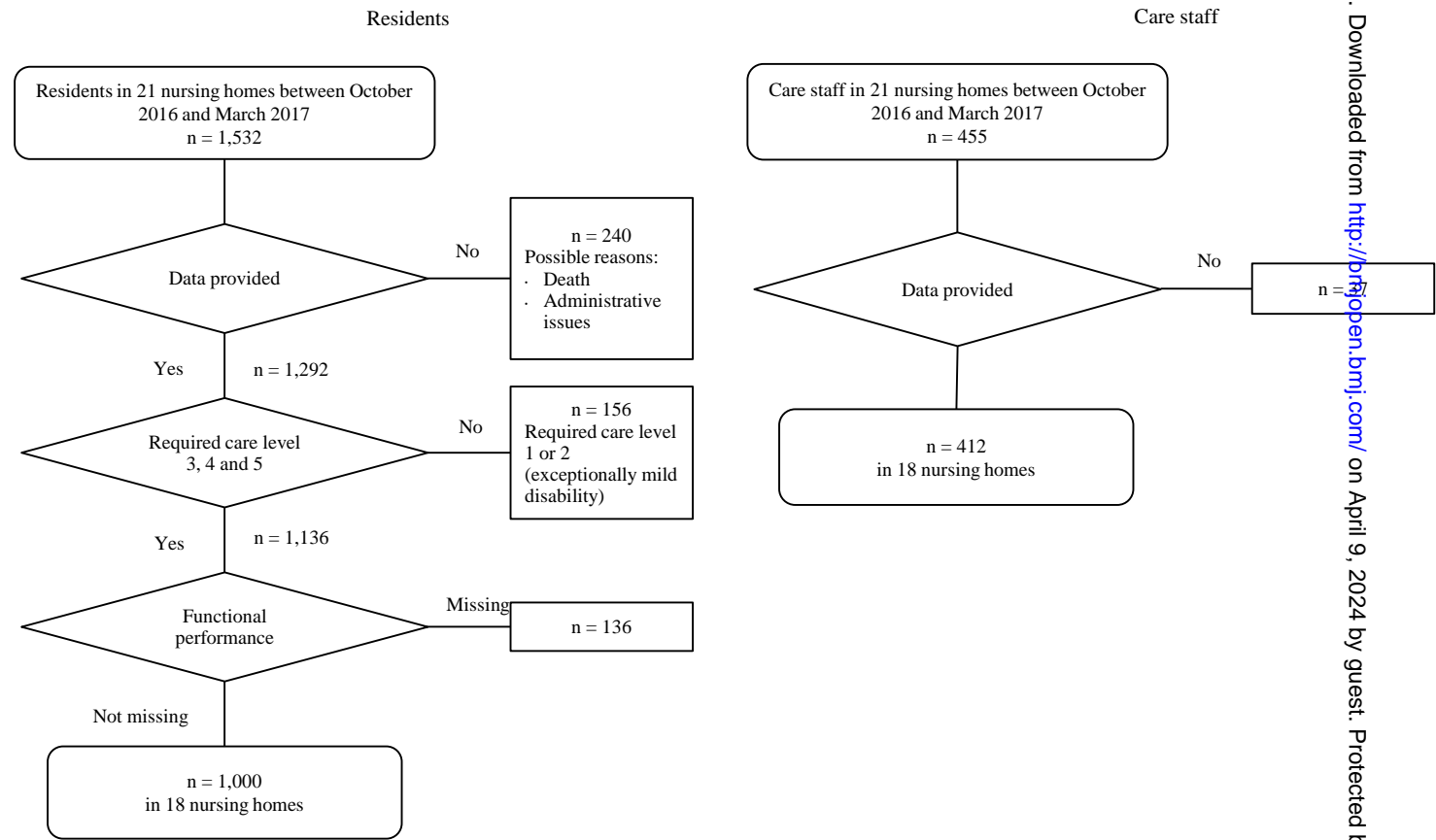
Figure 2. Study cohort

Residents

Care staff

Residents in 21 nursing homes between October 2016 and March 2017
n = 1,532

Care staff in 21 nursing homes between October 2016 and March 2017
n = 455

Data provided — No → n = 240
Possible reasons:
· Death
· Administrative issues

Data provided — No → n =

Yes   n = 1,292

Required care level 3, 4 and 5 — No → n = 156
Required care level 1 or 2 (exceptionally mild disability)

n = 412
in 18 nursing homes

Yes   n = 1,136

Functional performance — Missing → n = 136

Not missing

n = 1,000
in 18 nursing homes

(Legend) A total of 1,532 residents and 455 care workers from 21 special nursing homes participated in this study. The analysis cohort included 1,000 residents with 412 corresponding care workers from 18 special nursing homes.

Appendix Table 1. Baseline functional performance of nursing home residents, by required care level

Baseline functional performance	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
ADL				
1. Basic posture control				
1-1 Maintaining standing position	42.90%	14.90%	6.20%	18.40%
1-2 Moving between sitting positions	76.90%	44.20%	17.90%	42.30%
1-3 Maintaining sitting position (without assistance)	68.80%	36.10%	11.80%	34.90%
1-4 Rolling over	81.70%	54.80%	20.80%	48.70%
2. Walking and moving function				
2-1 Going out	1.70%	1.00%	0.60%	1.00%
2-2 Climbing up and down	4.30%	0.30%	0.80%	1.40%
2-3 Stable walking	42.90%	14.80%	3.90%	17.50%
2-4 Moving within facility	85.30%	61.70%	31.40%	56.20%
3. Eating function - Swallowing				
3-1 Chewing	76.60%	53.40%	24.10%	48.30%
3-2 Sucking	86.00%	70.20%	39.40%	62.80%
3-3 Swallowing (solid)	92.20%	81.20%	53.60%	73.80%
3-4 Swallowing (specially processed food)	93.40%	82.30%	70.90%	80.60%
4. Eating function – Feeding and feeding assistance				
4-1 Feeding him/herself	71.40%	47.40%	13.30%	40.90%
4-2 Dropping food and making mess	68.10%	68.90%	31.50%	54.80%
4-3 Special arrangement for feeding	29.60%	49.10%	56.80%	47.10%
4-4 Direct assistance for feeding	8.70%	22.50%	64.80%	34.60%
5. Toileting function				
5-1 Post-release cleanup	50.60%	28.20%	16.90%	29.40%
5-2 Dressing and undressing	56.50%	18.60%	4.20%	22.30%
5-3 Getting on and off western type toilet	65.20%	48.00%	19.10%	41.40%
5-4 Releasing on bed	17.90%	34.40%	49.40%	36.00%
6. Bathing function				
6-1 Stable movement in and out of bathtub and washing.	16.20%	3.40%	1.10%	5.60%
6-2 Bathing without assistance	7.50%	3.70%	0.90%	3.50%
6-3 Maintaining sitting position during bathing	74.30%	52.00%	20.10%	45.70%
6-4 Carrying out bathing	50.70%	70.20%	89.20%	72.60%
7. Personal care function - Oral care				
7-1 General oral care	48.70%	26.00%	6.50%	24.30%
7-2 Brushing teeth	39.30%	15.90%	4.00%	17.10%
7-3 Preparation for brushing teeth	66.40%	45.00%	14.70%	38.80%
7-4 Rinsing mouth	79.20%	58.30%	20.50%	49.00%
8. Personal care function – Self-care				
8-1 Trimming nails	3.90%	2.90%	1.10%	2.50%
8-2 Shaving, skincare, hair care	48.30%	27.20%	5.40%	24.30%
8-3 Washing face	71.90%	47.00%	14.40%	41.00%
8-4 Washing hands	55.00%	35.00%	9.10%	30.30%
Cognitive Functions				
9. Orientation				
9-1 Date	43.30%	22.00%	7.60%	21.80%
9-2 Name of place	48.10%	31.70%	11.20%	28.00%
9-3 Orientation toward other people	84.50%	69.80%	36.60%	61.20%
9-4 Own name	98.20%	89.80%	59.00%	80.50%
10. Communication				
10-1 Maintaining complicated human relationship	54.10%	36.80%	12.90%	32.20%
10-2 Understanding of written language	70.10%	50.80%	17.90%	43.30%
10-3 Everyday conversation	60.60%	46.60%	18.90%	39.80%
10-4 Understanding of spoken language	82.00%	74.40%	40.60%	63.80%
11. Cognitive function				
11-1 Time management	38.20%	24.00%	6.50%	21.00%
11-2 Simple arithmetic	57.60%	36.00%	10.40%	31.70%
11-3 Long-term memory	44.20%	35.10%	12.40%	28.90%
11-4 State of consciousness	5.60%	7.60%	5.70%	6.40%
Social Participation				
12. Leisure				
12-1 Traveling	1.30%	11.10%	0.60%	0.50%
12-2 Traveling	22.00%	56.90%	3.40%	10.90%
12-3 Group Recreation	73.00%	63.70%	30.20%	51.00%
12-4 Watching TV	75.00%	4.50%	38.40%	57.10%
13. Socializing				
13-1 Socializing using means of communication devices	10.00%	7.10%	2.30%	5.00%
13-2 Going out	11.40%	35.20%	4.90%	7.30%
13-3 Conversing with friend	50.90%	87.10%	15.50%	31.70%
13-4 Conversing with someone close	96.90%	96.90%	51.90%	76.50%

Proportion of residents capable of each ICF Staging item both in the overall analysis cohort and within residents with a specific required care level. A higher required care level is associated with more limited ability in most items of functional performance. ADLs = Activities of Daily Living

Appendix Table 2. Care staff's responses

	Median (Interquartile Range)
Global Happiness	
Are you happy? (0-10, not happy to very happy)	7 (6-8)
Job Satisfaction	
To what extent are you satisfied with you work? (1-6, not at all to extremely)	4 (4-5)
Career rewards	
How rewarding is your work? (1-6, not at all to etremely)	5 (4-5)
Frequency of Intentions to leave	
How often do you feel you want leave from the current care facilities? (1-4, often to not at all)	2 (2-3)
Quality of care at the nursing home	
To what extent are you satisfied with the quality of care provided at the nursing home at which you work? (1-5, not at all to etremely)	4 (3-4)
To what extent would you recommend this nursing home at which you work to your family and friends? (1-5, not at all to extremely)	4 (3-4)

Distribution of care staff's responses (N=412). This analysis was conducted in the unit of care staff members, not residents. Responses to the questions regardng global happiness and job stisfaction were summarized at each facility and used in the following correlation analysis.

Appendix Table 3. Global happiness and job satisfaction of care staff

	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Job Satisfaction	47.70%	51.40%	51.90%	50.70%
Global Happiness	59.00%	55.40%	47.80%	53.50%

Distribution of care staff's responses. This analysis was conducted in the unit of residents (N=1,000). Job satisfaction and happiness are represented by facility-level binary indicators (1 if the proportion of above-threshold responses is equal to or above the across-facilities median, 0 if it is below median). Note that these responses do not reflect experience of care workers with each resident, but their overall experience at the facility.

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Appendix Table 4. Occurrence of the risk events in six months, by required care level

Risk events	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000, 100.0%)
Falls	22.60%	13.90%	12.80%	15.60%
Pressure ulcers	1.70%	2.80%	2.70%	2.50%
Aspiration pneum	1.70%	2.30%	2.70%	2.30%
Fever	17.60%	15.20%	22.10%	18.30%

The most common undesirable risk events among the residents in the six-month period of observation were fever (18.3%) and falls (15.6%). Incidence of new pressure ulcers and aspiration pneumonia were relatively low.

Appendix Table 5. Overlap of improvement and deterioration

	Required Care Level 3 (n=239, 23.9%)			Required Care Level 4 (n=395, 39.5%)			Required Care Level 5 (n=366, 36.6%)			Total (n=1,000, 100.0%)		
	Improved	Not improved	Total	Improved	Not improved	Total	Improved	Not improved	Total	Improved	Not improved	Total
Deteriorated	10.9%	16.7%	27.6%	6.1%	16.7%	22.8%	4.9%	15.3%	20.2%	6.8%	16.2%	23.0%
Not deteriorated	8.8%	63.6%	72.4%	6.1%	71.1%	77.2%	3.8%	76.0%	79.8%	5.9%	71.1%	77.0%
Total	19.7%	80.3%	100.0%	12.2%	87.9%	100.0%	8.7%	91.3%	100.0%	12.7%	87.3%	100.0%

The number shows the percentage of each subgroup by required care levels.

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Appendix Table 6a. Correlation of deterioration in functional performance with resident features and risk events

	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Resident features				
Sex				
Male	0.46 (0.17-1.25)	1.61 (0.88-2.97)	1.08 (0.51-2.27)	1.08 (0.71-1.64)
Age groups, in years				
<80	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
80-84	3.12 (0.76-12.8)	0.56 (0.20-1.57)	0.69 (0.25-1.93)	0.91 (0.49-1.66)
85-89	1.35 (0.34-5.38)	1.00 (0.47-2.13)	1.03 (0.44-2.46)	1.03 (0.61-1.74)
90-94	1.61 (0.42-6.17)	1.00 (0.45-2.20)	1.43 (0.60-3.43)	1.18 (0.70-2.00)
95+	3.32 (0.76-14.48)	0.80 (0.33-1.95)	1.38 (0.52-3.71)	1.27 (0.70-2.29)
Risk events				
Fall	1.60 (0.75-3.42)	1.68 (0.84-3.33)	**2.80 (1.38-5.66)**	**1.95 (1.30-2.94)**
Pressure ulcers	-	2.97 (0.84-10.44)	-	0.98 (0.33-2.91)
Aspiration pneumonia	1.68 (0.17-16.53)	**4.18 (1.09-16.01)**	0.61(0.08-4.90)	1.86 (0.72-4.79)
Fever	1.46 (0.64-3.35)	1.86 (0.96-3.58)	1.51 (0.79-2.86)	**1.59 (1.07-2.38)**

Unadjusted odds ratios, obtained through bivariate correlation analysis, with their 95% confidence intervals.

Residents who had either a fall or fever were more likely to deteriorate.

Odds ratios of care staff job satisfaction and global happiness are presented in Tables 4a.

Appendix Table 6b. Multivariable logistic regression analysis for deterioration in residents' functional performance

	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Resident features				
Sex				
Male	0.71 (0.32-1.61)	1.43 (0.78-2.62)	1.70 (0.85-3.40)	1.31 (0.89-1.93)
Age groups, in years				
<80	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
80-84	1.88 (0.57-6.28)	0.51 (0.20-1.34)	0.64 (0.24-1.34)	0.84 (0.48-1.47)
85-89	1.16 (0.38-3.52)	0.84 (0.40-1.76)	1.18 (0.53-2.65)	1.07 (0.66-1.72)
90-94	1.42 (0.41-4.98)	0.89 (0.40-1.97)	1.83 (0.81-4.15)	1.25 (0.77-2.04)
95+	2.08 (0.57-7.55)	1.20 (0.53-2.70)	1.47 (0.58-3.73)	1.54 (0.90-2.64)
Risk events				
Fall	**2.12 (1.06-4.29)**	**2.08 (1.06-4.07)**	**2.38 (1.19-4.79)**	**2.25 (1.54-3.29)**
Pressure ulcers	1.25 (0.13-11.67)	1.92 (0.50-7.45)	0.26 (0.03-2.25)	0.90 (0.34-2.38)
Aspiration pneumonia	2.71 (0.34-21.49)	**5.25 (1.14-24.27)**	-	1.40 (0.57-3.39)
Fever	**2.79 (1.27-6.10)**	1.69 (0.86-3.35)	0.66 (0.87-3.18)	**1.81 (1.24-2.66)**

Adjusted odds ratios, obtained through multivariable logistic regression analysis, with their 95% confidence intervals.
The adjusted odds ratios of care staff's job satisfaction and happiness are presented in Table 4b.

For peer review only

Appendix Table 7a. Correlation of improvement in functional performance with resident features and risk events

	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Resident features				
Sex				
Male	0.82 (0.37-1.83)	1.55 (0.78-3.10)	1.42 (0.59-3.45)	1.27 (0.81-1.99)
Age groups, in years				
<80	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
80-84	2.25 (0.61-8.23)	2.37 (0.79-7.10)	1.31 (0.34-5.10)	2.00 (0.99-4.03)
85-89	1.65 (0.50-5.52)	1.45 (0.52-4.04)	1.60 (0.47-5.40)	1.66 (0.86-3.18)
90-94	1.65 (0.50-5.41)	1.02 (0.33-3.18)	2.15 (0.63-7.33)	1.75 (0.90-3.39)
95+	1.18 (0.26-5.28)	3.19 (1.15-8.84)	1.92 (0.49-7.55)	2.29 (1.13-4.63)
Risk events				
Fall	**2.37 (1.19-4.76)**	2.05 (0.97-4.31)	2.06 (0.84-5.07)	**2.36 (1.53-3.65)**
Pressure ulcers	4.22(0.58-30.79)	0.72 (0.09-5.73)	1.16 (0.14-9.50)	1.32 (0.45-3.91)
Aspiration pneumonia	1.37 (0.14-13.47)	**2.11 (0.43-10.47)**	-	1.03 (0.30-3.52)
Fever	2.15 (1.01-4.56)	0.78 (0.31-1.91)	1.19 (0.51-2.76)	1.24 (0.78-1.96)

Unadjusted odds ratios, obtained through bivariate correlation analysis, with their 95% confidence intervals.
Residents who had a fall were more likely to improve than those who did not have a fall, which might be partly because of rehabilitation after the fall.
Odds ratios of care staff job satisfaction and global happiness are presented in Tables 4b.

Appendix Tabel 7b. Multivariable logistic regression analysis for improvement in residents' functional performance

	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Resident features				
Sex				
Male	1.05 (0.44-2.51)	2.04 (0.95-4.40)	1.87 (0.74-4.76)	1.52 (0.95-2.45)
Age groups, in years				
<80	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
80-84	2.10 (0.54-8.09)	3.06 (0.97-9.75)	1.45 (0.36-5.87)	**2.24 (1.09-4.60)**
85-89	1.55 (0.45-5.42)	1.72 (0.58-5.11)	1.85 (0.53-6.53)	1.75 (0.90-3.43)
90-94	1.42 (0.41-4.98)	1.50 (0.44-5.07)	2.62 (0.73-9.35)	1.94 (0.98-3.85)
95+	0.80 (0.16-4.13)	**5.12 (1.65-15.88)**	2.13 (0.52-8.73)	**2.38 (1.14-4.96)**
Risk events				
Fall	2.08 (0.98-4.45)	2.10 (0.92-4.83)	1.97 (0.77-5.08)	**2.36 (1.51-3.70)**
Pressure ulcers	2.86 (0.32-25.16)	0.70 (0.07-6.94)	1.39 (0.77-5.08)	1.07 (0.35-3.26)
Aspiration pneumonia	1.46 (0.13-16.49)	2.75 (0.45-16.79)	-	0.78 (0.22-2.81)
Fever	2.00 (0.86-4.67)	0.51 (0.19-1.38)	1.30 (0.53-3.21)	1.15 (0.70-1.87)

Adjusted odds ratios, obtained through multivariable logistic regression analysis, with their 95% confidence intervals.
The adjusted odds ratios of care staff's job satisfaction and happiness are presented in Table 5b.

Appendix Table 8a. Correlation between deterioration in subdomains of functional performance and staff QWL

	ADL	Cognitive Function	Social Participation
Job Satisfaction	0.91 (0.65-1.28)	0.80 (0.48-1.32)	0.86 (0.61-1.20)
Global Happiness	0.72 (0.52-1.02)	0.86 (0.52-1.42)	0.92 (0.55-1.56)

Appendix Table 8b. Correlation between improvement in subdomains of functional performance and staff QWL

	ADL	Cognitive Function	Social Participation
Job Satisfaction	0.99 (0.62-1.59)	1.06 (0.56-2.01)	1.97 (0.89-4.36)
Global Happiness	1.06 (0.66-1.69)	0.71 (0.37-1.34)	1.06 (0.73-1.54)

Unadjusted odds ratios, obtained through bivariate correlation analysis, with their 95% confidence intervals.
Job satisfaction and happiness are represented by facility-level binary indicators (1 if the proportion of above-threshold responses is equal to or above the across-facilities median, 0 if it is below median).
These analyses were for seeking a specific subdomain of functional performance which was correlated with care staff's job satisfaction or happiness. However, no significant correlation was observed in the subdomains, presumably due to limited number of events (limited number of residents with deterioration in each of the subdomains).

Appendix Table 9. Results of bivariate correlation analysis and multivariable logistic regression analysis

Deterioration of residents' functional performance

	Care staff's job satisfaction and happiness	Resident features and risk events
Bivariate correlation analysis	**Table 4a**	**Appendix Table 6a**
Multivariable logistic regression analysis	**Table 4b**	**Appendix Table 6b**
Bivariate correlation analysis (subdomains of functional performance)	**Appendix Table 8a**	

Improvement of residents' functional performance

	Care staff's job satisfaction and happiness	Resident features and risk events
Bivariate correlation analysis	**Table 5a**	**Appendix Table 7a**
Multivariable logistic regression analysis	**Table 5b**	**Appendix Table 7b**
Bivariate correlation analysis (subdomains of functional performance)	**Appendix Table 8b**	

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Reporting checklist for cohort study.

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Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

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		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1

one group. Give information separately for for exposed and unexposed groups if applicable.

Bias	#9	Describe any efforts to address potential sources of bias	15-16
Study size	#10	Explain how the study size was arrived at	18
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	17-18
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	17-18
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	17
Statistical methods	#12c	Explain how missing data were addressed	18
Statistical methods	#12d	If applicable, explain how loss to follow-up was addressed	n/a
Statistical methods	#12e	Describe any sensitivity analyses	n/a

Results

| Participants | #13a | Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow- | 18-19 |

up, and analysed. Give information separately for for

exposed and unexposed groups if applicable.

Participants	#13b	Give reasons for non-participation at each stage	18
Participants	#13c	Consider use of a flow diagram	18
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	19
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	n/a
Descriptive data	#14c	Summarise follow-up time (eg, average and total amount)	n/a
Outcome data	#15	Report numbers of outcome events or summary measures over time. Give information separately for exposed and unexposed groups if applicable.	20-21
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	21-25
Main results	#16b	Report category boundaries when continuous variables were categorized	n/a
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a

Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	Appendix
Discussion			
Key results	#18	Summarise key results with reference to study objectives	25-26
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	26, 29-30
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	26-29
Generalisability	#21	Discuss the generalisability (external validity) of the study results	26
Other Information			
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	6

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Association of care worker's job satisfaction and global happiness with change of functional performance of severely disabled elderly residents in nursing homes: A cohort and questionnaire study in Japan

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Association of care worker's job satisfaction and global happiness with change of

functional performance of severely disabled elderly residents in nursing homes: A

cohort and questionnaire study in Japan.

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24   **Keyword**

25   Nursing home, elderly with severe disabilities, quality of care, functional performance,

26   care workers, quality of work life, job satisfaction, global happiness

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3

ABSTRACT

Objectives: There is growing concern regarding quality of work life (QWL) among

care staff in nursing homes. However, little is known about the impact of QWL on

nursing home residents' functional performance. Recent literature suggests that job

satisfaction and happiness of healthcare workers reflect their perceived QWL and

impact the quality of their care. This study examined the association between job

satisfaction and global happiness with change in functional performance of severely

disabled elderly residents in nursing homes.

Design: A retrospective cohort study of nursing home residents combined with a

questionnaire survey of their care staff.

Setting: Eighteen nursing homes in Japan.

Participants: Data were collected from 1,000 residents with a required care level of 3–

5 and 412 care staff in nursing homes between October 2016 and March 2017.

Outcomes and explanatory variables: Functional performance was structurally

assessed with ICF Staging, composed of 52 items concerning activities of daily life,

cognitive function, and social participation at baseline and six months later.

Deterioration and improvement of functional performance were dichotomously defined

as such change in any of the items. QWL of care staff was evaluated with a

questionnaire including questions about job satisfaction and global happiness.

4

48 **Results:** Functional performance deteriorated and improved in 23.0% and 12.7% of

49 residents, respectively. Global happiness of care staff was associated with lower

50 probability of residents' deterioration (adjusted odds ratio (aOR), 0.61; confidence

51 interval (CI), 0.44–0.84). There was no significant correlation between job satisfaction

52 or happiness of care staff and improvement of residents' functional performance.

53 **Conclusion:** These results suggest that QWL of care staff is associated with changes in

54 functional performance of elderly people with severe disabilities in nursing homes.

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5

57   **ARTICLE SUMMARY**

58   **Strengths and limitations of this study**

59   ● This is the first study to investigate the correlation between quality of work life,

60   specifically job satisfaction and global happiness, of care staff and changes in

61   functional performance of elderly people with severe disabilities in nursing homes.

62   ● Data included functional performance assessments of 1,000 residents at 18 nursing

63   homes across Japan at two time points at an interval of six months (retrospective

64   cohort study) and perceptions of 412 care staff at these nursing homes

65   (questionnaire survey).

66   ● Residents' functional performance was structurally recorded using ICF Staging, a

67   standardized and validated instrument that enables holistic, reproducible assessment

68   of a person's functional status, including activities of daily living, cognitive

69   function, and social participation, without the need for extensive training of users.

70   ● The six-month observation period of this study was relatively short for capturing

71   functional changes of residents and necessitated aggregating multifaceted

72   functional performance changes into binary indicators of deterioration and

73   improvement.

74

6

79   **Competing interests:** None declared.

7

80 **INTRODUCTION**

81 In developed nations, population aging and increased life expectancy have

82 resulted in increased demand for elderly care and a shortage of care workers.(1,2)

83 **Care worker shortage in Japan**

84 In Japan, as the number of elderly people requiring nursing care increases, so

85 does the need for a large number of care workers. A care worker is defined as a person

86 who provides direct care in long-term care settings, including nursing homes, and they

87 compose 41.3% of the workers in the long-term care settings; 62.6% of the care workers

88 work full time and 60.7% of them have been licensed as Certified Care Workers, a

89 national qualification, which is granted by the government, but not legally required in

90 care worker jobs.(3)(4) The Japanese government has estimated that by the year 2025, it

91 will be necessary to secure an additional care workforce of 380,000 while assuring the

92 quality of care and containing costs; nursing homes have experienced a serious shortage

93 of care workers.(5) The effective ratio of job vacancies to job applicants for care worker

94 was more than 3.95 across the nation in 2018.(5)(6) There are long waiting lists for

95 special nursing homes, partly due to the labour shortage.(7) Therefore, the government

96 and administrators of nursing homes and service providers must determine how to

97 maintain and improve work environments to recruit and retain care workers.

8

98   **Quality of Work Life**

99   There is growing concern regarding the impact of quality of work life (QWL)

100   perceived by care staff on the quality of care in nursing homes.(8–10) QWL is an

101   umbrella concept that encompasses a wide range of work-related issues.(10) Some

102   studies have considered QWL as a broad set of beneficial outcomes of working life.(11)

103   The other studies have described QWL as the quality of interaction between individuals

104   and every dimension of work.(11) In some previous studies, perceived QWL was

105   assessed using job satisfaction and global happiness.(10,12)

106   There are a number of reports on factors that affect job satisfaction of

107   healthcare workers. A previous study in nursing homes showed that internal factors

108   which affect job satisfaction about perceived job characteristics are supervisor support,

109   workload, financial rewards, career rewards, quality of co-workers, perceived quality of

110   care and team care. The same study showed that external factors with such impact are

111   contingency factors (e.g., being a primary breadwinner), personal characteristics (e.g.,

112   age, sex), organizational factors (e.g., type of ownership) and economic factors.(13)

113   Other studies revealed that job satisfaction among those who provide direct resident

114   care in residential long-term care facilities is influenced by empowerment and

115   autonomy as individual factors, and by facility resources and workload as

116   organizational factors.(7,14,15) Some other studies of QWL in healthcare settings have

9

117   focused on global happiness.(12) Global happiness is traditionally and often measured

118   with a simple item "Taking all things together, would you say you are …: very happy,

119   quite happy, not very happy, or not at all happy.(16,17) A further development of the

120   global happiness scale, the "Subjective Happiness Scale" developed by Lyubomirsky

121   and Lepper (1999) consists of four items and has become commonly used to measure

122   global happiness.(17,18) Healthcare workers' happiness can be attributed to a number

123   of personal factors and job environment characteristics.(19) Personal factors, such as

124   physical exhaustion and anxiety, negatively affect the global happiness of healthcare

125   workers.(20–22) Organizational/context-related factors, such as job tasks, relationships

126   with colleagues and superiors, and lack of safety, also impact the global happiness of

127   healthcare workers.(22–25)

128

129   Previous studies have illustrated that job satisfaction and global happiness

130   affect the quality of care provided by care staff through job commitment.(26) Care

131   communities with highly committed staff members endeavour to integrate the wishes,

132   preferences, and care needs of residents by respecting their privacy, dignity, comfort,

133   and choice in various activities.(27) Similarly, committed care workers are more likely

10

134   to respond to residents' health changes through appropriate communication among care

135   communities.(27)

136   It has been reported that job satisfaction of long-term care staff is correlated

137   with health-related outcomes of the residents. Higher job satisfaction of care staff in

138   nursing homes is associated with lower rates of resident injuries and residents' higher

139   satisfaction and well-being.(26,28) Higher job satisfaction and global happiness of care

140   managers is associated with clients' higher satisfaction and happiness with care.(12)

141   However, little is known regarding the association between QWL-related concepts,

142   specifically job satisfaction and global happiness, and functional performance of elderly

143   people with severe disabilities.

144   **Functional performance of elderly people with severe disabilities**

145   The degree of disability and dependency varies among elderly people who live

146   in nursing homes.(29) It is expected that elderly people with different degrees of

147   disability and dependency have different tendencies of deterioration or improvement in

148   their functional performance. Also, it is reasonably assumed that people with different

149   degrees of disability and dependency have their functional performance affected by

150   different factors. However, very few studies have focused on care outcomes of the

151   elderly people with severe disabilities.

11

152   **Long-Term Care Insurance system in Japan**

153   In Japan, elderly people with disabilities are eligible for receiving long-term

154   care under the public long-term care insurance (LTCI) system.(30) There are various

155   types of residential care facilities for the elderly, including LTCI facilities such as

156   special nursing homes, geriatric health facilities, sanatoria, or integrated facilities for

157   medical and long-term care. Elderly people who need care are stratified by the degree of

158   disability and dependency and certified as requiring a care level from 1 (mild) to 5

159   (severe).(31) Those with moderate to severe disabilities, or a required care level of 3–5,

160   are allowed to reside in special nursing homes which are specifically designed to

161   address their needs. Typically, a person with a required care level of 3 (moderate) needs

162   full assistance for standing, walking, dining, toileting, and bathing. A typical person

163   with a required care level of 5 (severe) needs full assistance for most essential activities

164   for survival, e.g., nutrition intake, excretion, maintenance of skin condition, and

165   avoidance of pressure ulcers, with a limited ability to comprehend their surroundings

166   and communicate with others.

167   **Aim of this study**

168   The aim of this study was to examine how job satisfaction and global happiness

169   of care staff were correlated with changes in functional performance of elderly people

170   with severe disabilities in Japanese special nursing homes.

12

171   A conceptual model of the correlation between care staff's QWL and

172   functional performance of residents in nursing homes is shown in Figure 1.

173

174   **Methods**

175   **Study design**

176   This was a retrospective cohort study of residents of special nursing homes,

177   combined with a questionnaire survey with care staff at the nursing homes.

178   **Participants and settings**

179   The residents and care staff of the nursing homes that agreed to cooperate were

180   invited to participate in the study. Written consent to participate in the study was

181   obtained from each resident, or his or her proxy family member if the resident had

182   cognitive impairment and was deemed by the care manager to be unable to give

183   informed consent. Consent from staff was obtained through the software described

184   below. They were informed that they could withdraw at any time and that all

185   information related to them would remain confidential. Data were anonymized at the

186   nursing homes and sent to the investigators. Only residents with a required care level of

187   3, 4, or 5 were included in the study, as required care levels 3, 4, and 5 represent

188   moderate to severe disability typical for residents in special nursing homes.

189   For efficient and accurate data collection, nursing homes, which have a specific

190   information system called "CAREKARTE" implemented, were asked to participate in

13

191   the study. CAREKARTE was developed by Fuji Data Systems, Japan, and integrates

192   functionalities for care recording and operational management.

193

194   **Measures**

195   **Outcome variables (functional performance): ICF Staging**

196   Concerning functional performances of elderly people, it is widely accepted

197   that maintaining independence in activities of daily living (ADL) and cognitive

198   functions and engaging in society are critical for people's quality of life as they

199   age.(32–34)

200   In this study, functional performance of the residents was measured using the

201   ICF Staging. The ICF Staging is an instrument to evaluate functional performance of

202   elderly people developed by the Japan Association of Geriatric Health Service

203   Facilities, and it is structured in line with the World Health Organization (WHO)

204   International Classification of Functioning, Disability and Health (ICF) codes.(35)

205   Table 1 shows the 13 categories of the ICF Staging items in the domains of ADL,

206   cognitive function, and social participation, each of which consists of four questions

207   corresponding to an ICF code, composing 52 items in total.(36) The ICF Staging

208   facilitates objective and multifaceted descriptions of elderly functional performance

209   efficiently and without the need for extensive training.(37)

14

210   The ICF Staging is regularly used in more than one thousand Japanese

211 intermediate facilities and nursing homes.(35) Previous studies have revealed this

212 instrument has high validity, test-retest reliability, and sensitivity to change.(37–40)

213

214 **Table 1. Functional performance items in the ICF Staging.**

ADL	01. Basic posture control
	02. Walking and moving function
	03. Eating function – Swallowing
	04. Eating function – Feeding and feeding assistance
	05. Toileting function
	06. Bathing function
	07. Personal care function - Oral care
	08. Personal care function - Self-care
Cognitive Function	09. Orientation
	10. Communication
	11. Mental activities
Social Participation	12. Leisure
	13. Socializing

215 Note: ADL = Activities of daily living

216

217 **Explanatory variables #1: Care staff QWL survey**

218   The care staff QWL survey included six items: job satisfaction, global

219 happiness, psychological rewards, intention to leave, and perceived quality of care at the

220 facility (2 items). Global happiness was scored on a scale of 0–10, with zero

221 representing "not happy at all" and 10 representing "very happy." Job satisfaction and

15

222   psychological rewards items ("To what extent are you satisfied with your work?" and

223   "How psychologically rewarding is your work?") were scored on a scale of 1–6, with

224   one representing "not at all" and six representing "extremely." Frequency of intentions

225   to leave from the current care facilities was scored on a scale of 1–4, where one

226   represented "often" and four represented "not at all." Items addressing perceived quality

227   of care at the facility ("To what extent are you satisfied with the quality of care provided

228   at the nursing home at which you work?" and "To what extent would you recommend

229   the nursing home at which you work to your family and friends?") were scored on a

230   scale of 1–5, where one represented "not at all" and five represented "extremely."

231   Previous studies have shown that career rewards, intentions to leave, and

232   perceived quality of care are elements composing staff job satisfaction.(14,41,42) In this

233   study, we assumed that job satisfaction and global happiness represent major aspects of

234   QWL of care staff in nursing homes, and chose these two factors as explanatory

235   variables in the analysis of this study.

236

237   **Explanatory variables #2: Risk events**

238   As risk events, falls, new pressure ulcers, aspiration pneumonia, and fever were

239   recorded.(28)

16

240

241 **Procedure**

242 All data were collected from October 2016 through March 2017. Residents'

243 age, sex, and required care levels were obtained from the care records.

244 Residents' functional performance was assessed by the care managers and

245 recorded in the aforementioned software at an interval of six months. The data on a

246 resident were compared between time points and evaluated either as improved,

247 deteriorated, or no change. In this study, the primary outcome measure was change,

248 either deterioration or improvement, in any of the 52 ICF Staging items. Note that

249 improvement and deterioration might coexist within an individual.

250 Occurrence of undesirable risk events within the same six months was also

251 reported by the care managers through review of the care record.

252 An electronic survey with care staff on their perceived QWL was also

253 conducted at the end of the six-month period. Responses to each item on the

254 questionnaire were summarized as follows to create a facility-level binary indicator.

255 First, the response of each care staff member was recoded either as "high" (equal to or

256 above a pre-specified threshold) or "low" (below the threshold). The threshold for job

257 satisfaction, on a scale of 1–6, was 4 and that for global happiness, answered in a scale

258 of 0–10, was 5. Second, responses within each facility were summarized either as "high

17

259   proportion" (proportion of "high" responses equal to or above the median across

260   facilities) or "low proportion" (proportion of "high" responses below the median across

261   facilities).

262

263   **Resident and Public Involvement**

264   Nursing home residents and care staff were not directly involved in the design

265   and conduct of this research, however, the authors have a constant relationship with

266   residents, care workers, and managers of nursing homes. Their insights have been

267   incorporated into the design of this study through informal interviews with the

268   administrators and care managers of participating facilities. The authors plan to formally

269   invite nursing home residents and care staff for determining optimal strategy for

270   disseminating the results of this study.

271

272   **Statistical Analyses**

273   Survey responses of care staff at each facility were converted to facility-level

274   binary indicators, as described earlier, and combined with the resident data. All

275   analyses, except when indicated, were conducted in a unit of residents.

18

276   Correlation of deterioration and improvement of functional performance with

277   resident features, risk events, and job satisfaction and global happiness of care staff was

278   assessed using Pearson's Chi square test.

279   Multivariable logistic regression was used to estimate effects of care staff's job

280   satisfaction and global happiness on change in functional performance adjusted for

281   other covariates. Age, sex, required care level, risk events, and job satisfaction and

282   global happiness of care staff were included in the model.

283   Analysis of distribution of variables, analysis of bivariate correlations, and the

284   multivariable logistic regression were all conducted with and without stratification with

285   required care level. Statistical analysis was performed using JMP computer software

286   (JMP® Pro 14.3. SAS Institute Inc., USA). A p-value less than 0.05 was considered

287   statistically significant.

288   The STROBE cohort reporting guidelines were used.(43)

289

290   **RESULTS**
291   **Resident characteristics, staff responses, and risk events**

292   A total of 1,532 residents and 455 care workers from 21 special nursing homes

293   participated in this study (Figure 2). The data of 1,292 residents were collected. While

294   the reason for missing data at this stage is unclear, it may be attributed to either the

19

295　death of certain residents or administrative issues. Residents with required care levels of

296　3, 4, and 5 (n=1,136) were included in the analysis. We excluded the data of residents

297　with missing functional performance data or care worker responses. As a result, 1,000

298　residents with 412 corresponding care workers from 18 special nursing homes were

299　included in the analysis. The proportion of missing values was 3.1% for items on

300　residents' functional performance and 1.2% for items on the QWL of care staff.

301　　　　The proportion of residents with required care levels of 3, 4 and 5 are 23.9%,

302　39.5%, and 36.6%, respectively (Table 2). Most residents (80.6%) were female and

303　more than half of the residents were aged 85–94. Baseline functional performance is

304　summarized in Appendix Table 1.

305

306　**Table 2. Sex and age of nursing home residents**

Baseline Characteristics	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Sex				
Female	78.2%	79.7%	83.1%	80.6%
Male	21.8%	20.3%	16.9%	19.4%
Age groups, in years				
<80	12.6%	19.5%	19.1%	17.7%
80-84	14.6%	13.7%	18.6%	15.7%
85-89	28.9%	27.8%	27.9%	28.1%
90-94	33.1%	22.3%	21.3%	24.5%

20

95+	10.9%	16.7%	13.1%	14.0%

307   (No legend for this table)

308

309   Appendix Table 2 summarizes the care staff's responses. The median and

310   interquartile range of job satisfaction were 4 (4–5) out of 6 and those of global

311   happiness were 7 (6–8) out of 10. Appendix Table 3 indicates the distribution of the

312   care staff's job satisfaction and global happiness summarized in the unit of residents.

313   As shown in Appendix Table 4, the most common undesirable risk events

314   among residents in the six-month period of observation were fever (18.3%) and falls

315   (15.6%).

316

317   **Change in functional performance**

318   As shown in Tables 3a and 3b, 23.0% of the residents exhibited deterioration

319   while 12.7% exhibited improvement, both in any of the functional performance items.

320   The overlap between deterioration and improvement of functional performance is

321   displayed in Appendix Table 5. Regarding ADL, both deterioration and improvement

322   were more frequent in residents with lower required care levels. Cognitive function

323   more frequently deteriorated and less frequently improved in residents with higher

324   required care levels. Social participation rarely improved in residents with the required

21

325   care level 5. As the proportion of change was highest in ADL, the residents' "overall"

326   deterioration and improvement most reflected that in ADL.

327

328   **Table 3a. Proportion of residents with deterioration**

Deterioration	Required care level 3 (n=239, 23.9%)	Required care level 4 (n=395, 39.5%)	Required care level 5 (n=366, 36.6%)	Total (n=1,000, 100.0%)
ADL	17.6%	17.5%	13.4%	16.0%
Cognitive Function	5.0%	6.1%	8.2%	6.6%
Social Participation	6.3%	6.6%	5.2%	6.0%
Total	27.6%	22.8%	20.2%	23.0%

329   (Legend) Proportion of residents with deterioration in any of the 52 items of the

330   functional performance assessment tool (ICF Staging).

331

332   **Table 3b. Proportion of residents with improvement**

Improvement	Required care level 3 (n=239, 23.9%)	Required care level 4 (n=395, 39.5%)	Required care level 5 (n=366, 36.6%)	Total (n=1,000, 100.0%)
ADL	11.7%	6.6%	5.7%	7.5%
Cognitive Function	7.1%	3.3%	2.7%	4.0%
Social Participation	4.2%	4.1%	0.8%	2.9%
Total	19.7%	12.2%	8.7%	12.7%

333   (Legend) Proportion of residents with improvement in any of the 52 items of the

334   functional performance assessment tool (ICF Staging).

335

336   **Bivariate correlation analyses and multivariable logistic regression analyses**

337   The correlation of change in residents' functional performance with care staff

338   job satisfaction and global happiness is presented in Tables 4a, 5a (unadjusted odds

339   ratios), 4b, and 5b (adjusted odds ratios). Similarly, the correlation of change in

340 functional performance with resident features and risk events is presented in Appendix

341 Tables 6a, 7a (unadjusted odds ratios), 6b, and 7b (adjusted odds ratios).

342   The correlation of change in subdomains of functional status (i.e., ADL,

343 cognitive function, and social participation) with care staff job satisfaction and

344 happiness is summarized in Appendix Tables 8a and 8b.

345   Appendix Table 9 summarizes tables on results of bivariate correlation analysis

346 and multivariable logistic regression analysis.

347

348 **Correlation between care staff's QWL and residents' deterioration**

349   As in Tables 4a and 4b, the residents of facilities with a high proportion of

350 happy care staff were less likely to deteriorate. The results are similar between bivariate

351 correlation analysis (unadjusted odds ratio (uOR): 0.67, CI 0.48-0.94, Table 4a) and

352 multivariable regression analysis (adjusted odds ratio (aOR): 0.61, CI 0.44–0.84, Table

353 4b).

354   When stratified by required care levels, the same trend was observed

355 throughout, with a statistically significant difference observed in required care level 4.

356 The results are similar between bivariate correlation analysis (uOR in required care

357 level 4: 0.49, CI 0.29-0.85, Table 4a) and multivariable regression analysis (aOR in

358 required care level 4: 0.36, CI 0.21-0.64, Table 4b).

23

359

360 **Table 4a. Correlation of deterioration in functional performance with care staff**

361 **job satisfaction and global happiness**

	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Job satisfaction	1.26 (0.64-2.49)	0.70 (0.41-1.19)	0.84 (0.48-1.48)	0.86 (0.61-1.20)
Global happiness	0.64 (0.33-1.27)	**0.49 (0.29-0.85)**	0.94 (0.53-1.66)	**0.67 (0.84-0.94)**

362 (Legend) Unadjusted odds ratios, obtained through bivariate correlation analysis, with

363 their 95% confidence intervals. Odds ratios of resident features and risk events are

364 presented in Appendix Table 6a.

365 **Table 4b. Multivariable logistic regression analysis of deterioration in residents'**

366 **functional performance**

	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Job satisfaction	1.71 (0.90-3.26)	1.18 (0.70-2.00)	0.92 (0.53-1.59)	1.07 (0.79-1.47)
Global happiness	0.54 (0.28-1.04)	**0.36 (0.21-0.64)**	0.86 (0.50-1.51)	**0.61 (0.44-0.84)**

367 (Legend) Adjusted odds ratios, obtained through multivariable logistic regression

368 analysis, with their 95% confidence intervals.

369 Job satisfaction and happiness are represented by facility-level binary indicators (1 if the

370 proportion of above-threshold responses is equal to or above the across-facilities

371 median, 0 if it is below the median).

24

372 The adjusted odds ratios of resident features and risk events are presented in Appendix

373 Table 6b.

374

375 **Correlation between care staff's QWL and residents' improvement**

376   As shown in Tables 5a and 5b, in the entire cohort, no significant correlation

377 was found between the improvement of residents' functional status and care staff job

378 satisfaction or global happiness.

379   In analyses stratified by required care level, correlation was observed between

380 chance of improvement and care staff job satisfaction in required care level 4. Similar

381 results are found in both bivariate correlation analysis (uOR in required care level 4:

382 2.56, CI 1.33-4.93, Table 5a) and multivariable logistic regression analysis (aOR in

383 required care level 4: 2.84, CI: 1.36-5.93, Table 5b).

384

385 **Table 5a. Correlation of improvement in functional performance with care staff**

386 **job satisfaction and global happiness**

	Required Care Level 3	Required Care Level 4	Required Care Level 5	Total
	(n=239, 23.9%)	(n=395, 39.5%)	(n=366, 36.6%)	(n=1,000)
Job satisfaction	0.55 (0.29-1.07)	**2.56 (1.33-4.93)**	0.80 (0.39-1.66)	1.06 (0.73-1.54)
Global happiness	0.92 (0.48-1.76)	1.39 (0.75-2.59)	0.84 (0.40-1.74)	1.12 (0.77-1.63)

25

387 (Legend) Unadjusted odds ratios, obtained through bivariate correlation analysis, with

388 their 95% confidence intervals. Odds ratios of resident features and risk events are

389 presented in Appendix Table 7a.

390

391 **Table 5b. Multivariable logistic regression analysis of the improvement of**

392 **residents' functional performance**

Characteristic	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Job satisfaction	0.73 (0.36-1.50)	**2.84 (1.36-5.93)**	0.92 (0.43-1.97)	1.14 (0.76-1.69)
Global happiness	0.77 (0.37-1.61)	1.15 (0.56-2.37)	0.78 (0.36-1.70)	1.02 (0.68-1.53)

393 (Legend) Adjusted odds ratios, obtained through multivariable logistic regression

394 analysis, with their 95% confidence intervals.

395 Job satisfaction and happiness are represented by facility-level binary indicators (1 if the

396 proportion of above-threshold responses is equal to or above the across-facilities

397 median, 0 if it is below the median).

398 The adjusted odds ratios of resident features and risk events are presented in Appendix

399 Table 7b.

400

26

DISCUSSION

401

402   This is the first study, to our knowledge, to examine the association between

403   changes in residents' functional performance and the job satisfaction and happiness of

404   care staff in nursing homes. The residents in nursing homes with high proportion of

405   happy care staff had a statistically lower chance of deterioration. The authors believe

406   that similar association may exist in other settings in long-term care for the elderly.

407   The observed correlation between staff happiness and residents' functional

408   deterioration theoretically implies that, as described in the Introduction section, happy

409   staff tend to highly commit to their job. Organizational culture may change in their

410   nursing home, which promotes maintenance of residents' functional performance

411   through provision of adequate communication and high-quality care.(26,27,44–46)

412   Also, either high quality care leading to residents' favourable outcomes, or residents'

413   functional performance itself being maintained or improved, might in turn promote the

414   happiness of care staff through professional fulfilment.(47)

415   The results here are not robust, possibly due to a limited number of

416   observations for examining this correlation. In subgroup analyses on residents with each

417   required care level, statistically significant differences were observed only in the

418   residents with a required care level of 4. A possible explanation is that, in general, many

419   of the residents with a required care level of 3 have health problems which are still not

27

420 completely stable and exercise a major influence on their functional performance

421 outcome, and residents with a required care level of 5 may tend to be irreversibly

422 disabled with static diseases. Observation of a larger number of residents would allow

423 for more reliable statistical analysis. Alternatively, a study design with a stronger focus

424 on residents whose functional performance can theoretically be influenced by quality of

425 care, such as excluding bed-ridden residents and those who have just been discharged

426 from a hospital, may make it possible to more efficiently examine the correlation under

427 discussion.

428   The results of this study imply that improvement of care staff's working

429 environment might lead to higher quality of care and, in turn, maintenance or

430 improvement of the functional performance in residents of certain severity levels.(7,26–

431 28,41,44,48)

432   The working environment of care staff in nursing homes has specific issues

433 that could be improved with organizational efforts. Relationships with other staff

434 members and a poor career outlook have been reported to be among the major causes of

435 care staff turnover in Japan.(49) Changing these QWL-related factors may improve staff

436 perceptions of the QWL, which may promote their commitment to their job. It will lead

437 to cultural change and hence improved quality of care provided in nursing homes. The

438 authors believe that evaluation of effectiveness of such an approach deserves further

439 study.

440   The authors also envision an alternative approach to improving functional

441 outcome of residents in nursing homes, which is to educate the care staff on physical,

442 psychological, and social process of aging and dying, as well as grief of the family of

443 residents and care staff themselves. Training on how to cope with aging and dying

444 should also be provided. We believe such education and training might mitigate the

445 psychological stress associated with working with residents with severe disabilities and

446 prevent compassion fatigue(50–54).

447   Care staff in nursing homes must regularly cope with residents' functional

448 decline, burdens associated with the terminal stage of life, and death.(50) In palliative

449 and intensive care settings, compassion fatigue is reported to be a serious causes of

450 nurse burnout.(51,55–59) There are reports of compassion fatigue of family members of

451 elderly people with severe disabilities.(52,60,61) Compassion fatigue may also impact

452 care staff in nursing homes.(53,54) Organizational programs for preventing compassion

453 fatigue may help care staff in nursing homes to maintain their own psychological

454 health.(62) The effectiveness of such an approach remains an open question requiring

455 further study.

29

456

457 **Limitations**

458   In this study, only the perceptions of nursing home care staff were used to

459 assess their QWL. More detailed and objective factors should be combined to assess the

460 QWL in nursing homes in future studies.

461   In addition, many of this study's participants were relatively stable and even

462 within the observation period of six months, only a small portion of them exhibited

463 change according to the ICF Staging. Although Mitnitski (63) insisted a frailty index

464 should be defined as the proportion of accumulated deficits, we labelled an elderly

465 person as exhibiting change if any of the items measured showed improvement or

466 deterioration. Some participants exhibited improvement and deterioration concurrently.

467   Even though functional performance was assessed with a validated instrument,

468 the assessment may have been affected by inter-rater variation. Measurement of walking

469 ability and muscle strength, and more formal assessment of cognitive function, would

470 increase the objectivity of functional performance assessment and allow more reliable

471 conclusions to be drawn regarding the correlation between QWL of care staff and

472 resident functional performance(64).

473   This study was conducted in Japanese special nursing homes and the target

474 group was elderly people with moderate to severe disabilities. Expanding the target

30

475   group to the elderly with mild disabilities or in different facilities and home care

476   situations would help foster deeper understanding of the association between the QWL

477   of care workers and changes in functional performance of elderly people.

478

479   **Conclusions**

480   The present study assessed how the changes in residents' functional

481   performance are related to job satisfaction and happiness of care staff in nursing homes.

482   Nursing home residents with a higher proportion of happy care staff had a lower chance

483   of deterioration. Detailed observations of the care process are needed to obtain further

484   insight into the interaction between the happiness of care staff and residents' functional

485   performance. Although the detailed mechanisms are unknown, the results of this study

486   imply that long-term care for the elderly with severe disabilities could be improved by

487   directing attention to both the QWL of care staff and the functional performance of

488   residents, ideally creating a virtuous cycle.

489

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Acknowledgments

670 We would like to thank our Advisory Group including Toru Takebayashi and Tomonori

671 Okamura. We are also grateful to the participating administrators, care staff and

672 residents of nursing homes, and Ken Ishikawa, the former head of the Japanese Council

673 of Senior Citizens Welfare Service, who made this study possible. Finally, we

674 acknowledge the contributions of Satoru Yoshie and Takanori Fujita who helped in the

675 early stages of the project.

676

Footnotes

678 **Contributors:** SIS planned and designed the research, collected and analyzed the data,

679 drafted and revised the manuscript and its accompanying materials. NI provided advices

680 on study design, data collection, and data analysis, revised the manuscript and its

681 accompanying materials, and approved them for submission. JO provided advices on

682 study design based on domain knowledge and expertise in research on long-term care.

683 AT provided support for summarizing the data. HM provided administrative support

684 and general advice.

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685 **Ethics approval:** This study was approved by the Ethical Review Board of the School

686 of Medicine, Keio University and is in compliance with the Declaration of Helsinki;

687 approval number 20170132 (01/15/2018).

688 **Data sharing statement:** The authors' agreement with participants of the study

689 precludes sharing of data used for this study outside the predetermined study group.

690 **Patient consent for publication:** No required.

691

692 **Figure legend/caption**

693 **Figure 1. Conceptual model of correlation between care staff's QWL and**

694 **residents' functional performance**

695 (Legend) We hypothesized that care staff's job satisfaction and global happiness affect

696 the quality of care through job commitment; job commitment affects culture of care in

697 the facility; and affects functional performance.

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699 **Figure 2. Study Cohort**

700 (Legend) A total of 1,532 residents and 455 care workers from 21 special nursing

701 homes participated in this study. The analysis cohort included 1,000 residents with 412

702 corresponding care workers from 18 special nursing homes.
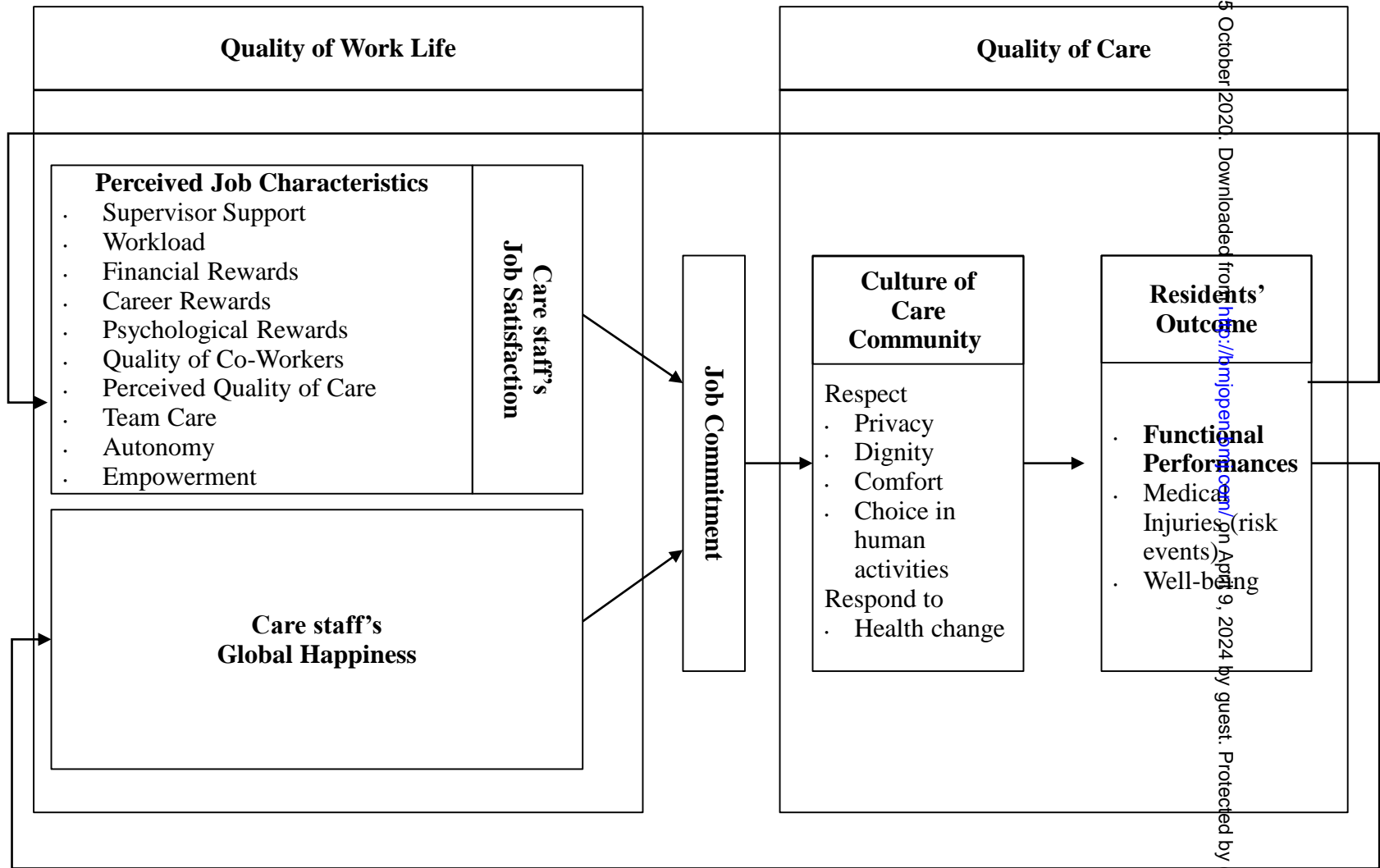
(Legend) We hypothesized that care staff's job satisfaction and global happiness affect the quality of care through job commitment; job commitment affects culture of care in the facility; and affects functional performance.

Figure 2. Study cohort

Residents

Care staff

Residents in 21 nursing homes between October 2016 and March 2017
n = 1,532

Care staff in 21 nursing homes between October 2016 and March 2017
n = 455

Data provided — No → n = 240
Possible reasons:
· Death
· Administrative issues

Yes   n = 1,292

Data provided — No → n = 47

Required care level 3, 4 and 5 — No → n = 156
Required care level 1 or 2 (exceptionally mild disability)

Yes   n = 1,136

n = 412
in 18 nursing homes

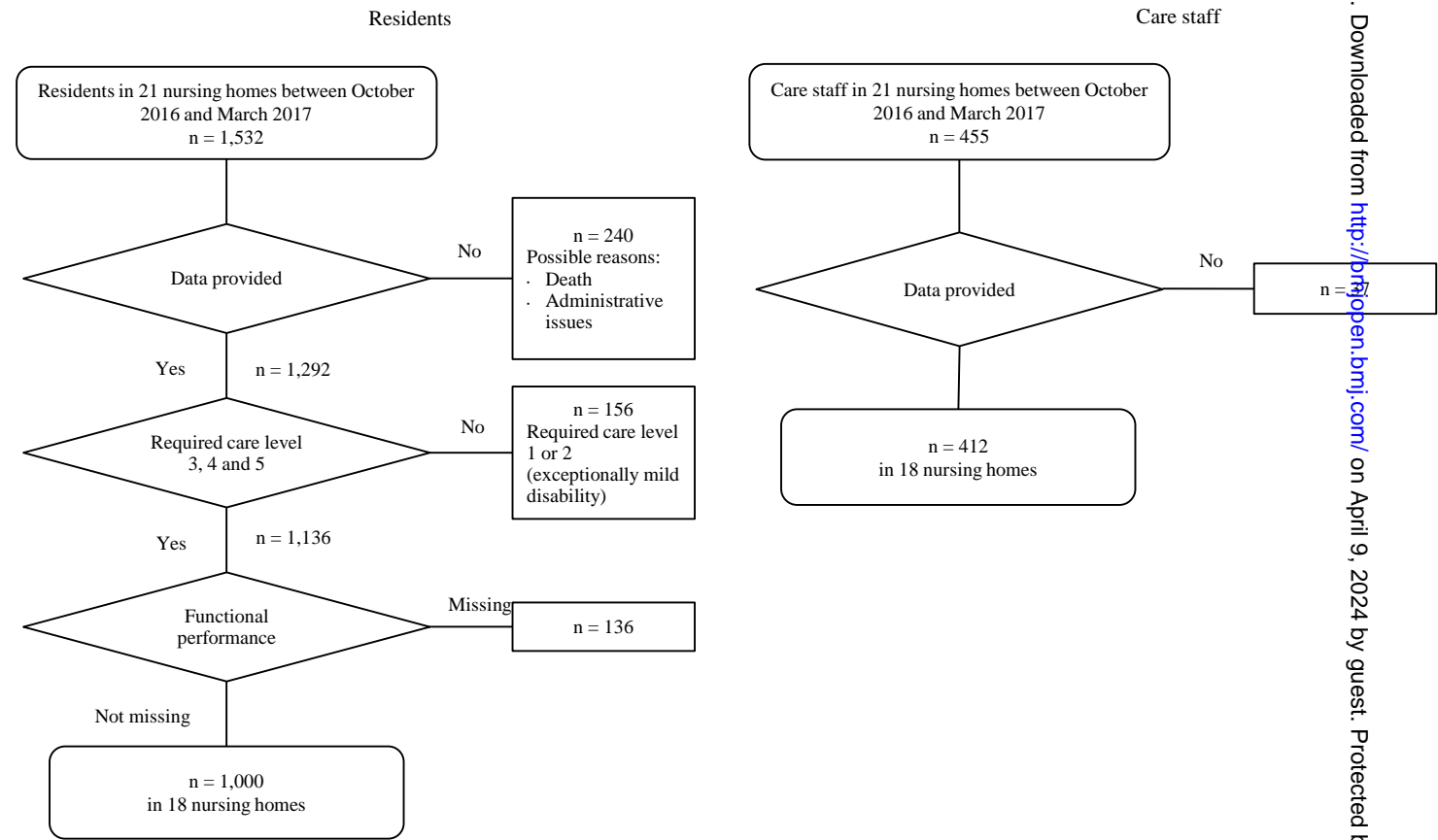Functional performance — Missing → n = 136

Not missing

n = 1,000
in 18 nursing homes

(Legend) A total of 1,532 residents and 455 care workers from 21 special nursing homes participated in this study. The analysis cohort included 1,000 residents with 412 corresponding care workers from 18 special nursing homes.

Appendix Table 1. Baseline functional performance of nursing home residents, by required care level

Baseline functional performance	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
ADL				
1. Basic posture control				
1-1 Maintaining standing position	42.90%	14.90%	6.20%	18.40%
1-2 Moving between sitting positions	76.90%	44.20%	17.90%	42.30%
1-3 Maintaining sitting position (without assistance)	68.80%	36.10%	11.80%	34.90%
1-4 Rolling over	81.70%	54.80%	20.80%	48.70%
2. Walking and moving function				
2-1 Going out	1.70%	1.00%	0.60%	1.00%
2-2 Climbing up and down	4.30%	0.30%	0.80%	1.40%
2-3 Stable walking	42.90%	14.80%	3.90%	17.50%
2-4 Moving within facility	85.30%	61.70%	31.40%	56.20%
3. Eating function - Swallowing				
3-1 Chewing	76.60%	53.40%	24.10%	48.30%
3-2 Sucking	86.00%	70.20%	39.40%	62.80%
3-3 Swallowing (solid)	92.20%	81.20%	53.60%	73.80%
3-4 Swallowing (specially processed food)	93.40%	82.30%	70.90%	80.60%
4. Eating function – Feeding and feeding assistance				
4-1 Feeding him/herself	71.40%	47.40%	13.30%	40.90%
4-2 Dropping food and making mess	68.10%	68.90%	31.50%	54.80%
4-3 Special arrangement for feeding	29.60%	49.10%	56.80%	47.10%
4-4 Direct assistance for feeding	8.70%	22.50%	64.80%	34.60%
5. Toileting function				
5-1 Post-release cleanup	50.60%	28.20%	16.90%	29.40%
5-2 Dressing and undressing	56.50%	18.60%	4.20%	22.30%
5-3 Getting on and off western type toilet	65.20%	48.00%	19.10%	41.40%
5-4 Releasing on bed	17.90%	34.40%	49.40%	36.00%
6. Bathing function				
6-1 Stable movement in and out of bathtub and washing.	16.20%	3.40%	1.10%	5.60%
6-2 Bathing without assistance	7.50%	3.70%	0.90%	3.50%
6-3 Maintaining sitting position during bathing	74.30%	52.00%	20.10%	45.70%
6-4 Carrying out bathing	50.70%	70.20%	89.20%	72.60%
7. Personal care function - Oral care				
7-1 General oral care	48.70%	26.00%	6.50%	24.30%
7-2 Brushing teeth	39.30%	15.90%	4.00%	17.10%
7-3 Preparation for brushing teeth	66.40%	45.00%	14.70%	38.80%
7-4 Rinsing mouth	79.20%	58.30%	20.50%	49.00%
8. Personal care function – Self-care				
8-1 Trimming nails	3.90%	2.90%	1.10%	2.50%
8-2 Shaving, skincare, hair care	48.30%	27.20%	5.40%	24.30%
8-3 Washing face	71.90%	47.00%	14.40%	41.00%
8-4 Washing hands	55.00%	35.00%	9.10%	30.30%
Cognitive Functions				
9. Orientation				
9-1 Date	43.30%	22.00%	7.60%	21.80%
9-2 Name of place	48.10%	31.70%	11.20%	28.00%
9-3 Orientation toward other people	84.50%	69.80%	36.60%	61.20%
9-4 Own name	98.20%	89.80%	59.00%	80.50%
10. Communication				
10-1 Maintaining complicated human relationship	54.10%	36.80%	12.90%	32.20%
10-2 Understanding of written language	70.10%	50.80%	17.90%	43.30%
10-3 Everyday conversation	60.60%	46.60%	18.90%	39.80%
10-4 Understanding of spoken language	82.00%	74.40%	40.60%	63.80%
11. Cognitive function				
11-1 Time management	38.20%	24.00%	6.50%	21.00%
11-2 Simple arithmetic	57.60%	36.00%	10.40%	31.70%
11-3 Long-term memory	44.20%	35.10%	12.40%	28.90%
11-4 State of consciousness	5.60%	7.60%	5.70%	6.40%
Social Participation				
12. Leisure				
12-1 Traveling	1.30%	11.10%	0.60%	0.50%
12-2 Traveling	22.00%	56.90%	3.40%	10.90%
12-3 Group Recreation	73.00%	63.70%	30.20%	51.00%
12-4 Watching TV	75.00%	4.50%	38.40%	57.10%
13. Socializing				
13-1 Socializing using means of communication devices	10.00%	7.10%	2.30%	5.00%
13-2 Going out	11.40%	35.20%	4.90%	7.30%
13-3 Conversing with friend	50.90%	87.10%	15.50%	31.70%
13-4 Conversing with someone close	96.90%	96.90%	51.90%	76.50%

Proportion of residents capable of each ICF Staging item both in the overall analysis cohort and within residents with a specific required care level. A higher required care level is associated with more limited ability in most items of functional performance. ADLs = Activities of Daily Living

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Appendix Table 2. Care staff's responses

	Median (Interquartile Range)
Global Happiness	
Are you happy? (0-10, not happy to very happy)	7 (6-8)
Job Satisfaction	
To what extent are you satisfied with you work? (1-6, not at all to extremely)	4 (4-5)
Career rewards	
How rewarding is your work? (1-6, not at all to etremely)	5 (4-5)
Frequency of Intentions to leave	
How often do you feel you want leave from the current care facilities? (1-4, often to not at all)	2 (2-3)
Quality of care at the nursing home	
To what extent are you satisfied with the quality of care provided at the nursing home at which you work? (1-5, not at all to etremely)	4 (3-4)
To what extent would you recommend this nursing home at which you work to your family and friends? (1-5, not at all to extremely)	4 (3-4)

Distribution of care staff's responses (N=412). This analysis was conducted in the unit of care staff members, not residents. Responses to the questions regardng global happiness and job stisfaction were summarized at each facility and used in the following correlation analysis.

Appendix Table 3. Global happiness and job satisfaction of care staff

	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Job Satisfaction	47.70%	51.40%	51.90%	50.70%
Global Happiness	59.00%	55.40%	47.80%	53.50%

Distribution of care staff's responses. This analysis was conducted in the unit of residents (N=1,000). Job satisfaction and happiness are represented by facility-level binary indicators (1 if the proportion of above-threshold responses is equal to or above the across-facilities median, 0 if it is below median). Note that these responses do not reflect experience of care workers with each resident, but their overall experience at the facility.

Appendix Table 4. Occurrence of the risk events in six months, by required care level

Risk events	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000, 100.0%)
Falls	22.60%	13.90%	12.80%	15.60%
Pressure ulcers	1.70%	2.80%	2.70%	2.50%
Aspiration pneum	1.70%	2.30%	2.70%	2.30%
Fever	17.60%	15.20%	22.10%	18.30%

The most common undesirable risk events among the residents in the six-month period of observation were fever (18.3%) and falls (15.6%). Incidence of new pressure ulcers and aspiration pneumonia were relatively low.

Appendix Table 5. Overlap of improvement and deterioration

	Required Care Level 3 (n=239, 23.9%)			Required Care Level 4 (n=395, 39.5%)			Required Care Level 5 (n=366, 36.6%)			Total (n=1,000, 100.0%)		
	Improved	Not improved	Total	Improved	Not improved	Total	Improved	Not improved	Total	Improved	Not improved	Total
Deteriorated	10.9%	16.7%	27.6%	6.1%	16.7%	22.8%	4.9%	15.3%	20.2%	6.8%	16.2%	23.0%
Not deteriorated	8.8%	63.6%	72.4%	6.1%	71.1%	77.2%	3.8%	76.0%	79.8%	5.9%	71.1%	77.0%
Total	19.7%	80.3%	100.0%	12.2%	87.9%	100.0%	8.7%	91.3%	100.0%	12.7%	87.3%	100.0%

The number shows the percentage of each subgroup by required care levels.

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Appendix Table 6a. Correlation of deterioration in functional performance with resident features and risk events

	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Resident features				
Sex				
Male	0.46 (0.17-1.25)	1.61 (0.88-2.97)	1.08 (0.51-2.27)	1.08 (0.71-1.64)
Age groups, in years				
<80	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
80-84	3.12 (0.76-12.8)	0.56 (0.20-1.57)	0.69 (0.25-1.93)	0.91 (0.49-1.66)
85-89	1.35 (0.34-5.38)	1.00 (0.47-2.13)	1.03 (0.44-2.46)	1.03 (0.61-1.74)
90-94	1.61 (0.42-6.17)	1.00 (0.45-2.20)	1.43 (0.60-3.43)	1.18 (0.70-2.00)
95+	3.32 (0.76-14.48)	0.80 (0.33-1.95)	1.38 (0.52-3.71)	1.27 (0.70-2.29)
Risk events				
Fall	1.60 (0.75-3.42)	1.68 (0.84-3.33)	**2.80 (1.38-5.66)**	**1.95 (1.30-2.94)**
Pressure ulcers	-	2.97 (0.84-10.44)	-	0.98 (0.33-2.91)
Aspiration pneumonia	1.68 (0.17-16.53)	**4.18 (1.09-16.01)**	0.61(0.08-4.90)	1.86 (0.72-4.79)
Fever	1.46 (0.64-3.35)	1.86 (0.96-3.58)	1.51 (0.79-2.86)	**1.59 (1.07-2.38)**

Unadjusted odds ratios, obtained through bivariate correlation analysis, with their 95% confidence intervals.

Residents who had either a fall or fever were more likely to deteriorate.

Odds ratios of care staff job satisfaction and global happiness are presented in Tables 4a.

Appendix Table 6b. Multivariable logistic regression analysis for deterioration in residents' functional performance

	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Resident features				
Sex				
Male	0.71 (0.32-1.61)	1.43 (0.78-2.62)	1.70 (0.85-3.40)	1.31 (0.89-1.93)
Age groups, in years				
<80	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
80-84	1.88 (0.57-6.28)	0.51 (0.20-1.34)	0.64 (0.24-1.34)	0.84 (0.48-1.47)
85-89	1.16 (0.38-3.52)	0.84 (0.40-1.76)	1.18 (0.53-2.65)	1.07 (0.66-1.72)
90-94	1.42 (0.41-4.98)	0.89 (0.40-1.97)	1.83 (0.81-4.15)	1.25 (0.77-2.04)
95+	2.08 (0.57-7.55)	1.20 (0.53-2.70)	1.47 (0.58-3.73)	1.54 (0.90-2.64)
Risk events				
Fall	**2.12 (1.06-4.29)**	**2.08 (1.06-4.07)**	**2.38 (1.19-4.79)**	**2.25 (1.54-3.29)**
Pressure ulcers	1.25 (0.13-11.67)	1.92 (0.50-7.45)	0.26 (0.03-2.25)	0.90 (0.34-2.38)
Aspiration pneumonia	2.71 (0.34-21.49)	**5.25 (1.14-24.27)**	-	1.40 (0.57-3.39)
Fever	**2.79 (1.27-6.10)**	1.69 (0.86-3.35)	0.66 (0.87-3.18)	**1.81 (1.24-2.66)**

Adjusted odds ratios, obtained through multivariable logistic regression analysis, with their 95% confidence intervals.
The adjusted odds ratios of care staff's job satisfaction and happiness are presented in Table 4b.

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Appendix Table 7a. Correlation of improvement in functional performance with resident features and risk events

	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Resident features				
Sex				
Male	0.82 (0.37-1.83)	1.55 (0.78-3.10)	1.42 (0.59-3.45)	1.27 (0.81-1.99)
Age groups, in years				
<80	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
80-84	2.25 (0.61-8.23)	2.37 (0.79-7.10)	1.31 (0.34-5.10)	2.00 (0.99-4.03)
85-89	1.65 (0.50-5.52)	1.45 (0.52-4.04)	1.60 (0.47-5.40)	1.66 (0.86-3.18)
90-94	1.65 (0.50-5.41)	1.02 (0.33-3.18)	2.15 (0.63-7.33)	1.75 (0.90-3.39)
95+	1.18 (0.26-5.28)	3.19 (1.15-8.84)	1.92 (0.49-7.55)	2.29 (1.13-4.63)
Risk events				
Fall	**2.37 (1.19-4.76)**	2.05 (0.97-4.31)	2.06 (0.84-5.07)	**2.36 (1.53-3.65)**
Pressure ulcers	4.22(0.58-30.79)	0.72 (0.09-5.73)	1.16 (0.14-9.50)	1.32 (0.45-3.91)
Aspiration pneumonia	1.37 (0.14-13.47)	**2.11 (0.43-10.47)**	-	1.03 (0.30-3.52)
Fever	2.15 (1.01-4.56)	0.78 (0.31-1.91)	1.19 (0.51-2.76)	1.24 (0.78-1.96)

Unadjusted odds ratios, obtained through bivariate correlation analysis, with their 95% confidence intervals.

Residents who had a fall were more likely to improve than those who did not have a fall, which might be partly because of rehabilitation after the fall.

Odds ratios of care staff job satisfaction and global happiness are presented in Tables 4b.

Appendix Tabel 7b. Multivariable logistic regression analysis for improvement in residents' functional performance

	Required Care Level 3 (n=239, 23.9%)	Required Care Level 4 (n=395, 39.5%)	Required Care Level 5 (n=366, 36.6%)	Total (n=1,000)
Resident features				
Sex				
Male	1.05 (0.44-2.51)	2.04 (0.95-4.40)	1.87 (0.74-4.76)	1.52 (0.95-2.45)
Age groups, in years				
<80	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
80-84	2.10 (0.54-8.09)	3.06 (0.97-9.75)	1.45 (0.36-5.87)	**2.24 (1.09-4.60)**
85-89	1.55 (0.45-5.42)	1.72 (0.58-5.11)	1.85 (0.53-6.53)	1.75 (0.90-3.43)
90-94	1.42 (0.41-4.98)	1.50 (0.44-5.07)	2.62 (0.73-9.35)	1.94 (0.98-3.85)
95+	0.80 (0.16-4.13)	**5.12 (1.65-15.88)**	2.13 (0.52-8.73)	**2.38 (1.14-4.96)**
Risk events				
Fall	2.08 (0.98-4.45)	2.10 (0.92-4.83)	1.97 (0.77-5.08)	**2.36 (1.51-3.70)**
Pressure ulcers	2.86 (0.32-25.16)	0.70 (0.07-6.94)	1.39 (0.77-5.08)	1.07 (0.35-3.26)
Aspiration pneumonia	1.46 (0.13-16.49)	2.75 (0.45-16.79)	-	0.78 (0.22-2.81)
Fever	2.00 (0.86-4.67)	0.51 (0.19-1.38)	1.30 (0.53-3.21)	1.15 (0.70-1.87)

Adjusted odds ratios, obtained through multivariable logistic regression analysis, with their 95% confidence intervals.
The adjusted odds ratios of care staff's job satisfaction and happiness are presented in Table 5b.

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Appendix Table 8a. Correlation between deterioration in subdomains of functional performance and staff QWL

	ADL	Cognitive Function	Social Participation
Job Satisfaction	0.91 (0.65-1.28)	0.80 (0.48-1.32)	0.86 (0.61-1.20)
Global Happiness	0.72 (0.52-1.02)	0.86 (0.52-1.42)	0.92 (0.55-1.56)

Appendix Table 8b. Correlation between improvement in subdomains of functional performance and staff QWL

	ADL	Cognitive Function	Social Participation
Job Satisfaction	0.99 (0.62-1.59)	1.06 (0.56-2.01)	1.97 (0.89-4.36)
Global Happiness	1.06 (0.66-1.69)	0.71 (0.37-1.34)	1.06 (0.73-1.54)

Unadjusted odds ratios, obtained through bivariate correlation analysis, with their 95% confidence intervals.

Job satisfaction and happiness are represented by facility-level binary indicators (1 if the proportion of above-threshold responses is equal to or above the across-facilities median, 0 if it is below median).

These analyses were for seeking a specific subdomain of functional performance which was correlated with care staff's job satisfaction or happiness. However, no significant correlation was observed in the subdomains, presumably due to limited number of events (limited number of residents with deterioration in each of the subdomains).

Appendix Table 9. Results of bivariate correlation analysis and multivariable logistic regression analysis

Deterioration of residents' functional performance

	Care staff's job satisfaction and happiness	Resident features and risk events
Bivariate correlation analysis	**Table 4a**	**Appendix Table 6a**
Multivariable logistic regression analysis	**Table 4b**	**Appendix Table 6b**
Bivariate correlation analysis (subdomains of functional performance)	**Appendix Table 8a**	

Improvement of residents' functional performance

	Care staff's job satisfaction and happiness	Resident features and risk events
Bivariate correlation analysis	**Table 5a**	**Appendix Table 7a**
Multivariable logistic regression analysis	**Table 5b**	**Appendix Table 7b**
Bivariate correlation analysis (subdomains of functional performance)	**Appendix Table 8b**	

Reporting checklist for cohort study.

Based on the STROBE cohort guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the STROBE cohortreporting guidelines, and cite them as:

von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.

Reporting Item			Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1

one group. Give information separately for for exposed and

unexposed groups if applicable.

| Bias | #9 | Describe any efforts to address potential sources of bias | 15-16 |

| Study size | #10 | Explain how the study size was arrived at | 18 |

| Quantitative variables | #11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why | 17-18 |

| Statistical methods | #12a | Describe all statistical methods, including those used to control for confounding | 17-18 |

| Statistical methods | #12b | Describe any methods used to examine subgroups and interactions | 17 |

| Statistical methods | #12c | Explain how missing data were addressed | 18 |

| Statistical methods | #12d | If applicable, explain how loss to follow-up was addressed | n/a |

| Statistical methods | #12e | Describe any sensitivity analyses | n/a |

Results

| Participants | #13a | Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow- | 18-19 |

up, and analysed. Give information separately for for

exposed and unexposed groups if applicable.

Participants	#13b	Give reasons for non-participation at each stage	18
Participants	#13c	Consider use of a flow diagram	18
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	19
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	n/a
Descriptive data	#14c	Summarise follow-up time (eg, average and total amount)	n/a
Outcome data	#15	Report numbers of outcome events or summary measures over time. Give information separately for exposed and unexposed groups if applicable.	20-21
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	21-25
Main results	#16b	Report category boundaries when continuous variables were categorized	n/a
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a

Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	Appendix
Discussion			
Key results	#18	Summarise key results with reference to study objectives	25-26
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	26, 29-30
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	26-29
Generalisability	#21	Discuss the generalisability (external validity) of the study results	26
Other Information			
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	6

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