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Predictors of patient portal use among community-dwelling older adults
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Order of Authors:	Maan Isabella Cajita, Ph.D.
	Marci Lee Nilsen, PhD
	Taya Irizarry, PhD
	Judith Callan, PhD
	Scott Beach, PhD
	Ellen Swartwout, PhD
	Laurel Person Mecca, MA
	Richard Schulz, PhD
	Annette DeVito Dabbs, PhD
Order of Authors Secondary Information:	
Abstract:	Older adults lag behind younger counterparts in the use of patient portals, which may limit their ability to engage in health care. A better understanding of the factors associated with portal use among older adults is needed. We examined the proportion of 100 community-dwelling older adults who reported using a portal, the associations between socio-behavioral factors and portal use and modeled predictors of portal use. Of the 52% who reported using a portal, 28% used the portal on their own, and 24% received assistance from others or had others access the portal on their behalf. After controlling for confounders, only marital status was significantly associated with any portal use. Marital status and patient activation were significantly associated with independent portal use. Further exploration is warranted to identify additional factors and the possible mechanisms underlying portal use by older adults.
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Authors

Maan Isabella Cajita, PhD, RN (corresponding author)
University of Illinois at Chicago College of Nursing
845 S Damen Avenue, Chicago, IL 60612
mcajit2@uic.edu
ORCiD: 0000-0002-2331-1229

Marci Lee Nilsen PhD, RN
University of Pittsburgh School of Nursing
3500 Victoria Street, Pittsburgh, PA 15261
mlf981@pitt.edu

Taya Irizarry PhD, RN-BC
University of Pittsburgh School of Nursing
3500 Victoria Street, Pittsburgh, PA 15261
taya.irizarry@gmail.com

Judith A. Callan PhD, RN
University of Pittsburgh School of Nursing
3500 Victoria Street, Pittsburgh, PA 15261
callanja@pitt.edu

Scott R. Beach, PhD
University of Pittsburgh Center for Social and Urban Research
3343 Forbes Avenue, Pittsburgh, PA 15260
scottb@pitt.edu

Ellen Swartwout, PhD, RN, NEA-BC, FAAN
O'Neil Center/GetWellNetwork
7700 Old Georgetown Road, Bethesda, MD 20814
eswartwout@getwellnetwork.com

Laurel Person Mecca, MA
McMaster University School of Nursing
1280 Main Street West, Hamilton, ON, Canada L8S 4K
laurel.person@gmail.com

Richard Schulz, PhD
University of Pittsburgh Center for Social and Urban Research
3343 Forbes Avenue, Pittsburgh, PA 15260
schulz@pitt.edu

Annette DeVito Dabbs, PhD, RN, FAAN
University of Pittsburgh School of Nursing
3500 Victoria Street, Pittsburgh, PA 15261
ajdst42@pitt.edu

1 **Abstract**
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4 ability to engage in health care. A better understanding of the factors associated with portal use

5 among older adults is needed. We examined the proportion of 100 community-dwelling older

6 adults who reported using a portal, the associations between socio-behavioral factors and portal

7 use and modeled predictors of portal use. Of the 52% who reported using a portal, 28% used

8 the portal on their own, and 24% received assistance from others or had others access the

9 portal on their behalf. After controlling for confounders, only marital status was significantly

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11 associated with independent portal use. Further exploration is warranted to identify additional

12 factors and the possible mechanisms underlying portal use by older adults.

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14 **Keywords** (4–5): patient portal, electronic health record, technology, older adults

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Introduction

38   A well-informed patient is an empowered patient, and patient portals provide an

39   excellent way for patients to keep up to date with their health information and manage aspects

40   of their health. Patient portals are two-way, Internet-based channels for communication between

41   patients and health providers, tethered to the provider-maintained electronic health record

42   (EHR) (Irizarry, DeVito Dabbs, & Curran, 2015). Since 2014, United States (US) health care

43   providers have been required to provide patients not only with access to their electronic health

44   information but also a secure means of communicating with providers (Nahm et al., 2018), and

45   patient portals have emerged as the most common vehicle for health providers to demonstrate

46   compliance with meaningful use requirements. Other countries—including Denmark, Finland,

47   United Kingdom, and Australia—also provide patients access to their EHRs via portal (Rigby et

48   al., 2015).

49   Unfortunately, the use of patient portals has remained low (Rigby et al., 2015). Although

50   patient portal availability increased 10% (from 42% to 52%) between 2014 and 2017, the rate of

51   using the portals among patients rose by only 1.2% (from 26.8% to 28%) (Nahm, Sagherian, &

52   Zhu, 2016; Patel & Johnson, 2018). Furthermore, of the 28% of all patients who use patient

53   portals as a tool for health care engagement, only a fraction are over 65 years of age (Patel &

54   Johnson, 2018).

55   Older adults, who utilize the greatest proportion of health care resources, often face

56   difficulties using patient portals—particularly those older adults who have lower numeracy skills

57   and less experience with technology (Taha, Sharit, & Czaja, 2014; Zarcadoolas, Vaughon,

58   Czaja, Levy, & Rockoff, 2013). Other factors that prevent older adults from adopting patient

59   portals include lack of access to technology and the Internet, lack of computer and/or Internet

60   skills, visual and cognitive impairments, decreased function and dexterity of the upper

61   extremities, and concerns over the security and privacy of their health information (Sakaguchi-

62   Tang, Bosold, Choi, & Turner, 2017). These factors have been implicated in the emergence of

63 the *grey digital divide* (i.e., the gap between those who have ready access to technology and

64 the skills to make use of those technologies and the older adults who do not) (Anderson &

65 Perrin, 2017), which places older adults at a disadvantage in health care engagement that is

66 facilitated electronically.

67   On the other hand, factors that have been shown to facilitate patient portal use among

68 older adults include doctor's or family member's recommendation and receiving technical

69 assistance (Sakaguchi-Tang et al., 2017). In addition, person-level factors such as age,

70 ethnicity, education level, health status, and health literacy, or the degree to which individuals

71 have the capacity to obtain, process, and understand basic health information and services

72 needed to make appropriate health decisions (*Health Literacy: A Prescription to End Confusion*,

73 2004), have been shown to influence the patient's interest and ability to use patient portals

74 (Irizarry et al., 2015; Powell, 2017). Other factors associated with patient portal use are

75 experience in using computer technology (Latulipe et al., 2015) and patient activation, or the

76 knowledge, skills, and confidence an individual has in managing their health (Hibbard, Stockard,

77 Mahoney, & Tusler, 2004; Smith, Pandit, Rush, Wolf, & Simon, 2015).

78   Despite the increasing number of studies that investigate how patients adopt electronic

79 patient portals, little is known about the socio-behavioral factors that promote patient portal

80 uptake among older adults. A better understanding of these factors would help inform the

81 design and implementation of patient portals. Therefore, the objectives of this study were to: (1)

82 identify the proportion of community-dwelling older adults who reported using a patient portal,

83 (2) examine the associations between socio-behavioral factors (e.g., socio-demographics,

84 health status, patient activation, health literacy, and technology experience) and patient portal

85 use, and (3) model predictors of portal use among community-dwelling older adults.

86   **Methods**

87 **Study Design and Sample**

88   This study featured a cross-sectional, correlational design. Convenience sampling was

89   used to recruit a sample of community-dwelling, English-speaking, older adults (≥65 years of

90   age) from the XXX registry. The demographically diverse registry contained approximately

91   9,000 regional residents of the XXX Metropolitan Statistical Area who were willing to be

92   contacted for participation in research studies. The participants included in the registry had

93   participated in a variety of population-based surveys conducted by XXX and were found to be

94   largely representative of the regional population and reflected adequate variation in socio-

95   behavioral characteristics of interest (e.g., education level, health literacy). To be eligible for

96   participation in the study, the participants recruited from the XXX registry were at least 65 years

97   of age or older and had to be community-dwelling. The study was approved by the XXX, Human

98   Research Protection Office, Institutional Review Board.

99   **Procedures**

100   Registry personnel contacted a total of 161 older adults about participating in the

101   study—of whom 52 were unreachable, nine declined to participate, and the remaining 100

102   individuals agreed to participate (response rate of 62%). Each potential participant was then

103   mailed a copy of the study's consent form. Prior to administering the 45-minute telephone

104   survey, the interviewer obtained the participant's verbal consent in accordance with IRB-

105   approved guidelines. Each participant received $10 for participating.

106   **Measures**

107   The survey measures were selected from the core battery for demographics, health, and

108   disability from the Quality of Life Technology Engineering Research Center (NSF—0540865)

109   and the Center for Research and Education in Aging and Technology Enhancement (CREATE)

110   (NIH—5P01AG017211-21), which included the Institute of Medicine's proposed socio-

111   behavioral factors for inclusion in electronic health records (Czaja et al., 2006).

112   ***Portal use***

113   Use of a patient portal was determined by the participant's responses to the following

114   questions: (1) Have you ever used a patient portal? (Yes / No); (2) Does someone who helps

115 you with your health, help you to use the portal? (Yes—all the time / Yes—some of the time /

116 No); (3) Does someone who helps you with your health, access the portal on your behalf?

117 (Yes—all the time / Yes—some of the time / No). Participants who answered "Yes" to any of

118 these questions were categorized as patient portal users (with or without assistance).

119 ***Socio-demographic Factors***

120 Variables included age, sex, race, marital status, and educational attainment. Age was

121 treated as a continuous variable. Race was dichotomized as either white or other. Similarly,

122 marital status was dichotomized as (i.e., either single / divorced / widowed or married / living

123 with a significant other). Lastly, educational attainment was dichotomized as either having less

124 than a college degree or having a college degree or greater.

125 ***Health Status***

126 General health status was measured using the single-item General Self-Rated Health

127 (GSRH) measure (DeSalvo et al., 2006). Participants responded to "In general, how would you

128 say your health is?" according to a 5-point Likert scale (Poor = 0, Fair = 1, Good = 2, Very good

129 = 3, or Excellent = 4). Per convention, responses were then dichotomized to Poor/Fair and

130 Good/Very good/Excellent (Rosenzveig, Kuspinar, Daskalopoulou, & Mayo, 2014) . The GSRH

131 has been validated among veterans and has shown robust reproducibility, reliability, and validity

132 (DeSalvo et al., 2006).

133 ***Patient Activation***

134 The 13-item version of the Patient Activation Measure (PAM-13) was used to measure

135 patient activation (Hibbard et al., 2004). Possible PAM-13 scores range from 0 to 100 and are

136 categorized into four levels: *Level one* (score ≤ 47—respondents believe in taking an active role

137 but are unprepared; *Level two* (score 47.1–55.1—respondents have some knowledge but still

138 struggle to manage their health; *Level three* (55.2–67—respondents begin to take action but do

139 not have the skills to sustain their behavior; *Level four* (score ≥ 67.1—respondents can sustain

140 self-management behaviors, even while under stress (Hibbard, Mahoney, Stockard, & Tusler,

141   2005). The PAM-13 has demonstrated good internal consistency (Cronbach's alpha = 0.9) and

142   construct validity in studies of older adults (Skolasky et al., 2011).

143   ***Health Literacy***

144   A single-item of the Brief Health Literacy Screen (BHLS) (*How confident are you filling*

145   *out medical forms by yourself?*) was used to measure the adequacy of health literacy (Chew,

146   Bradley, & Boyko, 2004). Participants responded using a 5-point Likert scale (*Extremely* = 0,

147   *Quite a bit* = 1, *Somewhat* = 2, *A little bit* = 3, and *Not at all* = 4). Using the suggested threshold

148   (Chew et al., 2004), participants who scored two or higher were deemed to exhibit inadequate

149   health literacy. The ability of this single BHLS question to detect inadequate health literacy

150   compared to two standard measures of inadequate health literacy (S-TOFHLA and REALM) has

151   been established (among a group of 1,259 veterans aged 50 years or older), with the area

152   beneath the receiver operating characteristic curve ranging from 0.7 to 0.8 (Chew et al., 2008).

153   ***Experience with Technology***

154   The participants were asked whether they used a cellphone/smartphone, computer, or

155   home device (e.g. security systems, remote appliance setting) for health-related activities. From

156   this question, a dichotomous variable labelled "health-related technology use" was created.

157   Next, the participants were asked whether they have searched online for health information

158   (e.g., medication information, availability of health services, information about health

159   professionals, and/or information about health care facilities). From the second question, a

160   dichotomous variable labelled "health-related online use" was created.

161   **Statistical Analyses**

162   Data were analyzed using Stata/SE 15 (StataCorp LP, College Station, Texas, USA).

163   Descriptive statistics were calculated for all variables (mean, standard deviation, and

164   proportions). Only two variables (race and education level) exhibited missing data (one missing

165   data point each). As such, Little's test was performed to check the pattern of the missing data,

166   and a highly nonsignificant p-value (p = 0.4) indicated that the data were missing at random.

167   Participant characteristics between those who used the patient portal and those who did not

168   were compared with a Pearson's chi-squared test (χ^2) (for categorical variables) and a two-

169   sample T-test (for continuous variables). Associations between socio-behavioral factors were

170   estimated using a Kendall's rank correlation test with Bonferroni correction. Additionally, the

171   multicollinearity of factors was assessed with a variance inflation factor (VIF). The resultant VIFs

172   ranged from 1.2 to 1.3. The mean VIF was 1.2, which indicated a weak correlation among

173   factors. To model predictors of portal use (with or without assistance), first, bivariate logistic

174   regression analyses were conducted to identify potential correlates (cut-off threshold $p \leq 0.05$).

175   Then, a multivariate logistic model was used to identify significant predictors of patient portal

176   use ($p \leq 0.05$). As a final step, the fit of the model was tested with a Pearson's Goodness-of-fit

177   test.

178   **Results**

179   **Sample Characteristics**

180   Socio-behavioral characteristics of participants in total and by portal use are shown in

181   Table 1. A total of 100 older adults participated in the study. The mean age of the participants

182   was 74.7 ± 1.2 years, and 58 per cent were female. The majority (78%) identified themselves as

183   White. Thirty-nine per cent possessed at least a college degree and 48% were married or living

184   with a significant other. For reference, among the US population aged 65 years and older, 86%

185   identify as White, 34% have a college degree or higher, and 57% are married (U.S. Census

186   Bureau 2018). The majority (69%) of the participants rated their general health as good to

187   excellent. Indeed, almost half (49%) of the participants reported the ability to sustain self-

188   management behaviors, even when under stress (based on meeting the threshold of level four

189   for high patient activation on the PAM). An even greater number of participants (75%) reported

190   possessing adequate health literacy. Of central importance to this study, 76% of participants

191   report using technology for health-related activities and 56% reported going online to search for

192   health-related information (see Table 1).

193 **Patient Portal Use**

194   Fifty-two participants reported that they used a patient portal (with or without assistance).

195 Of these, 28 used the portal independently; six received assistance from others; five had others

196 access the portal on their behalf;13 received assistance from others and/or had others access

197 the portal on their behalf. Among the participants who received assistance in using the patient

198 portal, three reported receiving assistance all the time and 16 only some of the time. Among

199 those who had someone else access the portal on their behalf, six reported having someone

200 else access their portal all the time and 12 only some of the time.

201 **Associations between Socio-behavioral Factors**

202   We observed evidence of moderate positive associations between health literacy and

203 patient activation (tau = 0.4, $p < 0.001$), marital status and health-related technology use (tau =

204 0.4, $p = 0.03$), and health-related online use and health-related technology use (tau = 0.4, $p =$

205 0.02). The associations between the remaining socio-behavioral factors (see Table 2) exhibited

206 no statistical significance (Khamis, 2008).

207 **Bivariate Associations between Socio-behavioral Factors and Portal Use**

208   Participants, who were married or living with a significant other, exhibited higher odds

209 (odds ratio [OR] = 3.2, $p = 0.005$) of using a patient portal (with or without assistance) compared

210 to participants who were single, divorced, or widowed. Participants who used technology for

211 health-related activities exhibited higher odds (OR = 2.8, $p = 0.04$) of using a patient portal (with

212 or without assistance) compared to those who did not.

213   Subsequently, marital status (OR= 6.5, $p < 0.001$) and health-related technology use

214 (OR = 12.7, $p = 0.016$) were associated with independent portal use. Similarly, participants who

215 reported high patient activation (PAM Level four) had higher odds of using a patient portal by

216 themselves compared to participants who reported low activation (OR = 3.7, $P = 0.007$).

217 Participants who had adequate health literacy had higher odds of using a patient portal

218 independently compared to those who had inadequate health literacy (OR = 3.7, $P = 0.05$).

219   Lastly, participants who searched online for health-related information had higher odds of using

220   a patient portal on their own (OR = 4.1, P = 0.006). (Table 3)

221   **Multivariate Model of Portal Use**

222   With $p \leq 0.05$ as the cut-off, our final multivariate model comprised marital status and

223   health-related technology use. Participants who used technology for health-related activities

224   exhibited greater odds of using a patient portal (with or without assistance); however, this result

225   was not statistically significant (OR = 1.9, p = 0.2). Only marital status remained statistically

226   significant in the final multivariate model, and participants who were married or living with a

227   significant other had greater odds (OR = 2.7, p = 0.03) of using a patient portal (with or without

228   assistance). A Pearson's goodness-of-fit test indicated the final multivariate model possessed a

229   good fit (p = 0.9).

230   The final multivariate model for independent portal use comprised of marital status,

231   health literacy, patient activation, health-related technology use, and health-related online use.

232   Only marital status (OR = 5.6, p = 0.003) and patient activation (OR = 3.6, p = 0.031) were

233   significantly associated with independent portal use in the final model. A Pearson's goodness-

234   of-fit test indicated the final multivariate model for independent portal use possessed a good fit

235   (p = 0.5). (Table 3)

236   **Discussion**

237   **Patient Portal Use**

238   Among our sample of 100 community-dwelling older adults, 52% reported using a

239   patient portal. This is higher than the proportion of the general public in the Health Information

240   National Trends Survey (HINTS) who have reported accessing a patient portal (28%)(Patel &

241   Johnson, 2018). The different sampling strategies employed in our study and in the HINTS

242   could be a reason for the discrepancy in the prevalence of portal use. The HINTS used random

243   sampling whereas convenience sampling was used in our study, which could have introduced

244   selection bias, wherein older adults who used patient portals might be more likely to participate

245   in a study about patient portals. Similar to our study, Nahm et al. (2016) reported that 60.6% of

246   older adults, who they recruited from a senior's online group (SeniorNet), used patient portals.

247   **Associations between Socio-behavioral Factors**

248   Similar to the authors of a prior study (Smith, Curtis, Wardle, von Wagner, & Wolf, 2013),

249   we found a moderate positive association between health literacy and patient activation.

250   However, contrary to our findings, Couture, Chouinard, Fortin, and Hudon (2018), found no

251   relationship between health literacy and patient activation in a similar sample of adults with a

252   mean age = 60 ± 13 years and at least one chronic disease. These conflicting findings may be

253   due in part to the variety of health literacy measures, used among the studies (e.g. BHLS, Test

254   of Functional Health Literacy in Adults [TOFHLA], and Newest Vital Sign [NVS]). Nevertheless,

255   conceptually, health literacy and patient activation overlap to a certain degree; therefore, the

256   moderate statistical association is not surprising (Hibbard, 2017).

257   The association between marital status and health-related technology use, albeit

258   moderate, also was statistically significant, and the role of social influence could potentially

259   explain this association. According to the Model of Technology in Households (MATH) (Brown,

260   Venkatesh, & Bala, 2006), adoption of technology is influenced by the members of a given

261   individual's social network. For older individuals, because their households are typically

262   comprised of their spouse or partner, their decision to use technology will be mainly influenced

263   by that partner. In addition, we observed a moderate association between health-related

264   technology use and health-related online use. Considering that most of the technologies

265   included in our technology experience questionnaire were information and communication

266   technologies (e.g., cellphones and computers), these technologies were associated, which

267   should not be surprising because these technologies are commonly used to access the Internet

268   (Anderson & Perrin, 2017).

269   **Associations between Socio-behavioral Factors and Portal Use**

270   At the bivariate level, only two of the socio-behavioral factors were significantly

271   associated with any patient portal use, namely marital status and technology experience.

272   However, marital status, health literacy, patient activation, and technology experience were

273   associated with independent portal use. Participants who used technology for health-related

274   activities were more likely to use a patient portal with or without assistance. Having technology

275   experience has been found to be an essential factor in patient portal adoption among older

276   adults (Latulipe et al., 2015). Latulipe et al. (2015) reported that older adults, who lacked

277   experience with computers during their working years, demonstrated a lack of interest and

278   confidence in using a patient portal. Moreover, these older adults preferred having an in-person

279   interaction with their health care provider and were concerned that patient portals would

280   eventually replace in-person visits (Latulipe et al., 2015).

281   Similarly, marital status was associated with patient portal use. In this study, participants

282   who were married or living with a significant other had higher odds of using a patient portal

283   compared to participants who were single, divorced, or widowed. This finding is in line with that

284   of a previous study which found that older adults who were married were more likely to utilize

285   the patient portal compared to those who were not married (Arcury et al., 2017). Specifically,

286   they reported that marital status remained significantly associated with patient portal utilization

287   even after adjusting for potential confounders such as race, education, comorbidity, insurance

288   status, Internet use frequency, and geographic location. In a retrospective study of hospitalized

289   cancer patients, marital status was also significantly associated with patient portal adoption

290   (Aljabri et al., 2018). Married patients were 60 per cent more likely to use a patient portal

291   compared to patients who were divorced, single, or widowed (Aljabri et al., 2018). Marital status

292   could be considered a proxy for social influence. Similarly, marital status could also act as a

293   proxy for social support. Social influence and social support could help explain the relationship

294   between marital status and patient portal use. Social influence has been known to predict

295   technology adoption (Venkatesh, Thong, & Xu, 2016). For an older adult, one's household

296   social network may mainly consist of one's spouse or live-in partner (Brown et al., 2006).

297   Older adults are more likely to require assistance from others when learning how to use

298   new technology (Anderson & Perrin, 2017). Hence, having a spouse/partner, especially one

299   who is familiar with how to navigate a patient portal, could potentially facilitate patient portal use.

300   On the other hand, it has also been reported that married individuals who use patient portals do

301   so on behalf of their spouses and not just for their personal use (Powell & Myers, 2018). In their

302   qualitative study, Powell and Myers (2018) reported that several patients mentioned accessing

303   the patient portal as proxies for their spouses. These patients shared that they have taken the

304   responsibility of keeping up with their own and their spouses' health information (Powell &

305   Myers, 2018). In this case, instead of being the recipient of their spouses' support, the

306   participants were the ones providing their spouses with support. Further research is needed to

307   explore the mechanisms underlying the possible role of social support and social influence as it

308   relates to patient portal use. Findings may inform the design of training and ongoing support for

309   future older patient portal users.

310   Participants who reported higher levels of patient activation, meaning they were more

311   engaged in their health care, were more likely to use patient portals on their own. This finding is

312   similar to that of a national survey of U.S. adults, which reported that the respondents who had

313   high patient activation were more likely to access their medical records online (Smith et al.,

314   2015). Given this conceptual definition of patient activation, it is reasonable to expect that older

315   adults who have high levels of patient activation may be more likely to access a patient portal, a

316   tool intended to assist patients in managing their health. It is interesting to note that patient

317   portals when designed properly, can increase patient activation, suggesting a two-way

318   relationship between patient activation and patient portal use (Solomon, Wagner, & Goes,

319   2012). Electronic portals enable patients to access their health information, communicate with

320   their health care providers, and perform other health-related tasks, such as request prescription

321   refills and schedule appointments (Patel & Johnson, 2018). In a way, portals provide patients

322   with another avenue to engage in their health care, which could increase patient activation. Like

323   in a recent study of hospitalized adults, wherein the introduction of a patient portal intervention

324   led to an increase in patient activation (Schnock et al., 2019).

325   Similarly, participants who had adequate health literacy were more likely to use a patient

326   portal on their own compared to their counterparts who had inadequate health literacy. This

327   finding is in line with that of Smith et al. (2015), who explored patient portal use among older

328   adults from the Health Literacy and Cognitive Function among Older Adults (LitCog) cohort.

329   Levy, Janke, and Langa (2015) explored the relationship between health literacy and using the

330   Internet to obtain health information and found that older adults with low health literacy were

331   less likely to search for health information online compared to older adults with adequate health

332   literacy. Health literacy is an important skill to make full use of a patient portal. Hence, it is not

333   surprising that those with adequate health literacy were more likely to use a patient portal by

334   themselves.

335   Unlike previous research, in this study there was not enough evidence to support the

336   association between educational attainment and patient portal use. In a previous study,

337   participants with greater than a high school education were shown to be more likely to access a

338   patient portal compared to those with less education (Arcury et al., 2017). The impact of

339   educational attainment on patient portal use might not be as significant among older adults due

340   to a cohort effect. It was not until the early 1990s that the internet was made public (Conseil

341   Européen pour la Recherche Nucléaire, n.d.), by which time today's older adults had completed

342   their formal schooling. Latulipe et al. (2015) noted that older adults' lack of interest in using

343   patient portals could be linked to the absence of computing technology during their formative

344   and working years.

345   **Limitations**

346   This study might have been underpowered due to its relatively small sample size even

347   though we included at least ten participants per covariate. Additionally, the participants were

348   recruited from one geographic area, and minority ethnic groups were under-represented, which

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349   could limit the generalizability of our findings. As previously noted, the use of convenience

350   sampling could have introduced selection bias. The cross-sectional design also precludes

351   making predictive inferences. The use of a single-item health literacy measure could also limit

352   the reliability of our findings. Lastly, patient portal use was measured through self-report rather

353   than objectively capturing actual patient portal use, which could limit the validity of our findings.

354   Despite these limitations, the study still contributes to the existing knowledge on patient

355   portals. Its findings on the socio-behavioral factors that influence patient portal use among

356   community-dwelling older adults could benefit future researchers who are looking to improve the

357   adoption of patient portal interventions.

358   **Implications for Future Research and Nursing Practice**

359   Considering the potential influence of social support on patient portal adoption in the

360   older population, future researchers should consider including accommodations for the patients'

361   designated care partner in the implementation of their patient portals, such as inviting them to

362   the orientation session or designing the portal in such a way that would enable patients to allow

363   their care partners access to their health information from the care partners' own portal

364   accounts. Researchers should also take into consideration that not all older adults have access

365   to social support. Incorporating a virtual assistant that would guide users on how to use the

366   features of the portal could improve its adoption among independent older adults. Similarly,

367   simplifying the navigation of patient portals by imitating how a telephone menu operates could

368   improve its usability, especially among older adults who might be more familiar with engaging

369   with their health care providers through the telephone. Designing the patient portal landing page

370   like a telephone menu (with buttons or links for accessing test results, requesting prescription

371   refills, scheduling appointments, and other common portal activities) could help older adults who

372   might otherwise have difficulty navigating a typical website. Beyond patient portal design and

373   adoption, future researchers should consider examining the actual impact of patient portal use

374   on health outcomes. Cost effectiveness analyses should also be undertaken to determine

375   whether establishing a patient portal, which requires a considerable investment, would lead to

376   the desired health-related outcomes.

377   Aside from informing future research, findings from this study could inform current

378   nursing practice. As members of the most trusted profession, nurses could help facilitate the

379   adoption of patient portals by recommending them to their patients. Nurses could also show

380   their patients how to access the portals and, subsequently, how to navigate them. Receiving the

381   recommendation and support from their nurses could encourage older patients to start using

382   patient portals.

383   **Conclusion**

384   Efforts to increase patient portal use among older adults require attention to multiple

385   factors including current level of health literacy, activation level, comfort in using information

386   technology, degree of social support, and opportunities for social influence within day-to-day life.

387   The significant association between marital status and patient portal use underscores the

388   important role of social support in the elderly population and may indicate the need to provide

389   extra training and support to older individuals who are living on their own or have less social

390   support. Just as financial incentives for meaningful use of EHR technology propelled the use of

391   portals, health care stakeholders (i.e., providers and insurers) could be further incentivized to

392   focus more on providing the social support needed, such as pairing target users with health

393   coaches who could serve as a proxy for social support, to increase adoption and long-term

394   utilization of patient portals. Promoting the use of patient portals among older adults,

395   independent or otherwise, could be a means of empowering older adults to become more

396   actively engaged in their health care and could potentially narrow the grey digital divide.

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Table 1

Table 1. Socio-behavioral characteristics of participants in total and by portal use

	Total N = 100	Uses portal n = 52	Does not use portal n = 48	χ^2	*p*-value
SOCIO-DEMOGRAPHICS					
Age, mean (SD)	74.7 (1.2)	75.2 (0.99)	74.2 (1.1)	4.6 [#]	< 0.001
Sex, N (%)				0.6	0.5
Male	42 (42%)	20 (38%)	22(46%)		
Female	58 (58%)	32 (62%)	26 (54%)		
Race, N (%)				0.2	0.6
White	78 (79%)	40 (77%)	38 (81%)		
Other	21 (21%)	12 (23%)	9 (19%)		
Marital status, N (%)				8	0.005
Single/divorced/widowed	52 (52%)	20 (38%)	32 (67%)		
Married/living with significant other	48 (48%)	32 (62%)	16 (33%)		
Education, N (%)				0.1	0.7
Less than a college degree	60 (61%)	30 (59%)	30 (63%)		
College degree or greater	39 (39%)	21 (41%)	18 (37%)		
HEALTH STATUS					
General health status, N (%)				0.2	0.7
Poor to fair	31 (31%)	17 (33%)	14 (29%)		
Good to excellent	69 (69%)	35 (67%)	34 (71%)		
PATIENT ACTIVATION					
Patient activation, N (%)				1	0.3
Levels 1-3 (score ≤ 67)	51 (51%)	24 (46%)	27 (56%)		
Level 4 (score > 67)	49 (49%)	28 (54%)	21 (44%)		
HEALTH LITERACY					
Health literacy, N (%)				1.9	0.2
Inadequate	25 (25%)	10 (19%)	15 (31%)		
Adequate	75 (75%)	42 (81%)	33 (69%)		
EXPERIENCE WITH TECHNOLOGY					
Health-related tech use, N (%)				4.4	0.04
No	24 (24%)	8 (15%)	16 (33%)		
Yes	76 (76%)	44 (85%)	32 (67%)		
Health-related online use, N (%)				2.5	0.1
No	44 (44%)	19 (37%)	25 (52%)		
Yes	56 (56%)	33 (63%)	23 (48%)		

Note. # = T-test

Table 2

Table 2. Associations between socio-behavioral factors

	Age	Sex	Race	Marital status	Education	Health status	Patient activation	Health literacy	Health-related tech use	Health-related online use
Age	1									
Sex	-.004	1								
Race	-.06	.2	1							
Marital status	-.3	.2	.3	1						
Education	-.07	.2	.1	.05	1					
General health status	.1	.2	.2	.05	.1	1				
Patient activation	-.1	-.1	-.1	.02	-.1	.2	1			
Health literacy	-.1	.01	.05	.1	.03	.2	.43	1		
Health-related tech use	-.2	-.1	-.05	.35	.3	.2	.2	.2	1	
Health-related online use	-.2	-.06	.01	.2	.2	.04	.04	.1	.36	1

Note: Kendall's rank correlation test with Bonferroni correction

Table 3

Table 3. Associations between socio-behavioral factors and patient portal use

	Any portal use				Independent portal use			
	Bivariate		Multivariate		Bivariate		Multivariate	
	Odds ratio	p-value	Odds ratio	p-value	Odds ratio	p-value	Odds ratio	p-value
Age	1	0.5	--	--	1	0.3	--	--
Sex	0.7	0.5	--	--	0.7	0.4	--	--
Race	0.8	0.6	--	--	1.9	0.3	--	--
Marital status	*3.2*	*0.005*	*2.7*	*0.03*	*6.5*	*<0.001*	*5.6*	*0.003*
Education	1.2	0.7	--	--	1.8	0.2	--	--
General health status	0.9	0.7	--	--	1.9	0.2	--	--
Patient activation	1.5	0.3	--	--	*3.7*	*0.007*	*3.6*	*0.03*
Health literacy	1.9	0.2	--	--	*3.7*	*0.05*	1.5	0.6
Health-related tech use	*2.8*	*0.04*	1.9	0.2	*12.7*	*0.02*	3.5	0.3
Health-related online use	1.9	0.1	--	--	*4.1*	*0.006*	2.7	0.1

Note: Logistic regression