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ARTICLE

Socio-economic and technological aspects of mental health of older persons: the role of strong and weak ties in Ghana

Padmore Adusei Amoah[1]*, Annabella Osei-Tutu[2] and Stephen Baffour Adjei[3]

[1]Department of Applied Psychology; Institute of Policy Studies; School of Graduate Studies, Lingnan University, Tuen Mun, Hong Kong (SAR), [2]Department of Psychology, University of Ghana, Accra, Ghana and [3]Department of Interdisciplinary Studies, Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development, Kumasi, Ghana
*Corresponding author. Email: pamoah@LN.edu.hk, padmoreamoah@yahoo.com

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Abstract

Research indicates that social capital can influence the extent to which socio-economic status (SES) and information and communications technology (ICT) affect mental health. This study uses empirical data to examine the veracity of this claim by examining the effect of SES and ICT use on the mental health of older persons in Ghana, as well as the moderating role of bonding (*i.e.* strong ties) and bridging (*i.e.* weak ties) social capital in these associations. Data were drawn from 409 older persons from four regions in Ghana as part of a broader cross-sectional survey. Ordinal logistic regression analyses showed that SES and ICT use had positive associations with mental health after adjusting for other socio-demographic factors. Bridging social capital modified the association between SES and mental health positively. Bonding social capital also moderated the relations between ICT use on mental health positively. We argue that the prevalent nature of resources embedded in strong ties and the diversity of support that emerge from weak ties account for the difference in their influence observed in this study. Thus, while advances in socio-economic and technological conditions can enhance older persons' mental health, equal attention must be paid to the characteristics of their strong and weak ties as they possess the resources to make socio-technological policies even more meaningful.

Keywords: social capital; mental health; health; socio-economic status; information and communications technology; Ghana

Introduction

Health-related challenges are inevitable among older persons (Wahl *et al.*, 2012; Maharaj, 2013; World Health Organization, 2015; Amoah *et al.*, 2019). However, social and technological determinants of health such as socio-economic inequalities, poor infrastructure, deficiencies in access to information and communications

technology (ICT), unresourceful social networks and weak social service systems exacerbate poor health outcomes of older persons in low- and middle-income countries (LMICs) (Maharaj, 2013; Gyasi *et al.*, 2018, 2020; Amoah, 2019). Notwithstanding, research in LMICs has devoted little attention to the interactive relationships between some of these critical factors as regards their influence on health outcomes in later life, particularly mental health. To rectify this deficiency, this study investigates the associations of the use of ICT and socio-economic status (SES) with the mental health of older persons in Ghana. The study further examines the influence that bonding social capital (*i.e.* strong social ties) and bridging social capital (*i.e.* weak social ties) have on the associations of ICT use and SES with the mental health of older persons. The investigation of these associations is depicted in Figure 1.

Ghana's population, of about 30 million people, has been described as 'young' (Kpessa-Whyte, 2018; World Bank, 2020). However, it is projected that Ghana will have one of the highest percentages of people over 60 years in sub-Saharan Africa by 2030 (United Nations, 2015; Van der Wielen *et al.*, 2018). Social embeddedness such as friendship and kinship attachments are important for defining personhood in Ghana (Adjei, 2019). Hence, older persons and other vulnerable groups in Ghana mostly rely on family and other social networks for support in health and social life because of inadequate welfare services (Amoah, 2019, 2020; Gyasi *et al.*, 2020). Research suggests that the way in which older people use social relationships and social networks can have important implications for their mental health conditions, such as depression, anxiety and overall wellbeing (Amoah, 2019; Bai *et al.*, 2020; Gyasi *et al.*, 2020).

In the present study, we focus on SES, ICT use and social capital primarily because their impact on mental health is strongly influenced by older persons' circumstances. For instance, while access to ICT – hardware infrastructure and software programs that enable individuals, households and organisations to transmit and receive information electronically (Karakara and Osabuohien, 2019) – is considered fundamental to the mental health of populations (Kim *et al.*, 2020), its provision and utilisation vary from place to place (Forsman *et al.*, 2018). Such variation is attributed to the digital divide between and within countries (*e.g.* among low- and high-income groups and across age groups) (Ohemeng and Ofosu-Adarkwa, 2014; Karakara and Osabuohien, 2019). For example, access and utilisation of internet-enabled equipment and platforms (*e.g.* computers and smartphones) are common in high-income countries, but telephones, radio and television remain fundamental to the ICT needs in many LMICs such as Ghana (Ohemeng and Ofosu-Adarkwa, 2014; Karakara and Osabuohien, 2019). Similarly, variations in SES markers such as educational attainment, income and occupation persistently change and reinforce inequalities in general and mental health outcomes, particularly among older persons (Adler and Newman, 2002; Read *et al.*, 2016; Srivastava *et al.*, 2021). These variations and inequalities cause the impact of social capital to be critical to the way SES and ICT use affect the mental health and wellbeing of older persons (Vonneilich *et al.*, 2012; Srivastava *et al.*, 2021; Wang *et al.*, 2021). However, little research on the role of different kinds of social capital in these relationships has been carried out in Ghana. As indicated earlier, the purpose of the current study is to fill this empirical gap. The rest of the paper provides details about the theoretical perspectives and literature review related to the study and

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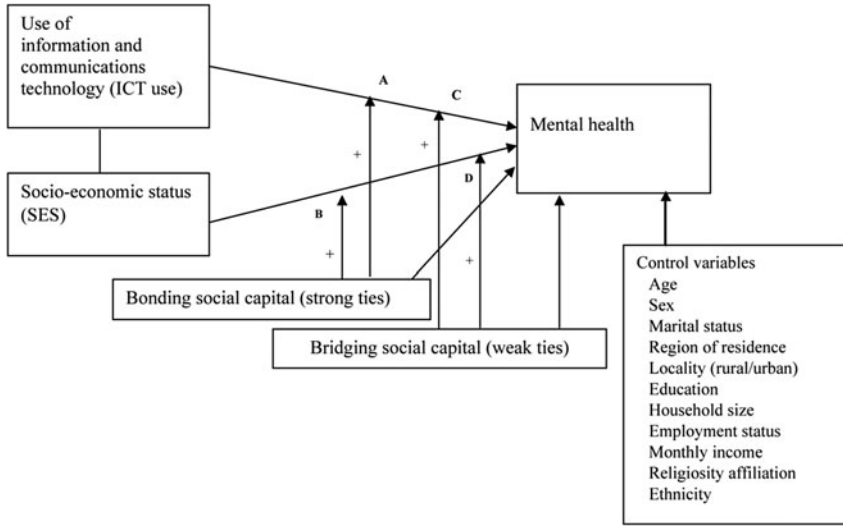

Figure 1. A heuristic model of the study.
Note: Points A, B, C and D are the primary relationships of interest to this study.

hypotheses. We then present the methodology, results from our analyses, as well as the discussion and conclusion.

ICT use, SES and mental health: theoretical and empirical perspectives

The relationship between SES and the mental health of older persons can be explained by the fundamental cause theory of health. The theory posits that SES is strongly associated with various kinds of health conditions and outcomes due to its effect on disease risk factors, access to basic resources (*e.g.* money, knowledge, ICT and social networks) to minimise the impact of health risks and its evident reproducible effect on health (Link and Phelan, 1995; Adler and Newman, 2002). Correspondingly, high SES enables individuals to manage their socio-physical environments through access to needed services while avoiding harmful physical environments and behaviours that cause stress and agony (Adler and Newman, 2002; Phelan *et al.*, 2010). Ageing well is thus associated with favourable conditions derived from SES (Hu *et al.*, 2005). Older persons with high SES tend to perceive their mental health in satisfactory terms (Hu *et al.*, 2005; Read *et al.*, 2016; Srivastava *et al.*, 2021). This is because SES influences mental health and other primary determinants of mental health such as ICT (Phelan *et al.*, 2010; Wahl *et al.*, 2012).

According to the person–environment interchange theory (P-E theory), ICT (*e.g.* internet, mobile phones, smart technologies and e-health) represents 'new' ways to experience ageing (Wahl *et al.*, 2012; Wahl, 2015). The theory conceives older persons' health as a product of the interactive exchanges they have with their circumstances. It argues that the influence of older persons' socio-physical environments on their health depends on their agency – proactive and reactive capabilities to manage the socio-physical environments for themselves. Besides, their health is also

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influenced by their sense of belonging – the extent of attachment that individuals have to their socio-physical environment (Wahl *et al.*, 2012; Wahl, 2015). ICT is considered a primary resource for older persons to engage productively with their environments because it enhances agency (*e.g.* using the internet to seek health information for themselves) (Lee *et al.*, 2020). ICT use also enables them to 'stay connected and age well' (Wahl, 2015). These benefits of ICT use help to reduce risk factors of psychological distress such as social isolation and loneliness, which are prevalent in later life and thereby promote good mental health (Ihm and Hsieh, 2015; Khosravi *et al.*, 2016; Kim *et al.*, 2020). Several empirical studies have established a connection between ICT use and older persons' mental health through mechanisms such as inclusivity and social connectivity (Ihm and Hsieh, 2015; Khosravi *et al.*, 2016; Francis *et al.*, 2019; Forsman *et al.*, 2018; Kim *et al.*, 2020).

Social capital and mental health of older persons

Despite the positive association between ICT use, SES and mental health, the relationships are seldom linear. Social capital – either from strong or weak sources – can buffer the degree of influence that ICT use and SES have on mental health of older persons (Read *et al.*, 2016; Kim *et al.*, 2020). Social capital is conceptualised as the resources (*e.g.* information, emotional support and tangible support) that emerge from the different kinds of social networks a person possesses and the associated norms of exchange (Putnam, 1993, 2000; Szreter and Woolcock, 2004; Harpham, 2008). There are other kinds of social capital aside from bonding and bridging social capital such as linking social capital and cognitive social capital (e.g. trust) (*see* Putnam, 2000; Szreter and Woolcock, 2004; Amoah and Phillips, 2017). Our emphasis on bonding and bridging social capital reflects the primary characteristics of the phenomenon as rooted in Granovetter's (1973) theory of strength of weak ties (*see also* Szreter and Woolcock, 2004). Granovetter (1973: 1371) posits that while strong social ties are fundamental to health-related well-being and access to instrumental and other forms of support, 'those to whom we are weakly tied are more likely to move in circles different from our own and will thus have access to information different from that which we receive'. Categorising social ties as either strong or weak is predicated on a 'combination of the amount of time, the emotional intensity, the intimacy (mutual confiding), and the reciprocal services which characterise the tie' (Granovetter, 1973: 1361). Thus, bonding social capital (which emerges from strong ties) describes the resources obtained through frequent and trusting relationships among groups/networks with homogenous characteristics and identity, and of equal or near-equal status such as families, close neighbours and close friends (Putnam, 2000; Szreter and Woolcock, 2004; Amoah and Phillips, 2017). Meanwhile, bridging social capital embodies weak ties that connect people of heterogeneous characteristics in terms of ethnicity, social class, geographical and social space, religion and occupational backgrounds (Halpern, 2005). Examples include distant neighbours (both in social and geographic terms), business associates and a friend of a friend (Amoah and Phillips, 2017).

Some existing empirical studies have distinguished bonding and bridging social capital and have established their role in mental health in different contexts

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(Hogarty and Wieland, 2005; De Silva *et al.*, 2007; Flores *et al.*, 2018; Bai *et al.*, 2020). Better cognitive functioning has been associated with higher bonding social capital (being married or co-habiting). In contrast, depressive symptoms have been linked to lower social capital (not being married or co-habiting) (Ramlagan *et al.*, 2013). Weak ties are also associated with positive self-worth (Zhai, 2021). Furthermore, a systematic review of the literature shows that while low SES contributes to poor psychological health, the association is weaker when the influence of social capital is examined (Read *et al.*, 2016). A study among middle-aged and older persons found that social capital shapes the association between SES and mental health (Phongsavan *et al.*, 2006). Likewise, there is evidence that social capital, especially strong ties, help to overcome the digital divide by facilitating access to and use of the internet and other technology, which can lead to better mental health (Chen, 2013). However, social capital can exclude individuals from the benefits of ICT due to limited resources in their social circles (Claudine and McCreadie, 2010; Chen, 2013). Therefore, Adler and Newman (2002) conclude that factors relating to the social environment can have a greater impact on health than elements of the physical environment. This is particularly true for older persons in LMICs, where families and other social networks are often the primary source of care and sustenance (Maharaj, 2013; Amoah, 2019; Gyasi *et al.*, 2020).

Hypotheses

Based on the fundamental cause theory and the P-E theory, as well as the empirical literature above, it is hypothesised that:

(1) High SES and ICT use will be positively associated with the mental health of older persons.
(2) Bonding social capital will positively modify the relationship between SES, ICT use and mental health.
(3) Bridging social capital will positively moderate the relationship between SES, ICT use and mental health among older persons in Ghana.

The formulation of these hypotheses arises because high bonding and bridging social capital can provide resources that make SES useful to older persons and improve their access to and use of ICT, which will ultimately empower them to manage their socio-physical circumstances to minimise stressful conditions (Link and Phelan, 1995; Putnam, 2000; Vonneilich *et al.*, 2012; Wahl *et al.*, 2012; Chen, 2013; Read *et al.*, 2016). Figure 1 depicts the variables and the primary relationships of interest to this study: points A, B, C and D.

Methods

Data were derived from a cross-sectional survey, which gathered information on the multi-dimensional aspects of wellbeing from adults who were 18 years and older. The survey was conducted from July to August 2018 in four of the ten administrative regions of Ghana, which has been increased to 16. This study analyses a subsample of the broader study with participants aged 50 years and older at the time of the survey. We used a minimum age of 50 years because of early onset of

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age-related frailty and low life expectancy among populations in LMICs (Gyasi *et al.*, 2020). The Council for Scientific and Industrial Research and Lingnan University Research Ethics Committee approved the study protocols.

Sampling and participants

A pragmatic multi-stage cluster sampling approach (Bryman, 2012) was employed in the data-gathering to have a regional, district, community (rural and urban) and household balance in the data. The first cluster comprised the four regions. Four regions were selected to consider geography (*e.g.* rural and urban areas), religious and ethnic compositions, and socio-economic characteristics. A simple random sampling was used in each region to select a conveniently determined number (N = 23) of administrative districts for inclusion, which formed the next cluster. The regions were: Ashanti (eight districts), Greater Accra (six districts), Eastern Region (four districts) and Upper East (five districts). While the four regions did not comprehensively cover all the socio-economic circumstances that exist among the whole population in Ghana, the inclusion of places such as the Greater Accra and Ashanti regions helped to capture an adequate range of characteristics of the population because of the diversity of people in these regions (Ghana Statistical Service, 2012). Thus, to ensure diversity in the sample, 36 rural communities and 70 urban areas were altogether selected across the 23 districts using a combination of convenient and purposive sampling techniques. Specific rural and urban areas were selected to become the sub-clusters for the survey. However, not all persons in these selected areas were surveyed. After demarcating the selected areas into sub-clusters, a person in every second house in the selected rural areas and a fifth house in the selected urban areas who were available and offered to participate in the study were included. This approach is consistent with techniques adopted in related studies in Ghana (Amoah, 2018; Gyasi *et al.*, 2020).

Questionnaires were proportionally distributed to the regions, districts and communities based on the available size of the sampling frame. Trained field assistants administered the questionnaires. The sample was based on the general adult population across the selected regions using a sample error of 0.05, 95 per cent confidence level and 50 per cent for the proportion of participants giving a positive response to a question (Monette *et al.*, 2008). While a sample of 384 would have sufficed, the study gathered 1,381 respondents across the regions. Of these, 409 were aged 50 years and older and are included in this article. Other details of this survey have been reported elsewhere (*see* Amoah, 2020).

Measures

Dependent variable: mental health

The General Health Questionnaire (GHQ-12) was used to measure mental health (Goldberg and Williams, 1988; Fridh *et al.*, 2014). The GHQ-12 instrument asks about recent negative (six items) and positive (six items) mental conditions relating to anxiety, ability to cope with daily demands and activities, and depression, which are measured on a four-point Likert scale: 'much less than usual', 'less than usual', 'same as usual' and 'better than usual' (Fridh *et al.*, 2014). The full instrument can be found in Table 1. All the negative items were reverse-coded so that higher scores

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Table 1. Descriptive statistics of mental health of older persons

In the last few weeks, have you…	Much less than usual	Less than usual	Same as usual	Better than usual	Mean (SD)
			Frequencies (%)		
1. been able to concentrate on daily tasks? (positive)	25 (6.1)	124 (30.3)	195 (47.7)	65 (15.9)	2.73 (0.79)
2. recently been able to enjoy your normal day-to-day activities? (positive)	21 (5.1)	107 (26.2)	211 (51.6)	70 (17.1)	2.81 (0.78)
3. lost much sleep due to worrying? (negative)	62 (15.2)	134 (32.8)	150 (36.7)	63 (15.4)	2.52 (0.93)
4. been able to face up to your problems? (positive)	38 (9.3)	113 (27.6)	176 (43.0)	82 (20.0)	2.74 (0.88)
5. felt that you were playing a useful part in things? (positive)	45 (11.0)	99 (24.2)	169 (41.3)	96 (23.5)	2.77 (0.93)
6. been feeling unhappy or depressed? (negative)	88 (21.5)	129 (31.5)	155 (37.9)	37 (9.0)	2.34 (0.91)
7. been capable of making decisions about things? (positive)	51 (12.5)	93 (22.7)	185 (45.2)	80 (19.6)	2.72 (0.92)
8. been losing confidence in yourself? (negative)	88 (21.5)	134 (32.8)	133 (32.5)	54 (13.2)	2.37 (0.9)
9. felt yourself to be constantly under strain? (negative)	99 (24.2)	127 (31.1)	139 (34.0)	44 (10.8)	2.31 (0.96)
10. been thinking of yourself as a worthless person? (negative)	97 (23.7)	132 (32.3)	140 (34.2)	40 (9.8)	2.30 (0.91)
11. felt that you couldn't overcome your difficulties? (negative)	92 (22.5)	124 (30.3)	148 (36.2)	45 (11.0)	2.36 (0.95)
12. been feeling reasonably happy, all things considered? (positive)	56 (13.7)	94 (23.0)	189 (46.2)	70 (17.1)	2.67 (0.92)

Notes: N = 409. SD: standard deviation.

represented good mental health. For purposes of our analyses, three of the items (items 3, 7 and 12) were excluded from the regression analysis to improve the reliability of the scale. This approach and others to scale purification have been used in different studies (Preston and Colman, 2000; Wieland *et al.*, 2017). The three items showed a negative corrected item-total correlation indicating their variation from other items. We posit that participants interpreted these questions differently. The remaining nine items showed adequate reliability with a Cronbach's alpha of 0.75. The nine mental health items were dichotomised for ease of interpretation. Following previous studies, responses to 'much less than usual' and 'less than usual' were given a value of '0' and responses to 'same as usual' and 'better than usual' were given a value of '1'. The results were summed to have the lowest of 0 and the highest of 9. The summed responses were used to represent mental health in the regression analyses (described under the data analyses sub-section below). However, to provide an explicit overview of mental health in the descriptive analyses, the summed responses were categorised into poor mental health (scores 0–7) and good mental health (scores 8–9) as a percentile equivalence to predominant approaches used in existing studies (Fridh *et al.*, 2014).

Independent variables

ICT use: ICT use was measured using an eclectic approach by generating the mean of the extent of use of three of prevalent media devices, namely mobile phone, television and FM radio, among older persons and most people in Ghana (Karakara and Osabuohien, 2019). Participants were asked to rate the frequency with which they used the three devices, regardless of ownership. For each device, participants responded on a five-point Likert scale: 'never', 'less than once a month', 'a few times a month', 'a few times a week' and 'every day'. The instrument was adapted from the Afrobarometer Round 7 Survey in Ghana (Afrobarometer, 2018). A Cronbach's alpha of 0.77 was observed, which assured a decent consistency in the use of the different devices and overall reliability of the scale.

SES: SES was measured using the one-item MacArthur Scale of Subjective Social Status, which has been used widely in health-related research (Adler and Newman, 2002; Sanders *et al.*, 2006; Nobles *et al.*, 2013). Participants were asked to rate their perceived social and economic positions in relation to others from 1 (low) to 10 (high). To provide a precise overview of conditions in the descriptive analyses, SES was categorised into three classes: low SES (scores 1–4), average SES (scores 5–7) and high SES (scores 8–10). However, in the regression analyses, the actual responses were used.

Moderators: social capital variables

Bonding and bridging social capital were measured using a modified form of the short version of the Adapted Social Capital Assessment Tool (S-ASCAT) (De Silva *et al.*, 2006; Harpham, 2008). In this study, the response options in the original instrument were specifically grouped to reflect the relevant types of social capital of interest (*i.e.* bonding and bridging). For bonding social capital, participants were asked to indicate if they received emotional, instrumental or informational support from these individuals within their communities in the past 12 months: nuclear family/household (*e.g.* mother, father, siblings), extended family, close

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friends, close neighbours, people from same association (*e.g.* religious group, sports and youth groups) and others (as specified by participants based on the definition provided). Participants could select as many categories as applicable to them. Likewise, for bridging social capital, participants were asked to select as many options as applied to them if they had received any emotional, instrumental or informational support from people such as a friend of a friend, people of other religious affiliations, people of other ethnicities, people in other communities/towns/abroad, neighbours they are not close with, foreigners and others (as specified by participants). The options for bonding and bridging social capital were derived through a contextual assessment in a prior study (Amoah, 2017) as De Silva *et al.* (2006) did for the original instrument. The responses for bonding and bridging social capital were summed to obtain a score for each (De Silva *et al.*, 2006; Harpham, 2008; Amoah *et al.*, 2021). Thus, higher numbers indicated more bonding/bridging social capital and *vice versa*. The two social capital variables showed only moderate correlation (*see* Appendix 1 in the online supplementary material), indicating that they measured different aspects of social capital.

Covariates

The study collected several demographic and objective socio-economic characteristics of participants, including age (in years), sex (male or female), educational attainment, monthly income/stipend and employment status, to ensure the robustness of the analyses (*see* Nobles *et al.*, 2013). Others included marital status, ethnicity, residence area (urban or rural), region of residence, household size and religion. Table 2 shows the details of how the various characteristics were measured.

Data analyses

The analyses comprised three steps. The first step was a descriptive analysis of the variables involved in the study. The second step was Spearman's correlation analysis to identify potential predictors of mental health (*see* Appendix 1 in the online supplementary material). The final step was an ordinal logistic regression analysis to identify relations between (a) SES and mental health, and (b) ICT use and mental health; and whether bonding and bridging social capital modify the relationships. To ensure the robustness of the results, seven models were constructed. However, three of these models, which contain the main results, are presented in Table 2. The first model included the socio-demographic correlates of mental health. The second model comprised the first model in addition to the independent variables and the moderators. The third model included the first two models and the interaction terms between the moderators and the independent variables. All seven models, including the other four, which tested the associations of the independent variables (*i.e.* ICT use and SES), the social capital variables as well as the interaction terms with mental health are presented in Appendix 2 in the online supplementary material. In all the models, marital status, religious affiliation and ethnicity were excluded as they are theoretically linked to bonding and bridging social capital, respectively (Szreter and Woolcock, 2004; Harpham, 2008).

Further to the regression analyses, simple slope analyses were conducted to check the robustness of the significant interaction terms. The slope analyses

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Table 2. Descriptive statistics of variables used in the study

Variable	Frequency	Percentage
Age:		
50–59	218	53.3
60–64	83	20.3
65+	108	26.4
Mean age (18–85 years) (SD)	59.56 (8.29)	
Sex:		
Male	214	52.3
Female	195	47.7
Region of residence:		
Ashanti	102	24.9
Greater Accra	41	10.0
Eastern Region	70	17.1
Upper East	196	47.9
Locality:		
Urban	207	50.6
Rural	202	49.4
Educational attainment:		
Never been to school	155	37.9
Primary school	97	23.7
MSLC	94	22.9
O Level	23	5.6
A Level	13	3.2
Vocational/technical	5	1.2
Tertiary	18	4.4
Postgraduate	4	1.0
Ethnicity:		
Asante	92	22.5
Other Akans	60	14.7
Ewe	21	5.1
Ga-Adangbe	18	4.4
Dagomba	12	2.9
Northern ethnicities	206	50.4
Religious affiliation:		
Christian	272	66.5

(*Continued*)

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Table 2. (*Continued.*)

Variable	Frequency	Percentage
Islam	50	12.2
Traditional religion	60	14.7
No religion	22	5.4
Monthly income (if employed, GH¢):		
Mean (SD)	453.21 (454)[1]	
Minimum–maximum	30–2,200[2]	
Employment status:		
Full-time employee	44	10.8
Part-time employee	29	7.1
Self-employed	153	37.4
Pension/retired	79	19.3
Student	3	0.7
Housewife	17	4.2
Unemployed	84	20.5
Household size:		
Mean (SD)	6.5 (3.28)	
Minimum–maximum	1–25	
Marital status:		
Married	275	67.2
Divorced	14	3.4
Windowed	60	14.7
Separated	14	3.4
Living together as married	3	0.7
Single	28	6.8
ICT use (mobile phone use):		
Never	60	14.7
Less than once a month	24	5.9
A few times a month	31	7.6
A few times a week	43	10.5
Every day	251	61.4
ICT use (television):		
Never	107	26.2
Less than once a month	31	7.6
A few times a month	35	8.6

(*Continued*)

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Table 2. (*Continued.*)

Variable	Frequency	Percentage
A few times a week	66	16.1
Every day	170	41.6
ICT use (FM radio):		
Never	63	15.4
Less than once a month	19	4.6
A few times a month	22	5.4
A few times a week	65	15.9
Every day	240	58.7
Mean (SD) of all ICT	3.78 (1.21)	
Minimum–maximum	1–5	
Socio-economic status:		
Low	168	41.1
Average	197	48.2
High	40	9.8
Mean (SD)	4.78 (2.14)	
Minimum–maximum	1–10	
Bonding social capital:		
Mean (SD)	3.21 (1.66)	
Minimum–maximum	0–6	
Bridging social capital:		
Mean (SD)	2.54 (1.60)	
Minimum–maximum	0–6	
Mental health:		
Poor	334	81.7
Good	75	18.3
Mean (SD)	5.23 (2.09)	
Minimum–maximum	0–9	

Notes: N = 409. 1. US $88.10 (88.3). 2. US $5.84–427.90. SD: standard deviation. ICT: information and communications technology. MSLC: Middle School Leaving Certificate.

evaluated the associations between the independent variables at different levels of the moderators (either high or low). This was done at one standard deviation below and above the mean (Dawson, 2014). Variables with missing values were replaced using the linear trend at point technique for continuous and ordinal variables, and missing categorical values were replaced by the response mean (Cokluk and Kayri, 2011). A template provided by De Coster and Iselin (2005) was used to

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compute the odds ratios for each regression estimate. Statistical significance was set at $p < 0.05$.

Results

The majority of participants were men (52.3%). They were mostly aged between 50 and 59 (53.3%) years. Almost as many participants lived in rural (49.4%) as urban (50.6%) areas. Most of them had never been to school (37.9%). Most participants were self-employed (37.4%). The participants were also mostly married (67.2%), as shown in Table 2.

Regarding the independent and moderating variables, most participants had used some form of ICT device on several occasions every week (for details, *see* Table 2). Their SES was generally poor because only 10 per cent of the older persons rated their status as high. This corresponded with low mental health as over 81.7 per cent of participants described their status as poor. Further details in Table 1 corroborate this result as most people rated their mental health modestly. Bonding social capital was more prevalent than bridging social capital (Table 2).

Table 3 shows the results from the inferential statistics of the study. From all three models of the table, older persons aged 50–59 were more likely to experience good mental health than those who were 65 and older ($B = 0.562$, $p < 0.05$). There was also evidence from Table 3 (Model 3) that older persons with some education (vocational/technical: $B = 1.732$, $p < 0.05$; tertiary: $B = 0.1.204$, $p < 0.05$) were more likely to experience good mental health compared to those who had never been to school. It was also found that older people who were employees (full-time employee: $B = 0.848$, $p < 0.05$; part-time employee: $B = 0.937$, $p < 0.05$) were more likely to have higher mental health scores compared to those who were unemployed.

Regarding the variables primary to this study's objectives, Table 3 (Model 3) shows that SES ($B = 0.127$, $p < 0.01$), ICT use ($B = 0.230$, $p < 0.05$) and bonding social capital ($B = 0.257$, $p < 0.01$) were positively associated with mental health. Bridging social capital showed an inconsistent association with mental health. It showed significant association with mental health when the analyses excluded: (a) independent variables and interactions, and (b) bonding social capital and its interaction terms (*see* Appendix 2 in the online supplementary material). However, the two categories of social capital did not moderate both primary relationships as expected. The association between SES and mental health was moderated by bridging social capital ($B = 0.311$, $p < 0.01$), while bonding social capital modified the influence of ICT use on mental health positively ($B = 0.232$, $p < 0.05$). The subsequent simple slope analyses confirmed these results. At high levels of bonding social capital, ICT use was associated with mental health ($B = 0.462$, $t = 4.405$, $p = 0.000$).

However, at low levels of bonding social capital, no association was found between ICT use and mental health ($B = -0.002$, $t = -0.016$, $p = 0.987$) (Figure 2). Likewise, the slope analyses indicated that at high levels of bridging social capital, a positive and significant association was observed between SES and mental health ($B = 0.0376$, $t = 3.178$, $p = 0.002$), but a non-significant association was observed at low levels of bridging social capital ($B = -0.120$, $t = -1.200$, $p = 0.231$), as shown in Figure 3.

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Table 3. The role of social capital (SC) in the relationship between information and communications technology (ICT) use, socio-economic status (SES) and mental health by ordinal logistics regression

	Model 1		Model 2		Model 3	
	Estimate (95% CI)	Adjusted odds ratio	Estimate (95% CI)	Adjusted odds ratio	Estimate (95% CI)	Adjusted odds ratio
Age (Ref. 65+):						
50–59	0.550* (0.035, 1.065)	1.733	0.609* (0.070, 1.148)	1.839	0.562* (0.021, 1.103)	1.754
60–64	0.442 (−0.095, 0.980)	1.556	0.591* (0.038, 1.144)	1.806	0.558 (0.005, 1.112)	1.747
Sex (Ref. Female):						
Male	0.068 (−0.293, 0.428)	1.070	−0.002 (−0.387, 0.347)	0.98	−0.085 (−0.456, 0.286)	0.919
Educational attainment (Ref. Never been to school):						
Primary school	0.307 (−0.175, 0.789)	1.359	0.124 (−0.363, 0.611)	1.132	0.094 (−0.397, 0.585)	1.099
MSLC	0.569* (0.016, 1.122)	1.766	0.330 (−0.231, 0.891)	1.391	0.387 (−0.181, 0.955)	1.473
O Level	0.229 (−0.568, 1.026)	1.257	−0.073 (−0.880, 0.734)	0.929	−0.061 (−0.876, 0.753)	0.941
A Level	−0.192 (−1.251, 0.867)	0.825	−0.466 (−1.532, 0.601)	0.628	−0.734 (−1.816, 0.348)	0.479
Vocational/technical	1.606* (0.004, 3.208)	4.983	1.589 (−0.021, 3.199)	4.899	1.732* (0.110, 3.354)	5.652
Tertiary	1.274** (0.368, 2.179)	3.575	1.034* (0.112, 1.956)	2.812	1.204* (0.274, 2.135)	3.333

(*Continued*)

Table 3. (*Continued.*)

	Model 1		Model 2		Model 3	
	Estimate (95% CI)	Adjusted odds ratio	Estimate (95% CI)	Adjusted odds ratio	Estimate (95% CI)	Adjusted odds ratio
Postgraduate	1.010 (−0.854, 2.875)	2.746	1.229 (−0.638, 3.097)	3.418	1.351 (−0.526, 3.228)	3.861
Region of residence (Ref. Upper East):						
Ashanti	−0.333 (−0.806, 0.140)	0.717	−0.498* (−0.989, −0.007)	0.607	−0.499* (−0.997, −0.002)	0.607
Greater Accra	−0.381 (−1.006, 0.243)	0.682	−0.625 (−1.275,.025)	0.535	−0.508 (−1.161, 0.145)	0.602
Eastern Region	3.248*** (2.648, 3.848)	25.739	3.279*** (2.664, 3.894)	26.549	3.433*** (2.762, 4.103)	30.969
Employment status (Ref. Unemployed):						
Full-time employee	0.794* (0.106, 1.483)	2.212	0.829* (0.123, 1.536)	2.291	0.848* (0.139, 1.558)	2.334
Part-time employee	0.943* (.143, 1.743)	2.568	0.898* (0.089, 1.708)	2.454	0.937* (0.120, 1.754)	2.552
Self-employed	0.160 (−0.336, 0.656)	1.174	0.102 (−.397, 0.602)	1.107	0.113 (−0.402, 0.629)	1.119
Pension/retired	0.499 (−0.109, 1.107)	1.647	0.306 (−0.316, 0.928)	1.358	0.197 (−0.429, 0.823)	1.218
Student	−0.333 (−2.454, 1.788)	0.717	−0.273 (−2.424, 1.878)	0.761	−0.236 (−2.395, 1.924)	0.789

Housewife	−0.798 (−1.769, 0.173)	0.450	−0.825 (−1.797, 0.147)	0.438	−0.920 (−1.896, 0.056)	0.399
SES			0.112* (0.025, 0.223)	1.119	0.127* (0.038, 0.371)	1.135
ICT use (index)			0.241** (0.077, 0.441)	1.272	0.230** (0.065, 0.479)	1.259
Bonding SC			0.226** (0.083, 0.469)	1.254	0.257** (0.110, 0.463)	1.293
Bridging SC			0.116 (−0.494, 0.056)	1.123	0.097 (−0.053, 0.319)	1.101
SES × Bonding SC					−0.018 (−0.291, 0.254)	0.982
ICT use (index) × Bonding SC					0.232* (0.140, 0.435)	1.261
SES × Bridging SC					0.311** (0.051, 0.571)	1.365
ICT use (index) × Bridging SC					−0.040 (−0.280, 0.200)	0.961
Nagelkerke pseudo R^2	0.350		0.398		0.419	

Notes: Model 1 = socio-demographic correlates of mental health. Model 2 = Model 1 + independent (SES and ICT use) and moderating (bonding and bridging SC) variables. Model 3 = Model 1 + Model 2 + interaction variables. The full model comprising the robustness checks are shown in Appendix 2 in the online supplementary material. CI: confidence intervals. Ref.: reference category. MSLC: Middle School Leaving Certificate.
Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

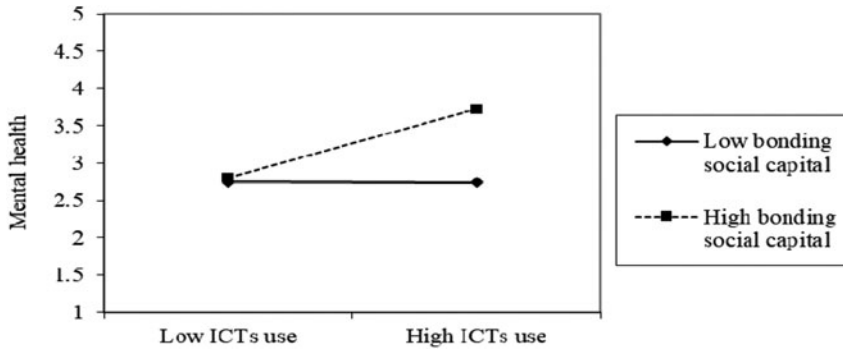

Figure 2. Bonding social capital moderates the relations between information and communications technology (ICTs) use and mental health. The template for Figure 2 was obtained from Dawson (2014).

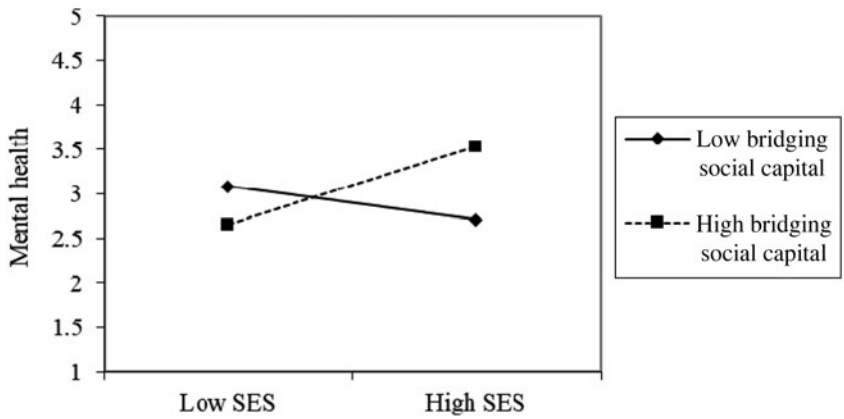

Figure 3. Bridging social capital moderates the relations between socio-economic status (SES) and mental health. The template for Figure 3 was obtained from Dawson (2014).

Discussion

Factors influencing the mental health of older persons in LMICs are numerous and complex. This study aimed to expand understanding of these complexities by examining the moderating roles of strong social ties and weak social ties in the association of SES and ICT use with mental health among older persons in Ghana. Consistent with our first hypothesis, older persons with high ICT use and high SES were more likely to perceive their mental health in satisfactory terms than those with low ICT use and low SES. While we found evidence of the moderating role of social capital, some inconsistencies were observed with regard to our second and third hypotheses. None of the social capital categories significantly moderated the two primary associations. Instead, bridging social capital moderated the association between SES and mental health, while bonding social capital modified the influence of ICT use on mental health. These observations are discussed below in light of our hypotheses.

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The positive association between SES and mental health augments the widely held view that SES is a fundamental cause of health outcomes, even among potentially vulnerable groups such as older persons (Adler and Newman, 2002; Phelan *et al*., 2010; Read *et al*., 2016). Congruent to the tenets of the fundamental cause theory, the association between SES and mental health involved different resources (Link and Phelan, 1995; Phelan *et al*., 2010). Bridging social capital moderated the association between SES and mental health positively, as proposed in our third hypothesis. This finding offers a substantial empirical basis concerning how social capital can attenuate widening social inequalities, which are injurious to mental health, especially in LMICs where older persons are more vulnerable to the vagaries of their socio-physical environments (Maharaj, 2013; Amoah *et al*., 2019). Concerning mental health, vulnerable people tend to place significant value on support emerging through weak social ties as opposed to personal or strong ones (Cohen, 2004; Hogarty and Wieland, 2005). Perceived interconnectedness can minimise psychological distress of older persons by boosting perceived socio-economic conditions (Putnam, 2000; Cohen, 2004; Song, 2011). It must be emphasised that the role of bridging social capital in this study is imputable to its fundamental characteristics, such as the provision of new resources (including economic, financial and even emotional support) compared to strong ties (Granovetter, 1973). The resources emerging from weak ties can offer older persons a new sense of purpose in life by raising their status in societies and thereby improving their mental health. Additionally, an abundance of weak social ties encourages a sense of belonging, which facilitates overall wellbeing (Granovetter, 1973; Wahl *et al*., 2012). This is why scholars argue that weak ties such as bridging social capital help people to 'get ahead' instead of the inward-looking bonding social capital, which enables people to 'get by' (Putnam, 2000).

Consistent with our first hypothesis, we observed a positive association between ICT use and mental health. The use of ICT helps older persons to understand, change and adapt to their socio-physical environments more easily by paving the way for healthy ageing as put forward by P-E theory (Wahl *et al*., 2012; Wahl, 2015). This result also aligns with the theses of other research findings (*e.g.* Ihm and Hsieh, 2015; Khosravi *et al*., 2016; Francis *et al*., 2019; Forsman *et al*., 2018; Kim *et al*., 2020).

Nonetheless, our results have indicated that strong ties (bonding social capital) modify the association between ICT use and mental health. The contribution of bonding social capital to the mental health of older persons is invaluable across contexts, and this is even so in the case of high-income countries (Ramlagan *et al*., 2013). ICT involves technical and financial implications which older persons may not be able to afford because many older persons rely on their strong social ties to access and use ICT (Claudine and McCreadie, 2010; Chen, 2013; Olsson *et al*., 2019). Moreover, the influence of bonding social capital in the association between ICT use and mental health relates to the more accessible nature of such strong ties compared to the support derived from weak ties (Granovetter, 1973). Strong social ties are usually the first point of contact for information, instrumental support and decisions about everyday activities, including access to ICT devices/services (Szreter and Woolcock, 2004; Chen, 2013; Amoah *et al*., 2018). Indeed, Chen (2013) argues that while ICT devices and services can promote social connectivity, the right social

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capital must be in place to close the existing digital divide (*see also* Claudine and McCreadie, 2010). According to the present study, bonding social capital is most likely the right social capital, especially when it comes to the effects of ICT on mental health. For instance, it is argued that 'once people overcome informational, motivational, and technical barriers and gain Internet access, bridging social capital is less crucial in affecting online communication' (Chen, 2013: 23). Because this study focused on commonly used ICT in Ghana, it is understandable that bonding social capital would be more influential in its association with mental health. Strong social ties are said to exert more peer pressure than weak ties regarding technology uptake (Chen, 2013). Thus, bonding social capital must be an integral part of measures to improve older persons' mental health through modern technology.

The results and the preceding discussions generate curiosity about what caused the roles of bonding and bridging social capital to differ from the propositions stated in our hypotheses. Such differences in the moderating effect of the two social capital categories reinforce their theoretical relevance by offering critical insight into the debates concerning their distinctiveness and similarities (Halpern, 2005; Kawachi and Berkman, 2014). Firstly, this study adds to existing empirical and theoretical works in its support of the appropriateness of distinguishing between different kinds of social capital in analysing the implication of their effects on health (Szreter and Woolcock, 2004; Ferlander, 2007; Nyqvist *et al.*, 2013). The differences in the moderating roles of bonding and bridging social capital in this study expand understanding of how each of these resources can help to improve the mental health of older persons. Second, it is possible that these social capital categories are best examined and utilised through an analysis of their functions in a given situation instead of the much-adopted approach focusing on the network characteristics, at least among older persons. Our position contests perspectives such as:

> while bonding–bridging distinction may be important in some cases, maybe we don't need to worry quite so much about always measuring both bonding and bridging social capital – if an individual or community is rich in one, they will probably be rich in the other, too. (Halpern, 2005: 21)

Thus, this study posits that the actual evidence of these forms of social capital may lie in their functions rather than in their mere availability, as demonstrated by their distinctive influence on the mental health of older persons in this study. Such functional diversity may have contributed to the different influence of bonding and bridging social capital on the associations between SES, ICT and mental health of older persons; and invites further studies into the role that these social phenomena play in improving mental health (Nyqvist *et al.*, 2013).

Limitations of the study

While the study expands our knowledge and understanding of the complex nature of older persons' mental health, it must be emphasised that the results are based on a cross-sectional study that limits the potential for drawing causal inferences. The sampling process was also not based entirely on a probability approach because of challenges, including lack of a complete address system and highly nucleated and

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scattered settlement patterns, making randomisation almost impossible in a household survey like this one. Thus, the sample is based on a balanced instead of a representative one. Besides, the study relied on and tested only two categories of social capital; it excluded the cognitive components of the phenomenon. Such an approach certainly offers a partial perspective on the importance of social capital to the mental health of older persons. Future studies should extend this work by considering other aspects of social capital, such as trust. In addition, ICT use was based on selected devices/services, and albeit justified, cannot be said to represent the entirety of older persons' experiences because of differences in specific definitions of ICT and SES between regions and communities in Ghana. These limitations imply that the results of the study cannot be generalised to the entire country. However, the results have significant implications for understanding the mental health of older persons in Ghana. It is also helpful to note that while important relations were found between socio-demographic characteristics of the older persons and their mental health, such results have not been discussed and factored into the conclusions drawn from this study. This leaves an important gap for future studies to fill.

Conclusions

Few studies have examined the socio-technological aspects of mental health in Ghana. This study has attempted to expand the knowledge base in this research area. The findings indicate that both strong and weak social capital are important phenomena in understanding the influence of SES and ICT use on mental health. The mental health of older persons, irrespective of their material and immaterial assets, is conditioned by social capital. Specifically, it was apparent from our discussions that the prevalent nature of strong ties and the diversity of resources embedded in weak ties resulted in their unique effect on the relations between ICT use and mental health, and SES and mental health, respectively. While the findings cannot be generalised due to some of the limitations elaborated above, they point to the potential areas for interventions to address problems with the mental health of older persons that can be attributed to their SES and access to and use of technological resources. Therefore, the generation of both strong and weak social ties and the support that emerges from these networks hold promising potential for the mental health of older persons, and they must be given attention in health promotion interventions.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/S0144686X21001859

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Conflict of interest. The authors declare no conflicts of interest.

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