# Information and Communication Technology, Well-being, and Ethnicity

**Running Title:**

Information technology and well-being

**ABSTRACT**

The relationship between use of information and communication technologies (ICTs) and well-being is an increasingly debated public health issue. Currently, there is limited understanding of how the ethnic digital divide influences this association. Thus, this study assessed how ethnicity has historically moderated relations between ICT (mobile phone, computer, TV) uptake, and several well-being indicators; (a) long-term health (chronic illness), (b) cigarette smoking, and (c) self-perceptions of personal health. Archived data from a UK Office for National Statistics household survey 2007-2011 (97,697 participant records) was analysed, controlling for multiple socio-demographic confounders. Mobile phone dependence was associated with poorer health perceptions in Caucasian women, but more favourable appraisals in ethnic minority females (OR = 0.51). Furthermore, mobile phone uptake was more strongly related to increased behavioural risk (cigarette smoking) in Caucasian men compared with ethnic minority males (OR = 1.68). Ethnicity did not influence relations between ICT uptake and long-term health. Overall, ethnicity was implicated in relations between mobile phone use and well-being indicators: unfavourable associations occurred primarily in Caucasians.

## INTRODUCTION

The association between information and communication technology (ICT) uptake and well-being has generated considerable interest amongst health professionals[1]. The definition of well-being remains contested[2]. For the purposes of this study we adopted a broad framework proposed by A. McNaught[3], in which well-being denotes a multidimensional construct encompassing individual wellbeing, and also wider contextual factors. Individual wellbeing incorporates subjective appraisals (e.g., positive or negative evaluations of one's personal health) and physical experiences (e.g., symptoms of chronic illness)[4]. Crucially, these elements are linked to wider societal factors, notably inequalities involving ethnic identity and access to material resources (e.g., ICTs)[4].

ICT uptake can improve wellbeing, by providing digital access to health care (e.g., online interventions) and monitoring (e.g., viewing electronic health records)[5]. Other evidence implicates ICT usage in adverse health outcomes[6]. For example, ICT use has been linked to long-term health problems, such as lower back pain[7]. Nevertheless, the association between ICT and well-being is complex, depending in part on socio-demographic factors, notably age and gender[8]. For example, intensive mobile phone usage has been associated with poorer perceived health in adolescent girls[9]. Also, higher computer use has underpinned sleep disturbance in men[10]. However, there has been growing interest in the role of ethnicity[5]. Research suggests an ethnic 'digital divide', primarily between Caucasians and ethnic minority groups (EMGs)[11]. ICT uptake is typically higher amongst Whites compared to EMGs[12].

An analysis of nationally representative US data from 2007 to 2012, collected by the National Cancer Institute, found that while internet access is similar for Blacks and Latinos, access is higher amongst Caucasians[12]. Another investigation found that Black and Latino diabetes sufferers were less likely to use a computer- based patient portal (e.g., to view laboratory results, request medication, make medical appointments), compared to Caucasians[13]. Face-to-face or telephone interviews with mostly older adults found that Blacks and Hispanics were more likely to have never used the Internet, compared with Causasians[14]. However, other research suggests greater use of digital technology amongst ethnic minorities, compared to Caucasians[15]. Unlike in the US, the ethnic digital divide in the UK is less clear cut[16]. ICT uptake is generally similar in Whites compared to non-Whites[16]. Indeed, ownership of certain ICTs (e.g., PCs, digital TVs) is higher amongst certain EMGs, compared to the Caucasian population[16]. However, Whites are generally more inclined to use a computer-based health care intervention[17], perhaps denoting greater awareness of the health benefits of ICT uptake. However, regardless of which ethnic groups are disadvantaged, any digital disparity can lead to ethnic-based inequities in health care[5], and hence differentials in well being[4].

Although research suggests an ethnic digital divide[11], there is a paucity of evidence concerning how the disparities in digital uptake affect wellbeing[18]. For example, does the higher ICT exposure in Caucasians denote better health outcomes? In other words, is the association between digital uptake and wellbeing moderated by ethnicity? A review of the literature on neck pain amongst workers implicated computer use as a risk factor, and found Caucasians to be more susceptible compared with non-Whites[19]. However, such evidence is rare. Most studies on the digital divide fail to address the moderating effect of ethnicity on ICT exposure and wellbeing[12, 14]. For example, the aforementioned analysis of US survey data on digital inequities didn't address whether greater ICT uptake amongst Caucasians denoted better health outcomes in this ethnic group[12]. This criticism also applies to the interview-based study demonstrating an ethnic digital divide[14]. One review of literature on the harmful effects of mobile phone use made little reference to ethnic differences[8]. Thus, it remains unclear how the digital divide actually benefits or disadvantages whites or non-

Whites, whether in terms of physical wellbeing (e.g., long-term illness) or psychological wellbeing (e.g., self-perceptions of health).

There are at least two reasons why ethnicity may qualify relations between ICT use and well-being. Firstly, there is an ethnic digital divide, as indicated earlier[11]. Secondly, EMGs experience poorer health profiles compared to the White population, with the former experiencing higher rates of chronic diseases such as cancer, diabetes, and cardiovascular disease[20]. EMGs are also more susceptible to behavioural risk factors associated with these illnesses, for example cigarette smoking[21]. Underlying social disparities, notably poorer health literacy, and lower income, may precipitate less healthy lifestyles in EMGs[22], cigarette smoking again being a notable behavioural risk factor in this context[23].

Rates of smoking-related illnesses vary as a function of ethnicity[24]. Cigarette smoking is the leading cause of preventable death and a major public health concern. It is implicated in cardiovascular disease, cancer, diabetes, and other major causes of premature mortality[25], and also considered a reliable index of physical and psychological wellbeing[26]. For example, a reduction in cigarette smoking has been associated with improved subjective well-being[27]. Furthermore, cigarette smoking has inspired the development of a large number of computer-based anti-smoking programmes and media campaigns[28]. Thus, ethnic groups that enjoy higher ICT uptake may have more access to these digital interventions[29], and hence experience reduced smoking rates and improved wellbeing[30].

Research also indicates ethnic variations in subjective evaluations of personal health[31], an indicator of individual wellbeing[4] and predictor of morbidity and mortality rates[32]. Individuals may evaluate their health negatively or positively, conditioned by objective or subjective experiences, such as back pain, chronic illness, or perceived symptoms[4]. The fact that EMGs experience higher rates of chronic diseases may have implications in this regard[20]. Evidence from five EU countries revealed more negative self-perceptions of health amongst EMGs, compared to Whites, even after controlling age, gender and key socio-economic indices[33].

Given that ethnicity is implicated in *both* well-being and ICT use, it is necessary to understanding how cultural differences have historically influenced relations between these variables. If the ethnic digital divide is associated with significant inequities in wellbeing, such that a specific racial group is better off from ICT uptake, this will add further urgency to calls to harness digital resources to benefit disadvantaged communities[5]. For example if mobile phone use denotes better management of diabetes or cardiovascular risk factors (e.g, less tobacco use) amongst EMGs, health care providers can focus on developing tailored mobile-based interventions or monitoring tools to further improve health outcomes in these demographics[34]. Thus, the purpose of this study was to examine archived data, to determine the extent to which ethnicity moderates associations between ICT uptake and three well-being indicators; (a) self-perceptions of health, (b) cigarette smoking, and (c) long-term health.

## METHOD

### *Participants*

This study involved an analysis of archived cross-sectional data from the GHS/GLF (General Household/Lifestyle Survey), a multi-purpose annual survey run by the UK Office for National Statistics[35]. The GHS/GLF has been conducted in Britain since 1971. The survey targets all adults aged 16 or over living in sampled households. To ensure the recruitment of representative samples, the surveys employed stratified design, sampling addresses from specific postcode areas. Data was collected weekly all year through face-to-face interviews. The study reported here analysed aggregated data from 2007 to 2011. Annual sample sizes ranged from 18,367 to 30,069, with an aggregated data set of 97,697 partially nonorthogonal participant records.

*Survey methods*

*ICT uptake*: Three key binary variables were created: '*Mobile-only'* (*yes*=1/*no*=0), '*Computer'* at home (*yes*=1/*no*=0), and *'Television*' at home (*yes*=1/*no*=0). Mobile-only was defined as relying solely on a mobile phone, with no other telephone device (e.g., landline phone). This strict definition was due to perceived overlap in the use of mobile and fixed-line phones, a potential source of confounding. We assumed a significant proportion of participants still had access to landline phones, for making/receiving calls, internet access, or both. To isolate mobile phone uptake, individuals with *both* mobile and landline phones were classified in the same category as people without a phone, or those with only a fixed line phone, and coded '0'.

*Long-term health*: Long-term health was assessed with the item *'Do you have any long-standing illness, disability or infirmity? By long-standing, I mean anything that has troubled you over a period of time or that is likely to affect you over a period of time?'* Respondents indicated *yes*=1/*no*=0.

*Self-perceived health*: Self-assessment of health was measured with the item. '*How is your health in general? Would you say it is…*'. Response options were *Very good, Good*, *Fair*, *Bad*, *Very bad*. These options were collapsed into a simple dichotomy; *Good* (Very good, Good) scored '1', and *Bad* (Fair, Bad, Very bad) scored '0'.

*Behavioural risk*: Cigarette smoking behavior was dichotomised into '*smokers*' (scored '1') and '*nonsmokers*' (scored '0'). A 'smoker' was defined as someone smoking 0 to

20+ cigarettes per day/week, while a ‘non-smoker’ was anyone in ‘*ex-smoker*’, or ‘*never smoked*’ categories.

*Ethnicity*: Ethnicity was classified from up to fifteen ethnic groups: ‘White British’, ‘any other White background’, ‘Mixed White and Black Caribbean’, ‘Mixed White and Black African’, ‘Mixed White and Asian’, ‘Other mixed…’, ‘Asian’ British/Indian/Pakistani/Bangladeshi/Other), ‘Black’ (British/Caribbean/African/Other), ‘Chinese’, and ‘Any other’. As *Caucasians* accounted for over 80%, the data was collapsed into a basic dichotomy, to maximise the number of non-whites. This binary variable consisted of ‘*White*’ (White British’, ‘any other White background’) coded ‘1’ versus ‘*EMG*’ (all other ethnic categories) coded ‘0’. The non-white group consisted primarily of people of *South Asian* (Pakistani, Indian, Bangladeshi) and *Afro-Caribbean* (Black African, Black Caribbean) descent.

*Confounding variables*: Six variables were treated as confounders: *age* (16+), *gender* (male/female), *education* (highest educational qualification of the HRP [Household Reference Person]), occupation (manual/non-manual), receipt of *income support* (HRP and/or partner receives income support), and *year* of data collection (2007-2011). Receipt of income support was considered a more reliable index of income status, due to the multi-faceted nature of a person’s financial circumstances (e.g., employment, savings, and dependents). Rather than simply ask people how much they earn, we opted for an (arguably) more accurate and reliable measure of deprivation - living in a home where the HRP, or their partner, received income support. As a general rule this social security benefit is paid to people who don't have sufficient funds to live on. However, ascertaining eligibility entails the evaluation of multiple personal and situational factors, including weekly income, employment status, partners’ employment status, and amount of savings. It is ‘means-tested’ and hence provides a reasonably accurate measure of an individual’s 'real-life' economic circumstances.

*Bias*

To reduce selection bias data analysis GHS/GLF data collection has historically been stratified based on age, gender, and post-code[35]. Furthermore, data sets were weighted to account for non-responding and underrepresentation. The surveys employed a standardised interview protocol and individual questionnaire. In the present study confounding variables were either employed in stratification (gender) or treated as covariates during data analysis.

*Data analysis*

The data was analysed using binary hierarchical logistic regression, controlling for confounding variables (age, income support, educational level, occupation, year of data collection). Prior to regression analysis the data was first stratified by *gender*. Next, *age, income support, educational level, occupation,* and *year of data collection,* were entered in the regression model as predictor variables (*Step* 1), followed by *ethnicity* and *mobile-only*, *computer*, and *TV* uptake (*Step* 2), and finally three Ethnicity x ICT interaction terms (*Ethnicity x Mobile phone*, *Ethnicity x Computer,* and *Ethnicity x TV*) (*Step* 3). This hierarchical protocol was performed separately for each of the three outcome variables; (a) self-perceived health, (b) long-term health status, and (c) behavioural risk (cigarette smoking). Significant interactions were explored graphically, using the predicted probabilities from each model. To reduce the likelihood of false positives (*type 1* errors) we performed a bonferroni correction across all five data sets. This suggested an alpha level of $p$<0.0001. All analysis was performed using SPSS (Statistical Package for the Social Sciences) version 21.

## RESULTS

*Descriptive data*

Descriptive statistics are shown in *Table* 1. There were significant ethnic differences in ICT uptake, behavioural risk and long-term health. Overall, Caucasians were less likely to rely solely on a mobile phone ($p$ <0.0001) and less likely to have a home computer ($p$ <0.0001). There were no ethnic variations in TV uptake. Regarding well-being, Caucasians were more likely to have a long-term health condition ($p$<0.0001), more likely to smoke ($p$<0.0001), and tended to evaluate their health more negatively, $t(9782.33) = -9.37$, $p$<0.0001.

[See Table I on next page]

[See Table II on next page]

*Self-perceived health*

Logistic regression results for perceived health are presented in *Table* 2. Amongst men, having a home computer was associated with better perceived health compared to not having one ($p$<0.001). There was no interaction between ICT variables and ethnicity. A more varied predictive profile emerged for women. Caucasian females felt healthier than non-White women ($p$<0.001). Like men, females with a home computer also reported more favourable appraisals of personal health, compared to those without one ($p$<0.001). However, unlike men, ethnicity moderated relations between mobile phone dependence and perceived health

**Table I**

| Variables | All men Non-White | White | | All women Non-White | White | |
|---|---|---|---|---|---|---|
| Age (mean/SD) | 29.7/±20.2 | 41.8/±23.9 | *P* <0.001* | 31.4/±19.7 | 43.3/±23.8 | *P* <0.001* |
| Perceived health (%) | | | | | | |
| Fair/Bad/Very bad | 13.8 | 18.4 | *P* <0.001* | 16.3 | 19.7 | *P* <0.001* |
| Good/Very good | 86.2 | 81.6 | | 83.7 | 80.3 | |
| Long-term health (chronic illness) (%) | | | | | | |
| No | 83.2 | 67.9 | *P* <0.001* | 81.4 | 66.9 | *P* <0.001* |
| Yes | 16.8 | 32.1 | | 18.6 | 33.1 | |
| Health behaviour (smoker) (%) | | | | | | |
| Non-Smoker | 91.2 | 86.1 | *P* <0.001* | 94.6 | 84.9 | *P* <0.001* |
| Smoker | 8.8 | 13.9 | | 5.4 | 15.1 | |
| Income support (receiving) (%) | | | | | | |
| No | 93.6 | 95.9 | *P* <0.001* | 90.7 | 94.9 | *P* <0.001* |
| Yes | 6.4 | 4.1 | | 9.3 | 5.1 | |
| Educational level (%) | | | | | | |
| Has Qualification | 87.5 | 87.5 | *P* >0.001 | 87.7 | 85.8 | *P* <0.001* |
| No Qualification | 12.5 | 12.5 | | 12.3 | 14.2 | |
| Occupation (%) | | | | | | |
| Non-Manual | 83.4 | 74.1 | *P* <0.001* | 88.4 | 82.5 | *P* <0.001* |
| Manual | 16.6 | 25.9 | | 11.6 | 17.5 | |
| Mobile-only (%) | | | | | | |
| No | 90.1 | 93.1 | *P* <0.001* | 90.8 | 93.1 | *P* <0.001* |
| Yes | 9.9 | 6.9 | | 9.2 | 6.9 | |
| Home computer (%) | | | | | | |
| No | 10.5 | 15.6 | *P* <0.001* | 11.1 | 19.0 | *P* <0.001* |
| Yes | 89.5 | 84.4 | | 88.9 | 81.0 | |
| Television | | | | | | |
| No | 20.6 | 19.9 | *P* >0.001 | 19.7 | 19.8 | *P* >0.001 |
| Yes | 79.4 | 80.1 | | 80.3 | 80.2 | |

**Table II**

| | Perceived health<br><br>OR (CI) Sig | Long-term health (chronic illness)<br>OR (CI) Sig | Health behaviour (smoking)<br>OR (CI) Sig |
|---|---|---|---|
| All men | | | |
| Age | 0.96 (0.96-0.96) *P* <0.001* | 1.04 (1.04-1.04) *P* <0.001* | 1.01 (1.01-1.01) *P* <0.001* |
| Income support | 0.23 (0.20-0.25) *P* <0.001* | 3.53 (3.18-3.93) *P* <0.001* | 1.58 (1.40-1.78) *P* <0.001* |
| Educational level | 0.69 (0.64-0.74) *P* <0.001* | 1.19 (1.12-1.27) *P* <0.001* | 1.30 (1.20-1.40) *P* <0.001* |
| Occupation | 0.67 (0.63-0.70) *P* <0.001* | 1.19 (1.13-1.25) *P* <0.001* | 2.47 (2.33-2.62) *P* <0.001* |
| Year | 0.99 (0.97-1.01) *P* >0.001 | 1.03 (1.02-1.05) *P* <0.001* | 0.99 (0.97-1.00) *P* >0.001 |
| Ethnicity | 1.40 (0.99-1.97) *P* >0.001 | 1.16 (0.87-1.54) *P* >0.001 | 1.08 (0.76-1.54) *P* >0.001 |
| Mobile-only | 0.73 (0.53-1.01) *P* >0.001 | 0.90 (0.68-1.19) *P* >0.001 | 1.70 (1.27-2.28) *P* <0.001* |
| Home computer | 1.61 (1.23-2.12) *P* ≤0.001* | 0.61 (0.48-0.77) *P* <0.001* | 0.62 (0.47-0.82) *P* ≤0.001* |
| Television | 0.84 (0.65-1.08) *P* >0.001 | 0.93 (0.76-1.14) *P* >0.001 | 1.17 (0.90-1.52) *P* >0.001 |
| Ethnicity x Mobile-only | 0.79 (0.56-1.10) *P* >0.001 | 1.17 (0.87-1.58) *P* >0.001 | 1.68 (1.24-2.28) *P* ≤0.001* |
| Ethnicity x Home computer | 0.82 (0.62-1.08) *P* >0.001 | 1.30 (1.02-1.65) *P* >0.001 | 1.51 (1.14-2.01) *P* >0.001 |
| Ethnicity x Television | 1.10 (0.84-1.42) *P* >0.001 | 1.10 (0.89-1.35) *P* >0.001 | 0.86 (0.65-1.12) *P* >0.001 |
| All women | | | |
| Age | 0.96 (0.96-0.96) *P* <0.001* | 1.04 (1.04-1.04) *P* <0.001* | 1.01 (1.01-1.01) *P* <0.001* |
| Income support | 0.28 (0.26-0.31) *P* <0.001* | 2.54 (2.31-2.78) *P* <0.001* | 2.27 (2.05-2.50) *P* <0.001* |
| Educational level | 0.79 (0.74-0.84) *P* <0.001* | 1.08 (1.02-1.15) *P* >0.001 | 1.18 (1.10-1.27) *P* <0.001* |
| Occupation | 0.62 (0.59-0.66) *P* <0.001* | 1.30 (1.24-1.37) *P* <0.001* | 2.46 (2.32-2.62) *P* <0.001* |
| Year | 1.00 (0.98-1.02) *P* >0.001 | 1.03 (1.02-1.05) *P* <0.001* | 0.98 (0.96-1.00) *P* >0.001 |
| Ethnicity | 1.67 (1.22-2.29) *P* ≤0.001* | 1.22 (0.92-1.61) *P* >0.001 | 3.36 (2.10-5.36) *P* <0.001* |
| Mobile-only | 1.17 (0.85-1.62) *P* >0.001 | 0.90 (0.67-1.19) *P* >0.001 | 3.14 (2.28-4.33) *P* <0.001* |
| Home computer | 1.71 (1.33-2.19) *P* <0.001* | 0.68 (0.54-0.85) *P* ≤0.001* | 1.04 (0.72-1.49) *P* >0.001 |
| Television | 0.93 (0.74-1.17) *P* >0.001 | 1.00 (0.82-1.21) *P* >0.001 | 1.31 (0.93-1.85) *P* >0.001 |
| Ethnicity x Mobile-only | 0.51 (0.37-0.72) *P* <0.001* | 1.34 (0.99-1.81) *P* >0.001 | 1.01 (0.73-1.41) *P* >0.001 |
| Ethnicity x Home computer | 0.84 (0.65-1.08) *P* >0.001 | 1.17 (0.93-1.48) *P* >0.001 | 1.14 (0.79-1.64) *P* >0.001 |
| Ethnicity x Television | 0.99 (0.78-1.25) *P* >0.001 | 1.03 (0.84-1.27) *P* >0.001 | 0.77 (0.54-1.10) *P* >0.001 |

in women ($p$<0.001); *Figure* 1 shows that compared to other women, mobile-only females perceived themselves *less* healthy if they were Caucasian, and *more* healthy if they were from an EMG background.

*Long-term health*

Results for long-term health are shown in *Table* 2. In men, individuals with a home computer were less likely to be suffering from a chronic illness ($p$<0.001). There was no interaction between ICT variables and ethnicity. A similar predictive profile emerged in women; those with a home computer were less likely to have a long-term health condition ($p$<0.001). ICT uptake failed to interact with ethnicity in predicting long-term health.

*Behavioural risk*

*Table* 2 shows the findings for health-compromising behaviour. Amongst men ICT variables independently predicted smoking status; cigarette smoking was more likely in mobile-only men ($p$<0.001), but less probable in those with a home computer ($p$<0.001). Furthermore, the association between mobile phones and cigarette smoking was moderated by ethnicity ($p$<0.001); mobile-only men were more likely to smoke, but this relationship was more pronounced in Caucasians, compared with their EMG counterparts (see *Figure* 2). There was a near-significant interaction between ethnicity and having a computer ($p$=0.004). Amongst women, both ethnicity and mobile dependence showed independent associations with behavioural risk; cigarette smoking was over three times more likely in Caucasian women ($p$<0.001), and mobile-only females ($p$<0.001). However, unlike in men, ethnicity did not affect relations between ICT variables and cigarette smoking in women.

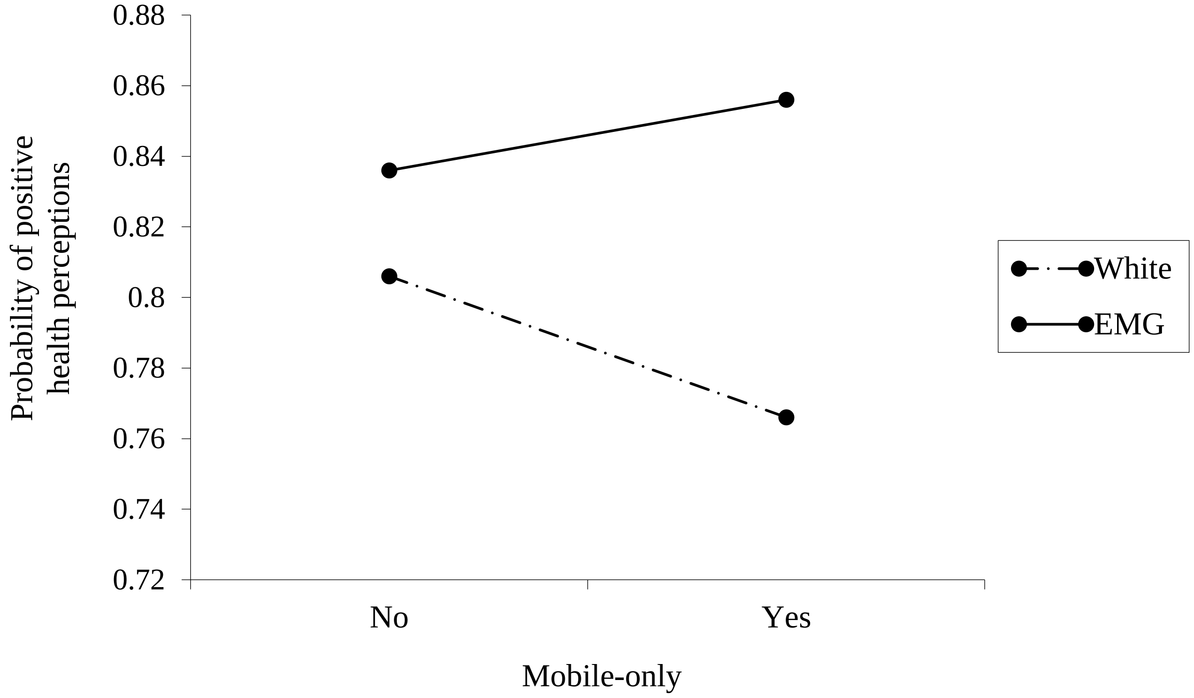


Figure 1 Mobile phone x Ethnicity interaction in predicting women's self-perceived health

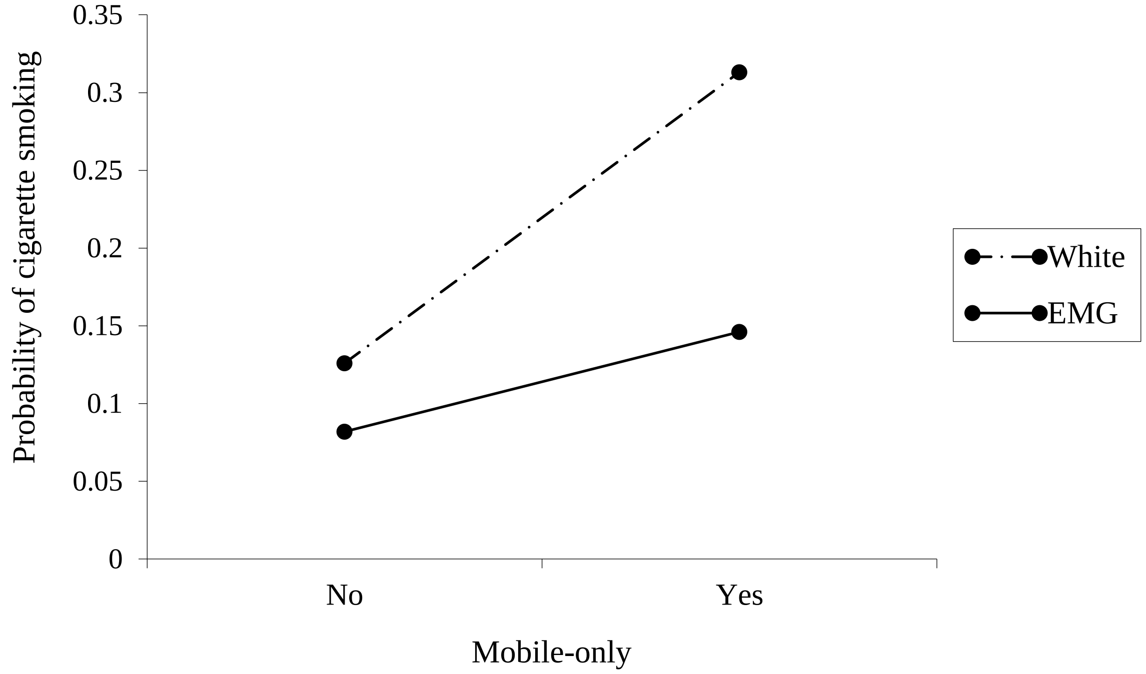


Figure 2 Mobile phone x Ethnicity interaction in predicting men's cigarette smoking

## DISCUSSION

This study suggests ethnicity moderates both the magnitude and direction of relations between ICT uptake and well-being. More specifically, the association between mobile phone uptake and perceived health was reversed for Caucasian women compared with their EMG counterparts. Furthermore, the relationship between having a mobile phone and being a smoker was more pronounced in Caucasian men compared to EMG males. These interactions weren't explained by age, educational background, economic circumstances, occupation, or year of data collection. Overall, the findings highlight an ethnic digital divide, but one characterised by indications of poorer well-being amongst Caucasians.

What cultural factors may underpin the present findings? Research suggests Caucasians in the UK are generally more likely to engage with an ICT-based health intervention, especially if they've had prior health problems[17]. Thus, it is possible Whites who evaluate their health negatively, perhaps due to an adverse medical history, are more disposed to use ICTs to access online health care[29]. Alternatively, Caucasian ICT users may experience more health problems associated with ICT use (e.g., neck pain, musculoskeletal problems), and hence evaluate their health more negatively as a result. For example, Caucasians are more susceptible to neck pain linked to computer use[19]. Either way, greater ICT uptake will correspond with more negative self-perceptions of health amongst Whites.

It is interesting that mobile-only Caucasian *females* evaluated their health more negatively, whereas their EMG counterparts felt healthier. Punamaki et al[9] have demonstrated that mobile phone use predicts poor self-evaluations of health in young women, partly due to sleep deprivation, waking-time tiredness, and musculoskeletal symptoms resulting from intensive use. The present findings suggest Caucasian women are especially prone to such pessimistic assessments. The reason for this propensity is unclear. Mobile phone activity is more pronounced in females generally, causing more sleep deprivation and musculoskeletal issues in the former group[7, 9]. Furthermore, Juno et al[36] have found higher mobile uptake amongst White females compared to EMG women, suggesting the former experience more sleep-related problems associated with ICTs, and hence may consider themselves *less* healthy[9].

The *Mobile x Ethnicity* interaction observed in men can be best explained by reference to culture, gender, and the notion that mobile phones and cigarettes are complementary products that satisfy overlapping psychological needs (e.g., the desire to look 'cool')[37]. EMGs experience stronger cultural constraints against cigarette smoking, compared with Whites. This is particularly so for people of South Asian descent, notably Muslim and (particularly) Hindu's and Sikhs[38]. Thus, for South Asians, the idea of cigarettes and mobile phones as complementary ('get one and you have to get the other'!) may be more problematic to fulfill, due to greater cultural proscriptions on smoking.

That the *Mobile x Ethnicity* interaction applied only to males arguably reflects (a) more severe cultural/religious sanctions faced by EMG women[38], and (b) differences in how males and females in general perceive mobiles and cigarettes. South Asian women face greater social penalties for smoking[38], and hence may universally avoid cigarettes regardless of mobile phone ownership. Furthermore, females as a whole may see less overlap between cigarettes and mobiles - to them these products seemingly serve very different functions; mobile phones are primarily a means of communicating and interacting with friends, via online social networking, texting, and so on, while smoking serves mainly for weight control[39]. Thus, relations between mobiles phones and cigarettes may be attenuated in females, regardless of ethnicity.

The absence of an ethnic influence on relations between ICTs and long-term health is intriguing. ICT use has been implicated in chronic health conditions, such as lower back pain[7]. Since EMG's are more susceptible to poor health, including chronic illness[20], we expected any adverse effect of ICT use to be aggravated in these communities, given their increased risk. However, people with chronic conditions may rely heavily on ICTs (e.g., mobile phones) for communication with health services, such that ethnic differences have little relevance.

This study has several limitations. From 2005 the GHS/GLF adopted a longitudinal design, in which some households were sampled repeatedly. Thus, data sets from this period onwards are partly nonorthogonal. However, year of data collection was treated as a covariate; this variable was partialled out prior to testing the direct effects of ethnicity/ICT, and their interaction terms. It is worth noting that while the probability of long-term illness increased significantly over time, year had no impact on perceived health, or behavioural risk. Another limitation is the lack of data on intensity of ICT use. Variations in the intensity of use may help explain ethnic differences in well-being associated with ICT exposure. Finally, this study merely offers a 5-year 'snap shot' on how ethnicity affects relations between ICT uptake and well-being. The impact of ICTs on society changes very rapidly[8]. Thus, there is a need for population-based research to verify the present findings, especially in relation to mobile phones (arguably the most prolific ICT, in terms of uptake/use).

In conclusion, this study contributes to existing literature in three ways. Firstly, it shows that ethnicity has historically affected both the strength and direction of associations between ICT uptake and individual well-being. Secondly, the study shows these interactions apply primarily to subjective (self-perceptions of health) and lifestyle (cigarette smoking) indications of individual wellbeing, rather than wellbeing denoted by physical symptoms (long-term illness)[4]. Thirdly, it demonstrates that the influence of ethnicity relates mainly to mobile phone uptake. Overall, mobile phone owners tended to evaluate their health more negatively if they were female and Caucasian; furthermore, mobile phone users were more likely to smoke if they were male and Caucasian. Overall, adverse associations between ICT uptake and well-being emerged primarily in *Caucasians,* irrespective of wider socio-demographic factors. More research is needed to better understand these ethnic effects, particularly their implications for current public health campaigns to mitigate the ethnic digital divide and also improve wellbeing[5].

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Figure Legends

Figure 2 Mobile phone x Ethnicity interaction in predicting women's self-perceived health

Figure 2 Mobile phone x Ethnicity interaction in predicting men's cigarette smoking