**Experiencing the Digital Divide: A Longitudinal Analysis of Cell Phone Ownership, Use, and Diffusion among Young Adults in Southern Malawi**

Hannah E. Furnas[1], The Pennsylvania State University

**Abstract**

The experience of the Digital Divide – inequality of access to and use of technology – is well understood at the population level, with developing countries lagging behind, particularly in cell phone use; less is known about how these inequalities in use impact individuals at the community level. The Southeastern African country of Malawi provides a unique context for studying the Digital Divide, as the vast majority of the population is covered by cell phone towers, but less than half of households actually own a cell phone. My project uses longitudinal data from a study of young adults in Southern Malawi, Tsogolo la Thanzi, to (1) understand the prevalence and predictors of the digital divide in rural Malawi and (2) assess what it means for young adults in Malawi to experience the digital divide, through measuring the impact of cell phone ownership and use on indicators of subjective well-being. I use multinomial logistic regression and random effects models to determine the predictors of access and use for young adults in Malawi and how these relationships change over time.

**Key Words:** Digital Divide; Malawi; Technological diffusion; Cell phones; Status

[1] The author can be reached at hzf113@psu.edu

## BACKGROUND

Following the advent of the internet and the cellular phone, social and political scientists, economists, and ICT experts coined the term "the digital divide" to refer to inequalities of access to and use of technology across populations. The digital divide tends to be used as a buzz word for "any and every disparity within the online community" (Norris 2001, p.4), though some researchers use the term more specifically to indicate "disparities in cell telephone systems" (Buys et al. 2009, p. 1494), "inequality between the "haves" and "have-nots" differentiated by dichotomous measures of access to or use of new technologies" (DiMaggio and Hargittai 2001, p.1), or "global differences in access to resources and in networking with world society" (Drori and Jang 2003, p. 144). Much of the existing research has looked at inequalities in the diffusion of new technologies at the population level, cross-nationally and cross-sectionally; yet, many cross-sectional studies could be criticized as "blurred snapshots of a moving bullet" due to the rapid rate of diffusion and adaptation (Norris 2001, p. 26). Overall though, studies find that developing regions tend to lag behind in the uptake of internet and cellular technologies and this trend has been slow in much of sub-Saharan Africa (SSA) where dispersion of technologies across rural populations can be difficult and costly.

The use of cell phones in sub-Saharan Africa has been hailed as transformative for economic and social development (Aker and Mbiti 2010; James and Versteeg 2007), particularly because many individuals in SSA do not have access to computers and instead use cell phones to access the internet. Recent research has noted that cell phones can be used as a tool to improve chronic and acute disease management in developing countries (Kaplan 2006; Lester et al. 2010; Pop-Eleches et al. 2011). Pop-Eleches et al. (2011) report that cell phones are a potential tool for encouraging adherence to antiretroviral therapy in SSA, as "many resource-limited settings have well developed cellular telecommunications networks and mobile phone ownership worldwide has grown dramatically" (p. 2). The cell phone also symbolizes "modernity and capitalism," encouraging "informal globalization" in rural markets (Donner 2008, p. 147). This indicates that not only does the cell phone provide internet access and connection to a globalizing world, but at the community level these phones may act as status symbols. In fact, DiMaggio and Hargittai (2001) note that, "at first, access to [a] new technology is restricted to *an elite*" (p. 4; italics added). These first users, or "new adopters," of a technology tend to be the first to experience access to and use of cellular technologies (DiMaggio and Hargittai 2001, p. 5).

Despite the clear cross-national digital divide, spatial analysis has shown that cell phone coverage in many SSA countries has increased enormously over the past decade (Buys et al. 2009). Particularly, the Southeastern African country of Malawi has seen an increase from zero percent coverage in 1999 to 93.1 percent of the population identified as having cell phone coverage in 2006 (Buys et al. 2009, p. 1499). These numbers raise an important question: is coverage enough? To address this conundrum I ask the following questions. (1) What does cell phone ownership and use look like in Malawi where coverage is reportedly high?; (2) What important social and demographic factors influence the access to and use of cell phones in the developing country context?; And, to address the issue of access versus use, as raised by James and Versteeg (2007), Buys et al. (2009), and others, (3) does owning a cell phone always equate to use and do individuals who do not own a cell phone still use a cell phone through sharing (James 2011)? The second piece of my project will explore what it means to be one of the "technology elites." Specifically, does owning a cell phone impact well-being and livelihood for this "first adopters?" More generally, my project will introduce the concept of the digital divide to the discipline of demography,

emphasizing the importance of this concept for development, population health, and understanding social networks in the developing country context.

## STUDY CONTEXT

My project takes place in Malawi, a country in southeastern Africa with a population of around 16 million (World Bank 2013). In 2006, a majority of the Malawian population (93.1 percent) and land area (79.8 percent) had cell phone coverage (Buys et al. 2009). These are high numbers given that Malawi is largely rural (84 percent) and scores 170 out of 187 countries on the human development index (Population Reference Bureau 2014; UNDP 2013). Infrastructure in Malawi is poor, with 55 percent of roadways unpaved and public transportation costly and often dangerous (CIA 2011; Cole 2004). It is important to note that quality of cell phone service varies greatly across the country with some areas experiencing up to 30 percent dropped call rates per month (Batzilis et al. 2010).

Despite these discrepancies between coverage and development little research has looked at the actual access to and use of technology, particularly cell phones, for individuals in Malawi. A notable project looks at the predictors of service rollout and network performance in Malawi and, while the project looks at the population level, the researchers note that the "ability to access the network in Malawi is still somewhat limited to wealthier individuals" (Batzilis et al. 2010, p. 7). This is due in large part to the cost of purchasing a phone and, subsequently, air time (referred to in Malawi as "units"). They note that the cost of a handset can be equal to 50 days labor and "cell phone rates in Malawi are still 5 times higher than the per-second cost of using a cellular phone in the US" (Batzilis et al. 2010, p. 8). In a country where around 60 percent of the population lives on less than 1USD per day, these costs represent substantial obstacles to cell phone access and use (UNDP 2010).

The Malawi Demographic and Health Survey reports that 39 percent of Malawian households own a mobile phone (National Statistical Office and ICF Macro 2011). Yet, the number of actual cell phone users may be higher. Lopez (2000) notes that, "although a mobile phone may nominally belong to a single person, in some African countries it is regarded as the property of the community, because there is a culture of sharing around communication" (p. 65). This "culture of sharing" indicates that there may be two types of users: (a) users who own cell phones and (b) users who borrow (i.e. through sharing) cell phones.

## DATA & METHODS

The data for my project come from an ongoing longitudinal study in Southern Malawi titled Tsogolo la Thanzi (TLT), which translates to "Healthy Futures." The baseline sample consists of 1,505 females and 600 male respondents aged 15 to 25 years. These respondents were randomly selected from census enumeration areas within 7 kilometers of the district capital, Balaka. Eight waves of data are collected across a period of three years from 2009 to 2012. At each wave, respondents are asked if they own a cell phone. Regardless of the response to the previous question, all respondents are also asked if, in the last month, they have acquired phone units (prepaid minutes that are loaded onto a cell phone in order to place calls, use data, or text). Respondents who acquired units in the last month can report that they either purchased them for themselves or that the units were given as a gift. A respondent who reports that the units were a gift is then asked who the gift was from. Possible responses include: parent, spouse,

romantic partner, sibling, friend, aunt/uncle, or other. These data represent a unique opportunity to look at the digital divide at the community level, as well as the ability to measure both access and use.

In order to address both access and use, I construct a variable that includes these two aspects of the digital divide– indicating whether a respondent owns a phone and/or if a respondent uses a phone (acquiring units will serve as a proxy for this). The four values for the cell phone use and ownership variable are as follows: (1) do not own a cell and do not use units, (2) do not own a cell but use units, (3) own a cell but do not use units, and (4) own a cell and use units. Essentially, the first value represents complete nonuse of cellular technologies, while the two middle categories represent either lack of ownership but access to units that would be used on a borrowed phone or ownership of a phone but no units to use on the phone. The last category is individuals who have the resources to both own and use a phone. I will follow a descriptive analysis of these variables with a random effects model, predicting movement into and out of cell phone access and ownership across time. My primary independent variables include years of education, gender, SES, distance to town center, age, and experience of job shocks (specifically if the respondent got a better job, worse job, or lost a job between waves).

## PRELIMINARY RESULTS

My preliminary descriptive results show that indeed, ownership and cell phone use vary across time and key demographic variables. Figure 1, below, shows that there is a clear trend in ownership of cell phones across time, with a decrease in the percent of individuals who neither own nor use a cell phone and an increase in respondents who both own and use a cell phone. Notably, the middle groups (i.e. owning but not using and using but not owning) remain relatively steady across time, with less than 5 percent of respondents in each group at any given wave, indicating that the "culture of sharing" in Malawi is not as pervasive as expected or that cell phones are more accessible than anticipated. Regression models will help expand on this further to indicate what characteristics predict membership in these middle categories as opposed to the two dominant categories.

**Figure 1. Percent Cell Phone Ownership and Use across Waves**

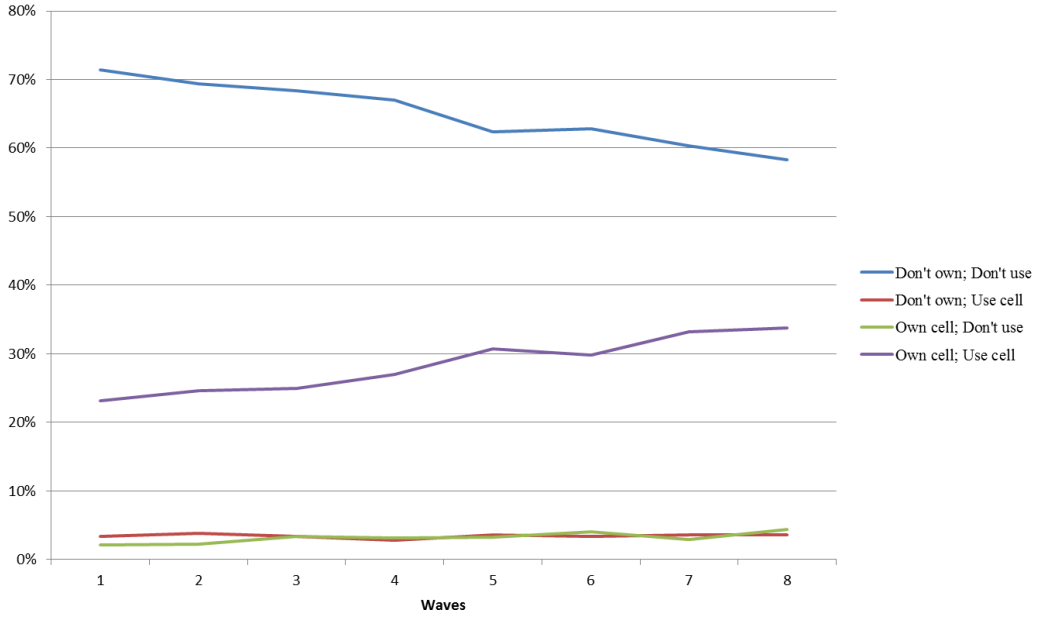

Table 1, below, provides some preliminary insight into the relationships between a few demographic markers and the four outcome groups at baseline, although my project will primarily focus on change over time using all eight waves of data. Using the baseline data, I find that younger, less educated, poorer, and more rural females are significantly more likely to be in the group who do not own a cellphone and do not use a cell than the group of individuals who own a cell phone and use it. Similarly, younger and poorer women are more likely to be in the group that do not own a cell phone but acquire units, compared to those who do own a cell phone and use it. Distance to town center significantly predicts membership in the group that does not own a cell but acquires units, with more urban individuals being significantly ($p$<0.05) less likely to fall into this group, as compared with the group who owns and uses a cell phone. This suggests that rural Malawians are more likely to engage in sharing of cell phones. The only significant predictor of owning, but not using the cell phone, as compared to owning and using the cell phone, is level of education. With each additional year of education, an individual is about 15 percent less likely to be in the group who owns a cell but does not use the cell, suggesting that with an increase in education, individuals are more likely to own and use a cell phone.

**Table 1**. Multinomial Logistic Regression Predicting Cell Phone Ownership and Use at Wave 1, Relative Risk Ratios

| | *Don't Own; Don't Use* | *Don't Own; Use Cell* | *Own Cell; Don't Use* | *Own Cell; Use Cell (REF)* |
|---|---|---|---|---|
| Age | 0.750*** | 0.885** | 0.935 | - |
| | (0.02) | (0.04) | (0.05) | - |
| Female | 1.887*** | 1.072 | 1.367 | - |
| | (0.26) | (0.30) | (0.48) | - |
| Years of Education | 0.848*** | 0.925 | 0.855* | - |
| | (0.02) | (0.05) | (0.05) | - |
| SES (standardized; from low SES to high SES) | 0.351*** | 0.401*** | 1.034 | - |
| | (0.03) | (0.07) | (0.19) | - |
| Distance to town center (normed) | 0.962 | 0.686* | 1.147 | - |
| | (0.07) | (0.12) | (0.22) | - |
| **N** | 2062 | | | |
| pseudo R-sq | 0.208 | | | |

*Exponentiated coefficients; Standard errors in parentheses; * p<.05, ** p<.01, *** p<.001*

## NEXT STEPS

In an uncertain and tumultuous economic environment, having the resources to use a cell phone may vary over time, owning a cell phone doesn't necessarily equate to using a cell phone, and individuals who do not own cell phones may have access to phones through sharing. For young adults in Malawi, cell phone ownership and use may rely on both time invariant variables (such as gender) and time variant ones (such as job stability and educational attainment). I will utilize all eight waves of data in a random effects model to see how these time variant and invariant characteristics influence the ownership and use of a cell phone. Next, I will use the ownership and use variable as an independent variable in a model predicting one's subjective level of well-being to see, after controlling for all of the variables that predict cell phone ownership/use, if owning or using a cell phone impacts an individual's perception of their livelihood. Overall, the goals of my project are twofold: (1) to understand the prevalence and predictors of the digital divide in rural Malawi and (2) to assess what it means for young adults in Malawi to experience the digital divide, through the impact of cell phone ownership and use on subjective well-being.

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