WIFI USE AND MENTAL HEALTH IN A REFUGEE CAMP IN ITALY

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ABSTRACT

Background: Migrants often rely on digital connectivity enabled by WiFi hotspots accessed via technologies such as mobile phones. However, there is a lack of evidence of the relationship between WiFi use and mental health during displacement. We assessed the relationship between symptoms of depressive disorder and digital connectivity, as well as potential mediating mental health outcomes of perceived social support and self-efficacy.

Methods: This study included a cross-sectional, census survey of displaced individuals in a transit camp in Italy. The survey consisted of a structured questionnaire: connectivity was operationalized as WiFi use in the past week and mobile phone ownership. Mental health status was evaluated by interviewer-administered screening tools for depressive disorder (8-item Patient Health Questionnaire), perceived social support (Duke-UNC Functional Social Support Questionnaire), and self-efficacy (General Self-Efficacy Scale).

Results: In total, 104 migrants were included (97% men). The median age was 26 years (interquartile range 22-30). Nearly two-thirds (72%) of participants accessed WiFi daily in the past week, and 60% owned a mobile phone. Over 86% of participants had symptoms consistent with moderate/major depressive disorder. There is a trend between daily access to WiFi in the past week and increased social support and perceived self-efficacy (OR: 1.28, 95% CI: 0.52 – 3.13 and OR: 1.41, 95% CI 0.57 – 3.48, respectively), and lower odds of depressive symptoms (OR: 0.84, 95% CI 0.16 – 4.44).

Interpretation: This data provides evidence of the role of WiFi access in the mental health of displaced persons in a refugee camp setting.

Keywords: Refugees, Migrants, WiFi, Mental health

BACKGROUND

The world is facing the greatest number of forced migrants since World War II due to the changing nature of conflict and compounding effects of climate change. The characteristics of 21st century forced migrants are unique, as are the contexts in which they migrate. Reliance on the Internet for information and communication with family, friends and other networks is a defining characteristic of both forced migrants and organizations and governments that seek to provide humanitarian assistance, information and support. Among forced migrants that have recently arrived in Europe, many have coordinated and organized their movements using digital infrastructure: smartphones, online maps, translators, electronic money transfers, social media and real-time messaging are facilitating one of the largest mass migrations in human history – all creating a reliance on Internet connectivity.

Similarly, humanitarian organizations rely on the Internet to provide information and distribute aid. However, Internet access varies substantially across different contexts and is mediated by devices used to facilitate connection and regular access to connectivity and devices themselves. Evidence from a study among Syrian refugees in Greece demonstrates the potential association between depressive disorder and mobile phone connectivity.[1] However, the pathways through which connectivity, such as WiFi usage, improves the mental health of displaced populations have yet to be assessed. We hypothesize that WiFi connectivity is associated with increased perceived social support and self-efficacy, and a reduced probability of depressive disorder. Evidence of how WiFi supports wellbeing during 21st century migration is needed to achieve the humanitarian imperative of assisting the most vulnerable populations with connectivity.

The overall objective of this study was to develop an in-depth understanding of how WiFi connectivity interventions in humanitarian contexts affect displaced populations in a camp setting. The study used a methodology that yields internally and externally valid results, which can be adapted across the complex settings in which humanitarian crises exist. This method was adapted for the migration trends in Italy at the time of the study in order to collect empirical evidence of the demographic and socioeconomic predictors of WiFi use to inform humanitarian aid delivery and policy.

This study investigated the relationships between WiFi use with mental health outcomes among forced migrants, including asylum seekers and refugees, in Italy.

METHODS

This research was a collaboration between Mercy Corps and the Harvard Humanitarian Initiative. The study included a face-to-face cross-sectional survey in a transit camp in Ventimiglia, located at the border of France and Italy. Data were collected in June 2019. Access to the camp was granted by the camp management as well as the Italian Prefecture.

Sample size and sampling strategy

Individuals ≥18 years of age with verbal Arabic, English, Italian, Farsi, French, Urdu, or Tigrinya language skills were eligible to participate. A minimum representative sample of 97 participants was needed to estimate the prevalence of the primary outcomes with ±10% precision in the 95% confidence intervals (95% CIs) under the assumption of maximum variability.

The sampling frame included all adults residing in the transit camp during the study period. The camp population was characterized by turnover – each day, approximately 5-20 of camp residents left while 16-24 individuals arrived. Upon arrival, individuals receive an identification card that is scanned to enter and exit the camp, and to receive services including meals and health care. We approximated the camp population during the study period as the number of individuals scanning their identification cards for meals (range: 136-155 individuals).

This study used mixed sampling procedures. The first phase consisted of purposive sampling procedures for several reasons specific to the high turnover of the camp population: 1) a detailed sampling frame for simple random sampling was not available, 2) the research team chose not to recruit individuals the day they were admitted to the camp and occupied with settling in, and 3) to prevent coerced consent.

After establishing familiarity with and receiving positive feedback regarding the research from camp management and the study population, a second phase of sampling was deemed feasible and was performed to increase the representativeness of the sample. The research team recruited a quasi-census sample by going door-to-door. The total combined sample from the first and second phases of sampling was 104 participants.

Procedures

In order to facilitate representation of the diversity of individuals in camp settings, all survey items were translated to and back-translated from Arabic, Italian, Farsi, French, Urdu, and Tigrinya. Face-to-face interviews took place in an area with audio privacy. The survey was administered by a member of the research team.

The survey, available upon request, was designed to evaluate the relationship between mental health status and WiFi connectivity.

Measures

The primary outcomes were moderate or major depressive disorder, perceived social support, and self-efficacy based on the theoretical framework of the relationship between WiFi connectivity and mental health.

Depressive disorder

Depressive disorder screening was conducted with the Patient Health Questionnaire-8 (PHQ-8).[2] The PHQ-8 has been used to assess depressive disorder among migrant populations[3,4,5] and has been validated in Arabic,[6,7] as well as low-income settings. A cut-off score of 10 or more was used for depressive disorder on the basis of validation studies.[8] The detection of depressive disorder by the persistence and severity of depressive symptoms for two weeks[9] is an important threshold for clinical diagnostic assessments and treatment.[10] In our study, the PHQ-8 had a Cronbach's α of 0.80, indicating satisfactory reliability of this scale. Participants that reported depressive symptoms in the last two weeks were referred for assessment by an on-site psychologist employed by the camp management.

Perceived social support

The Duke-UNC Functional Social Support Questionnaire (FSSQ)[11] was used to measure perceived social support. The scale is comprised of eight items and distinguishes subjectively high or low social support based on whether an individual feels supported or not rather than actual support received. The Cronbach's alpha value in this study indicates high reliability (α = 0.84).

Self-efficacy

The General Self-Efficacy Scale (GSE)[12] was used as a measure of self-efficacy. The GSE is composed of 10 items that assess self-efficacy beliefs relevant to a wide range of stress-inducing situations. The psychometric properties of the GSE have been evaluated among participants from 25 countries, and have demonstrated the globality of the underlying construct.[13] The self-efficacy scale was dichotomized using the median of the sample distribution (median: 30). The Cronbach's alpha value indicated high reliability (α = 0.91), slightly higher than the reported reliability of the scale (α = 0.76-0.90).

WiFi connectivity
Open WiFi for camp residents was available from 17:00 each day until 12:00 (seven hours total) at the beginning of the observation period.

WiFi use was operationalized as the number of days in the past week a participant has accessed the Internet using WiFi. WiFi use was categorized as "daily" or "less than daily" based on the distribution of the responses.

Sociodemographic characteristics
Sociodemographic characteristics included age, gender, marital status, and nationality were collected using a standardized survey. Level of education was used as a proxy measure of socioeconomic status in country of origin. The interview date, date of departure from country of origin, and date of arrival in Italy were used to calculate the total time displaced and time in the transit phase of migration in Italy.

Statistical analysis
The prevalence estimates of WiFi connectivity, mobile phone ownership, and depressive symptoms were reported with 95% CIs; perceived self-efficacy and social support are reported as the median and interquartile range (IQR). Finite population correction was applied to adjust the prevalence estimate such that the variance applies only to the unsampled proportion of the population.[14] Missing responses to the depressive disorder, social support, and perceived self-efficacy scales were replaced with minimum values, indicating the absence of the condition, to produce the most conservative estimates and biasing the relationship between WiFi use and mental health toward the null.

We used descriptive statistics to quantify the participants' sociodemographic characteristics. Sociodemographic characteristics attributable by >5% of the study sample are reported as >5%. Associations between WiFi use and mental health status were analysed by logistic regression and are reported as Odd Ratios (ORs) with 95% CIs.

Missing data for the primary outcomes were <10% and for all exposure and covariates data <1%, so we performed complete case analysis for all regression models. Statistical analyses were performed using Stata version 15.1.[15]

Ethical considerations
This study was under ethics review, oversight, and governance both in Italy and in the United States by the Ethics Committee of the Unità di Bioetica, Istituto Superiore di Sanità and the Institutional Review Board of the Harvard T.H. Chan School of Public Health (Protocol IRB19-0692), respectively. Informed consent was obtained orally from all participants to avoid the potential risks of collecting participant names.

FINDINGS

A total of 104 interviews were completed, representing 67-76% of the adult camp population. Participant sociodemographic characteristics are presented in **Table 1**. Participants came from several countries: Afghanistan, Bangladesh, Cameroon, Chad, Congo, Cote d'Ivoire, The Gambia, Iraq, Libya, Mali, Morocco, Niger, Nigeria, Pakistan, Senegal, Somalia, Sudan, and Tunisia. Men comprised 97% of the sample, which reflected the gender distribution of the camp population, which was >90% men during the study period. The median age of the participants was 26 years (Interquartile Range [IQR]: 22-30 years); and 26% of the participants had ever married. 44% of participants had not attended secondary school, including 19% who had never attended any school.

Table 1: Sociodemographic characteristics of the study participants (n=104)

Characteristics	% or Median (IQR)
Age, years	26 (22-30)
Nationality	
Afghanistan	<5%
Bangladesh	<5%
Cameroon	<5%
Chad	<5%
Congo	<5%
Cote d'Ivoire	<5%
Gambia	12%
Iraq	<5%
Libya	<5%
Mali	<5%
Morocco	<5%
Niger	<5%
Nigeria	<5%
Pakistan	<5%
Senegal	10%
Somalia	<5%
Sudan	11%
Tunisia	<5%
Gender	
Men	97%
Women	<5%
Ever married	26%
Education	
Prefer not to answer	2%
None	19%
Primary school or less education	25%
Secondary or more education	55%

The prevalence and distributions of the connectivity exposures and mental health outcomes are presented in **Table 2**. Connectivity levels were high, but not ubiquitous: 72% of participants reported daily WiFi usage, and 60% reported mobile phone ownership. Among participants using WiFi daily who did not own a mobile phone, 93% borrowed a mobile phone and 7% used a tablet/laptop to connect.

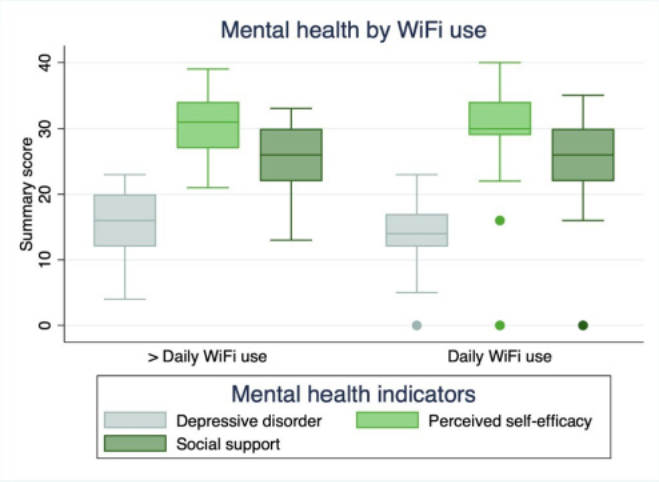
The scales used for measuring mental health status were highly reliable in the study sample (Cronbach's α: 0.80-0.91). The prevalence of depressive disorder was high – 86% of respondents reported symptoms consistent with moderate/major depressive disorder. The summary scores for social support and perceived self-efficacy were categorized into high and low levels based on the median scores.

Table 2. Mental health and connectivity distributions

	Point prevalence estimate or median	95%CI or IQR
Connectivity		
WiFi access	72	63-81
Mobile phone ownership	60	50-70
Mental health		
Moderate/major depressive disorder	86	79-92
Perceived self-efficacy	30	28-34
Social support	26	21-30

The mental health scores, stratified by WiFi use, are presented in **Figure 1**.

Figure 1. Mental health summary scores by daily WIFI use



Trends were observed between daily access to WiFi in the past week and increased social support and perceived self-efficacy (OR: 1.28, 95% CI: 0.52 – 3.13 and OR: 1.41, 95% CI 0.57 – 3.48, respectively), and lower odds of depressive symptoms (OR: 0.84, 95% CI 0.16 – 4.44). Median depressive disorder, social support, and perceived self-efficacy scores by WiFi use are presented in Figures 1A-C.

LIMITATIONS

Our study has several limitations. First, the nonprobability sampling procedures may limit the internal reliability of the results. However, we achieved census recruitment of the camp, representing 90% of residents or more throughout the study period. Second, the small number of women participants, which is reflective of the proportion of women in the camp during the study period, impedes analyses of the role of gender in the observed associations. Future studies should strive to achieve both a representative sample, as well as purposive sampling to facilitate gender analyses. Third, while our findings suggest potential associations between WiFi use and mental health status, the cross-sectional nature of our study precludes causal inference. Future prospective designs could increase the strength of causal inferences regarding the effects of WiFi on the mental health status of displaced populations. Finally, the heterogeneity of the sociodemographic

characteristics of the study sample precluded adjusted analyses and the detection of significant associations. Nonetheless, the participant sociodemographic characteristics were reflective of the complexity of contemporary forced migration. Moreover, the high reliability of the psychosocial scales in this diverse population demonstrates the feasibility of future investigations.

CONCLUSIONS

Understanding the role of WiFi in the context of displacement is critical for responding to the needs articulated by displaced populations. The direct relationship between daily use of WiFi and higher levels of social support and perceived self-efficacy, and the lower odds of depressive symptoms associated with daily WiFi usage provide the first evidence of the associations between WiFi use and mental health status in the context of a refugee camp. The prevalence of depressive symptoms was high, and demonstrates unmet need for screening and treatment. Finally, our findings demonstrate the feasibility of recruiting and the performance of validated measures among a diverse study sample. Digital connectivity performs critical roles in the mental health of displaced persons, and access to connectivity should be incorporated into services.

FUNDING

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STATA CODE

Once field research was completed, lead researcher Dr. Danielle N. Poole (PhD, MPH) conducted a statistical analysis of survey results from Roya Camp in Ventimiglia, Italy. Although the research team learned a great deal from its time at Rebbio Parish in Como, Italy, the total number of surveys conducted in Rebbio was insufficient to generate results at the level necessary for peer review. The following STATA code reflects the analysis that was used in the article, "WiFi use and mental health in a refugee camp in Italy" by D. Poole et al (submitted 2020).

```
*_____________________________________
*                    MIC Roya: Data Cleaning and Analysis
*
* Programming:
*   Stata Version:  Stata 15.1.
*   Original Author: Dani Poole
*   Modifications:
*   Last Modified: December 20, 2019
*_____________________________________
*_____________________________________
* Stata Version:
   version 15.1

* Clearing
   clear all
set more off

***Upload datasets***
import excel "/Users/dap355/Desktop/MIC Data/Raw/mic_study_Ventimiglia_all_langua
ge_2019_06_26_09_04_32_982674.xlsx", firstrow
save "/Users/dap355/Desktop/MIC Data/Clean/MIC_Roya", replace
label data "MIC Roya"
clear

import excel "/Users/dap355/Desktop/MIC Data/Raw/mic_study_arabic_2019_07_18_08_59_44_185826.xlsx", firstrow
save "/Users/dap355/Desktop/MIC Data/Clean/MIC_Roya_Arabic", replace
label data "MIC Roya Arabic"
clear

***Append***
use "/Users/dap355/Desktop/MIC Data/Clean/MIC_Roya"
append using "/Users/dap355/Desktop/MIC Data/Clean/MIC_Roya_Arabic", force
save "/Users/dap355/Desktop/MIC Data/Clean/MIC_Roya_Appended", replace

use "/Users/dap355/Desktop/MIC Data/Clean/MIC_Roya_Appended", replace

*_____________________________________
* Data cleaning
*_____________________________________
tab group_techconnectivitygroup_has
gen phone_own = .
replace phone_own = 1 if group_techconnectivitygroup_has == "yes"
replace phone_own = 0 if group_techconnectivitygroup_has == "no"
tab phone_own
lab define binary 1 "Yes" 0 "No"
lab val phone_own binary
tab phone_own
```

```
cii proportions 97 58, wald //Phone own//


tab BQ
gen wifi_week = .
replace wifi_week = 1 if BQ == "once_per_week"
replace wifi_week = 2 if BQ == "2_per_week"
replace wifi_week = 3 if BQ == "3_per_week"
replace wifi_week = 4 if BQ == "4_per_week"
replace wifi_week = 5 if BQ == "5_per_week"
replace wifi_week = 6 if BQ == "6_per_week"
replace wifi_week = 7 if BQ == "7_per_week"
tab wifi_week

gen wifi_bin = .
replace wifi_bin = 1 if wifi_week == 7
replace wifi_bin = 0 if wifi_week == 1 | wifi_week == 2 | wifi_week == 3 | wifi_week ==4 | wifi_week == 5 | wifi_week == 6
tab wifi_bin
lab val wifi_bin binary
cii proportions 96 69, wald //WiFi everyday//

tab group_demographicsmarital
gen marital = .
replace marital = 1 if group_demographicsmarital== "divorced/separated" | group_demographicsmarital== "married" |
group_demographicsmarital== "widowed"
replace marital = 0 if group_demographicsmarital== "never_married"
lab define marital 1 "Ever married" 0 "Never married"
lab val marital marital
tab marital
*_____
* Perceived social support
*_____
tab group_pyschosocialwellbeingsupp
gen ss_visit = group_pyschosocialwellbeingsupp
replace ss_visit = 0 if ss_visit == .
lab define ss 1 "Never" 2 "Much less than I would like" 3 "Less than I would like" 4 "As much as I would like" 0 "Missing"
lab val ss_visit ss
tab ss_visit

tab DC
gen ss_advice = DC
replace ss_advice = 0 if ss_advice == .
lab val ss_advice ss
tab ss_advice

tab DD
gen ss_work = DD
replace ss_work = 0 if ss_work == .
lab val ss_work ss
tab ss_work

tab DE
gen ss_trust = DE
replace ss_trust = 0 if ss_trust == .
lab val ss_trust ss
tab ss_trust

tab DF
gen ss_care = DF
replace ss_care = 0 if ss_care == .
```

```
lab val ss_care ss
tab ss_care

tab DG
gen ss_love = DG
replace ss_love = 0 if ss_love == .
lab val ss_love ss
tab ss_love

tab DH
gen ss_house = DH
replace ss_house = 0 if ss_house == .
lab val ss_house ss
tab ss_house

tab DI
gen ss_money = DI
replace ss_money = 0 if ss_money == .
lab val ss_money ss
tab ss_money

tab DJ
gen ss_transport = DJ
replace ss_transport = 0 if ss_transport == .
lab val ss_transport ss
tab ss_transport

tab DK
gen ss_sick = DK
replace ss_sick = 0 if ss_sick == .
lab val ss_sick ss
tab ss_sick

gen ss_sum = ss_visit + ss_advice + ss_work + ss_trust + ss_care + ss_love + ss_house + ss_money + ss_transport + ss_sick
tab ss_sum

gen ss_ave = ss_sum/10
tab ss_ave
hist ss_ave
sum ss_ave if ss_ave != 0

/*          sum ss_ave if ss_ave != 0

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
      ss_ave |         98    2.581633    .5148009         1.3        3.5*/


sum ss_sum, detail
gen ss_bin = .
replace ss_bin = 1 if ss_sum >= 26
replace ss_bin = 0 if ss_sum < 26
tab ss_bin

*Scale validation

alpha ss_visit ss_advice ss_work ss_trust ss_care ss_love ss_house ss_money ss_transport ss_sick, std

/*Test scale = mean(standardized items)
```

```
Average interitem correlation:     0.3440
Number of items in the scale:        10
Scale reliability coefficient:     0.8398*/

alpha ss_visit ss_advice ss_work ss_trust ss_care ss_love ss_house ss_money ss_transport ss_sick, std item


*Median and IQR
sum ss_sum, detail




*_____________________________________
* Self-efficacy
*_____________________________________
tab group_pyschosocialwellbeingprob, m
gen se_solve = group_pyschosocialwellbeingprob
replace se_solve = 0 if se_solve == .
lab define se 1 "False" 2 "Somewhat false" 3 "Somewhat true" 4 "True" 0 "Missing"
lab val se_solve se
tab se_solve

tab CS, m
gen se_oppose = CS
replace se_oppose = 0 if se_oppose == .
lab val se_oppose se
tab se_oppose

tab CT, m
gen se_goals = CT
replace se_goals = 0 if se_goals == .
lab val se_goals se
tab se_goals

tab CU, m
gen se_confidence = CU
replace se_confidence = 0 if se_confidence == .
lab val se_confidence se
tab se_oppose

tab CV, m
gen se_resource = CV
replace se_resource = 0 if se_resource == .
lab val se_resource se
tab se_resource

tab CW, m
gen se_effort = CW
replace se_effort = 0 if se_effort == .
lab val se_effort se
tab se_effort

tab CX, m
gen se_calm = CX
replace se_calm = 0 if se_calm == .
lab val se_calm se
tab se_calm

tab CY, m
```

```
gen se_options = CY
replace se_options = 0 if se_options == .
lab val se_options se
tab se_options

tab CZ, m
gen se_solution = CZ
replace se_solution = 0 if se_solution == .
lab val se_solution se
tab se_solution

tab DA, m
gen se_whatever = DA
replace se_whatever = 0 if se_whatever == .
lab val se_whatever se
tab se_whatever

gen se_sum = se_solve + se_oppose + se_goals + se_confidence + se_resource + se_effort + se_calm + se_options +
se_solution + se_whatever

sum se_sum, detail
hist se_sum

gen se_bin = .
replace se_bin = 1 if se_sum >= 30
replace se_bin = 0 if se_sum < 30
lab define se_bin 0 "Low self-efficacy" 1 "High self-efficacy"
lab val se_bin se_bin
tab se_bin

*Scale validation

alpha se_solve se_oppose se_goals se_confidence se_resource se_effort se_calm se_options se_solution se_whatever, std

/*Test scale = mean(standardized items)

Average interitem correlation:     0.5044
Number of items in the scale:         10
Scale reliability coefficient:     0.9106
*/

alpha se_solve se_oppose se_goals se_confidence se_resource se_effort se_calm se_options se_solution se_whatever, std
item

*Median and IQR
sum se_sum, detail

*Prevelance estimates
tab se_bin
cii proportions 104 60, wald //High self-efficacy//
/*                                                  – Binomial Wald —
    Variable |        Obs  Proportion    Std. Err.       [95% Conf. Interval]
-------------+---------------------------------------------------------------
             |        104    .5769231    .0484453         .481972    .6718742*/


*_____________________________________
* Depression
*_____________________________________
tab group_pyschosocialwellbeingfeel, m
```

```
gen dep_interest = .
replace dep_interest = 0 if group_pyschosocialwellbeingfeel == 1
replace dep_interest = 0 if dep_interest == .
replace dep_interest = 1 if group_pyschosocialwellbeingfeel == 2
replace dep_interest = 2 if group_pyschosocialwellbeingfeel == 3
replace dep_interest = 3 if group_pyschosocialwellbeingfeel == 4
lab define phq 0 “Not at all” 1 “Several days” 2 “More than half the days” 3 “Nearly every day”
lab val dep_interest phq
tab dep_interest

tab DM
gen dep_down = .
replace dep_down = 0 if DM == 1
replace dep_down = 0 if dep_down == .
replace dep_down = 1 if DM == 2
replace dep_down = 2 if DM == 3
replace dep_down = 3 if DM == 4
lab val dep_down phq
tab dep_down

tab DN
gen dep_sleep = .
replace dep_sleep = 0 if DN == 1
replace dep_sleep = 0 if dep_sleep == .
replace dep_sleep = 1 if DN == 2
replace dep_sleep = 2 if DN == 3
replace dep_sleep = 3 if DN == 4
lab val dep_sleep phq
tab dep_sleep

tab DO
gen dep_energy = .
replace dep_energy = 0 if DO == 1
replace dep_energy = 0 if dep_energy == .
replace dep_energy = 1 if DO == 2
replace dep_energy = 2 if DO == 3
replace dep_energy = 3 if DO == 4
lab val dep_energy phq
tab dep_energy

tab DP
gen dep_app = .
replace dep_app = 0 if DP == 1
replace dep_app = 0 if dep_app == .
replace dep_app = 1 if DP == 2
replace dep_app = 2 if DP == 3
replace dep_app = 3 if DP == 4
lab val dep_app phq
tab dep_app

tab DQ
gen dep_fail = .
replace dep_fail = 0 if DQ == 1
replace dep_fail = 0 if dep_fail == .
replace dep_fail = 1 if DQ == 2
replace dep_fail = 2 if DQ == 3
replace dep_fail = 3 if DQ == 4
lab val dep_fail phq
tab dep_fail
```

```
tab DR
gen dep_focus = .
replace dep_focus = 0 if DR == 1
replace dep_focus = 0 if dep_focus == .
replace dep_focus = 1 if DR == 2
replace dep_focus = 2 if DR == 3
replace dep_focus = 3 if DR == 4
lab val dep_focus phq
tab dep_focus

tab DS
gen dep_slow = .
replace dep_slow = 0 if DS == 1
replace dep_slow = 0 if dep_slow == .
replace dep_slow = 1 if DS == 2
replace dep_slow = 2 if DS == 3
replace dep_slow = 3 if DS == 4
lab val dep_slow phq
tab dep_slow

gen dep_sum = dep_slow + dep_focus + dep_fail + dep_app + dep_energy + dep_sleep + dep_down + dep_interest
sum dep_sum

*Scale validation

alpha dep_slow dep_focus dep_fail dep_app dep_energy dep_sleep dep_down dep_interest, std

/*Test scale = mean(standardized items)

Average interitem correlation:     0.3322
Number of items in the scale:            8
Scale reliability coefficient:     0.7992*/

*Binary outcome
gen phq_bin = .
replace phq_bin = 1 if dep_sum >=10
replace phq_bin = 0 if dep_sum <10
tab phq_bin

 /*phq_bin |      Freq.     Percent        Cum.
------------+-----------------------------------
          0 |         15       14.42       14.42
          1 |         89       85.58      100.00
------------+-----------------------------------
      Total |        104      100.00*/

*Prevelance estimates

cii proportions 104 89, wald //Moderate to major depression//
                                                  /*- Binomial Wald --
    Variable |        Obs  Proportion    Std. Err.       [95% Conf. Interval]
-------------+------------------------------------------------------------
             |        104    .8557692    .0344501        .7882483    .9232902*/



*-------------------------------------------
* Unadjusted associations
*-------------------------------------------
```

```
*TABLE 3
logistic phone_own group_demographicsage
logistic wifi_bin group_demographicsage

logistic phone_own i.marital
logistic wifi_bin i.marital

logistic ss_bin i.wifi_bin
logistic se_bin i.wifi_bin
logistic phq_bin i.wifi_bin

reg ss_sum i.phone_own

    /* Source |       SS           df       MS      Number of obs   =        97
-------------+----------------------------------   F(1, 95)        =      5.23
       Model |  197.807542         1  197.807542   Prob > F        =    0.0244
    Residual |  3589.69761        95  37.7862907   R-squared       =    0.0522
-------------+----------------------------------   Adj R-squared   =    0.0422
       Total |  3787.50515        96  39.4531787   Root MSE        =    6.1471

------------------------------------------------------------------------------
      ss_sum |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  phone_own |
        Yes  |  -2.912467   1.272936    -2.29   0.024    -5.439565   -.3853686
      _cons |   27.15385   .9843166    27.59   0.000     25.19973    29.10796
------------------------------------------------------------------------------*/

reg se_sum i.phone_own

  /*Source |       SS           df       MS      Number of obs   =        97
-------------+----------------------------------   F(1, 95)        =      0.02
       Model |  .811634627         1  .811634627   Prob > F        =    0.8900
    Residual |  4011.25022        95  42.2236865   R-squared       =    0.0002
-------------+----------------------------------   Adj R-squared   =   -0.0103
       Total |  4012.06186        96   41.792311   Root MSE        =     6.498

------------------------------------------------------------------------------
      se_sum |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  phone_own |
        Yes  |   .1865606   1.345605     0.14   0.890    -2.484803    2.857925
      _cons |   29.64103   1.040509    28.49   0.000     27.57535     31.7067
------------------------------------------------------------------------------*/

logit se_bin i.phone_own
/*Logistic regression                             Number of obs     =         97
                                                  LR chi2(1)        =       1.29
                                                  Prob > chi2       =     0.2554
Log likelihood = -64.715688                       Pseudo R2         =     0.0099

------------------------------------------------------------------------------
      se_bin |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  phone_own |
        Yes  |  -.4855078    .430228    -1.13   0.259    -1.328739    .3577236
      _cons |   .6931472   .3396831     2.04   0.041     .0273805    1.358914
------------------------------------------------------------------------------*/
```

```
reg dep_sum i.phone_own


    /* Source |       SS           df       MS      Number of obs   =        97
-------------+----------------------------------   F(1, 95)        =      2.57
       Model |  57.6962455         1  57.6962455   Prob > F        =    0.1120
    Residual |  2129.62334        95  22.4170878   R-squared       =    0.0264
-------------+----------------------------------   Adj R-squared   =    0.0161
       Total |  2187.31959        96   22.784579   Root MSE        =    4.7347

------------------------------------------------------------------------------
     dep_sum |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   phone_own |
         Yes |   1.572944   .9804584     1.60   0.112    -.3735117      3.5194
       _cons |   13.46154   .7581538    17.76   0.000     11.95641     14.96666
------------------------------------------------------------------------------*/

reg ss_sum i.wifi_bin

 /*Source |       SS           df       MS      Number of obs   =        96
-------------+----------------------------------   F(1, 94)        =      0.27
       Model |  8.91913245         1  8.91913245   Prob > F        =    0.6065
    Residual |  3139.32045        94  33.3970261   R-squared       =    0.0028
-------------+----------------------------------   Adj R-squared   =   -0.0078
       Total |  3148.23958        95   33.139364   Root MSE        =     5.779

------------------------------------------------------------------------------
      ss_sum |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    wifi_bin |
         Yes |   .6779388   1.311847     0.52   0.607    -1.926764     3.282641
       _cons |   25.14815   1.112172    22.61   0.000      22.9399     27.35639
------------------------------------------------------------------------------*/

reg se_sum i.wifi_bin

    /* Source |       SS           df       MS      Number of obs   =        96
-------------+----------------------------------   F(1, 94)        =      0.03
       Model |  .773752013         1  .773752013   Prob > F        =    0.8724
    Residual |  2803.72625        94  29.826875   R-squared       =    0.0003
-------------+----------------------------------   Adj R-squared   =   -0.0104
       Total |      2804.5        95  29.5210526   Root MSE        =    5.4614

------------------------------------------------------------------------------
      se_sum |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    wifi_bin |
         Yes |  -.1996779   1.239747    -0.16   0.872    -2.661225     2.261869
       _cons |   30.51852   1.051047    29.04   0.000     28.43164     32.6054*/

logit se_bin i.wifi_bin
/*Logistic regression                             Number of obs     =         96
                                                LR chi2(1)        =       0.55
                                                Prob > chi2       =     0.4594
Log likelihood = -63.725072                     Pseudo R2         =     0.0043

------------------------------------------------------------------------------
      se_bin |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
```

```
    wifi_bin |
        Yes  |   .3421703   .4612237     0.74   0.458    -.5618115    1.246152
       _cons |   .2231436   .3872983     0.58   0.565    -.5359472    .9822343
------------------------------------------------------------------------------*/



reg dep_sum i.wifi_bin

      /*Source |       SS           df       MS      Number of obs   =        96
-------------+----------------------------------   F(1, 94)        =      1.87
       Model |  35.2540761         1  35.2540761   Prob > F        =    0.1751
    Residual |  1774.98551        94  18.8828245   R-squared       =    0.0195
-------------+----------------------------------   Adj R-squared   =    0.0090
       Total |  1810.23958        95  19.0551535   Root MSE        =    4.3454

------------------------------------------------------------------------------
     dep_sum |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    wifi_bin |
        Yes  |  -1.347826   .9864218    -1.37   0.175     -3.30639    .6107375
       _cons |   15.66667   .8362798    18.73   0.000     14.00621    17.32712*/
------------------------------------------------------------------------------

*FIGURES
```